
Guide to assessing air quality impacts from state highway projects

This document provides direction on how air quality risks and impacts from state highway improvement projects should be assessed. It outlines the minimum requirements for each phase of highway improvement project development and delivery. Information about air quality mitigation and management methods is also provided.

Version 2.3, October 2019



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DOCUMENT MANAGEMENT PLAN

1. PURPOSE

This management plan outlines the updating procedures and contact points for the document.

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3. AMENDMENTS AND REVIEW STRATEGY

All corrective action/improvement requests (CAIRs) suggesting changes will be acknowledged by the document owner.

ACTIVITY	COMMENTS	FREQUENCY
Amendments (minor revisions)	Updates incorporated immediately when they occur.	As required
Review (major revisions)	Amendments fundamentally changing the content or structure of the document will be incorporated as soon as practicable. They may require coordinating with the review team timetable.	Not less than three years
Notification	All users that have registered their interest by email to environment@nzta.govt.nz will be advised by email of amendments and updates.	Immediately

RECORD OF AMENDMENT

AMENDMENT NUMBER	DESCRIPTION OF CHANGE	EFFECTIVE DATE	UPDATED BY
Version 2.1	Minor revisions to finalise 2014 draft version 2.1	July 2018	Sharon Atkins
Version 2.2	Minor revisions to version 2.1 to incorporate updates to VEPM and NZTA processes	August 2019	Sharon Atkins
Version 2.3	Minor revisions to amend process for assessing construction impacts	October 2019	Sharon Atkins

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INTRODUCTION

1.1 FOREWORD

The NZ Transport Agency is a Crown entity established on 1 August 2008, under the amended Land Transport Management Act 2003, to provide an integrated approach to transport planning, funding and delivery. Its objective is to 'undertake its functions in a way that contributes to an effective, efficient and safe land transport system in the public interest'. In meeting its objective, the Transport Agency must 'exhibit a sense of social and environmental responsibility'.

The Transport Agency manages almost 11,000km of state highways. These account for about 12% of New Zealand's roads and around half of the 45 billion vehicle kilometres New Zealanders travel each year⁰¹. Motor vehicles travelling on roads emit an array of air pollutants that can contribute to harmful effects on human health and the surrounding environment.

This document (the guide) provides guidance on how to assess the air quality impacts associated with state highway improvement projects to enable the Transport Agency to:

- understand the contribution of vehicle traffic to air quality
- ensure new state highway projects do not directly^a cause national environmental standards for ambient air quality to be exceeded
- contribute to reducing emissions where the state highway network is a significant source of exceedances of national ambient air quality standards.

This guide is intended to act as a bridge between air quality consultants (those undertaking the air quality assessment) and Transport Agency project managers (those managing the project) to better coordinate the technical requirements of the assessment with the Transport Agency's business practices and vice versa. It sets out the minimum requirements for good practice but does not preclude higher standards being adopted for projects where the sensitivity of the environment or the scale of the project warrants greater attention.

Awareness and implementation of this guide is expected to improve communication between all stakeholders involved in the project, result in fewer surprises, streamline the processes, ensure national consistency in the way assessments are undertaken nationally, and deliver a better air quality outcome from state highway projects in New Zealand.

Acknowledgements

The Transport Agency wishes to acknowledge and thank the various end users from regional councils, unitary authorities, air quality consultancies, crown research institutes, universities and government agencies who provided feedback on the draft version of this guide that was invaluable in its finalisation.

⁰¹ Ministry of Transport (2017) *The New Zealand vehicle fleet, annual fleet statistics 2016*. www.transport.govt.nz

^a In most locations, motor vehicle emissions from the state highway network are not the only contributor to air pollution and therefore do not usually cause an exceedance of the national environmental standards by themselves.

1.2 CONTEXT

Air quality is only one of a number of potential environmental impacts resulting from roads. However, for state highway projects, air quality can be a significant area of community concern. An assessment of the discharges to air from these projects must be undertaken to determine the impacts on air quality.

The Transport Agency has a commitment to achieving quality environmental and social outcomes, including the management of air quality effects. This reflects the requirements of the Land Transport Management Act 2003 (LTMA) and Resource Management Act 1991 (RMA) as well as the commitments made in internal strategy and policy documents, including the Transport Agency's *Strategy set, Environmental and social responsibility policy*⁰² and the *State highway environmental and social responsibility standard*⁰³ (figure 1).

The *State highway environmental plan*⁰⁴ sets formal objectives regarding air quality and the state highway network including:

A1 - Understand the contribution of vehicle traffic to air quality.

A2 - Ensure new state highway projects do not directly^b cause national environmental standards for ambient air quality to be exceeded.

A3 - Contribute to reducing emissions where the state highway network is a significant source of exceedances of the national ambient air quality standards.

This guide gives effect to these statutory and policy obligations and outlines the approach that should be adopted when assessing the potential and actual impacts on air quality as they relate to state highway improvement projects.

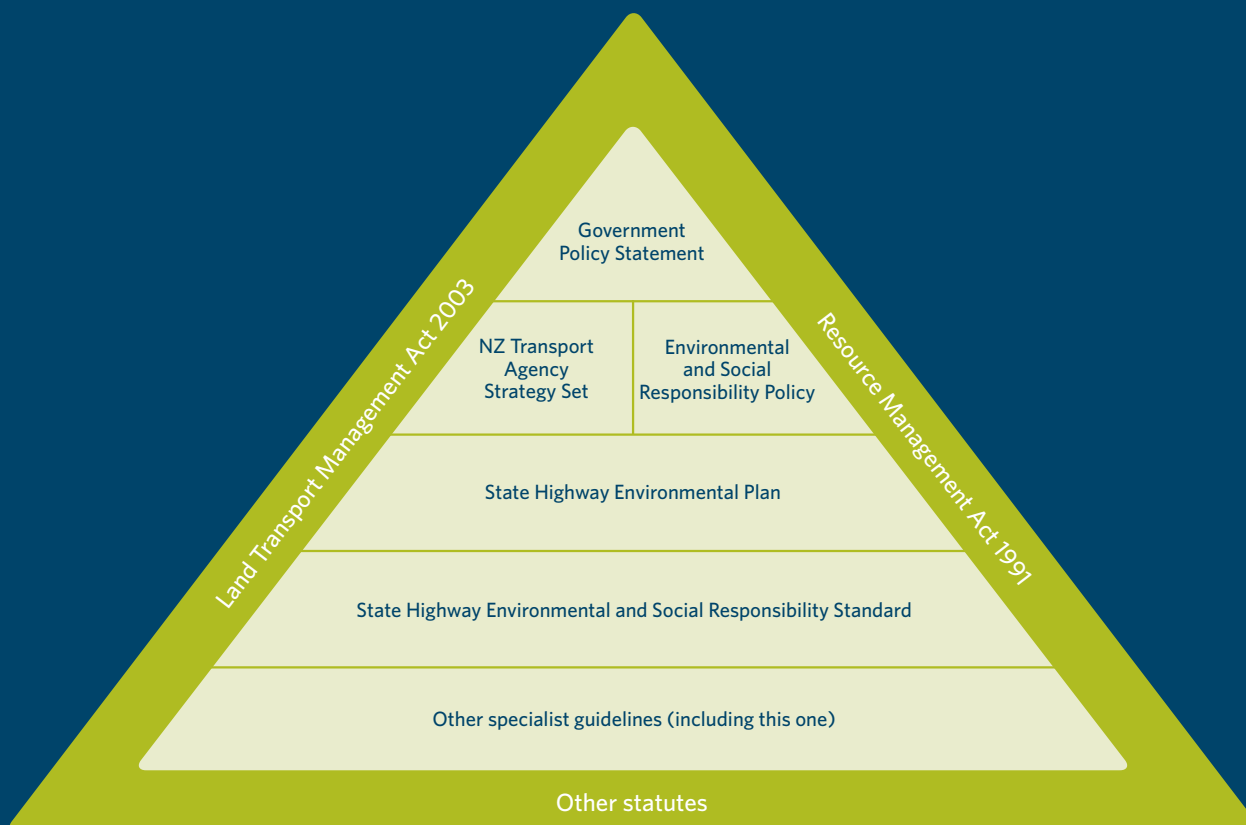
⁰² NZ Transport Agency (2016) *HNO Environmental and social responsibility manual*. www.nzta.govt.nz

⁰³ NZ Transport Agency (2016) *Z19 State highway environmental and social responsibility standard, draft*. hip.nzta.govt.nz

⁰⁴ NZ Transport Agency (2008) *Environmental plan: improving environmental sustainability and public health in New Zealand, version 2*. www.nzta.govt.nz

^b In most locations, motor vehicle emissions from the state highway network are not the only contributor to air pollution and therefore do not usually cause an exceedance of the national environmental standards by themselves.

FIGURE 1: IMPACT ASSESSMENT STATUTORY AND POLICY CONTEXT



1.3 PURPOSE OF THIS DOCUMENT

The purpose of the guide is to achieve nationally consistent application of assessment methods within the context of Transport Agency business processes and the requirements of the relevant statutory approvals process that the Transport Agency must meet when lodging a Notice of Requirement for a new or altered designation and/or resource consent under the RMA.

It provides direction on how air quality risks and impacts from state highway improvement projects should be assessed and outlines the minimum requirements for each phase of highway improvement project development and delivery. Information about air quality mitigation and management methods is also provided.

The guide is based on the *Good practice guide for assessing discharges to air from land transport* developed by the Ministry for the Environment⁰⁵ but differs from it in the following important aspects:

- It is tailored to a broader audience including roading engineers and planners rather than just air quality practitioners.
- It focuses solely on state highway projects, which because of their scale and traffic volume often have greater air quality impacts than projects involving local roads and therefore generally require more detailed assessments.
- It covers the air quality impacts of construction as well as operation (use) of state highway projects.
- It embeds the critical phases of the air quality assessment processes into the framework of business processes the Transport Agency follows as part of managing a state highway project and highlights the key areas of interaction and decision making.
- It emphasises the 'what?' and also the 'how?' by listing the important areas or questions that need to be addressed in the various stages of the air quality assessment, which can then be checked by Transport Agency project managers to ensure that good practice methodology is followed and that an appropriately robust assessment of effects will be delivered. The expectation is that important technical decisions are reviewed by a technical peer reviewer, but that the project manager is able to ensure that all of the critical areas have been addressed.

The guide sets out the minimum requirements for good practice but does not preclude higher standards being adopted for projects where the sensitivity of the environment or the scale of the project warrants greater attention.

⁰⁵ Ministry for the Environment (2008) *Good practice guide for assessing discharges to air from land transport*. www.mfe.govt.nz

^c The word 'harmful' is used to denote those pollutants which have the potential to endanger human health and ecosystems and impact local air quality, as opposed to greenhouse gases which have far ranging environmental consequences and impact global air quality.

^d However, much of the information collected for use in an air quality assessment of PM₁₀ and NO₂ effects can also be used to assess greenhouse gas emissions.

⁰⁶ NZ Transport Agency (2015) *State highway maintenance contract proforma manual*. www.nzta.govt.nz

^e Various government agencies, including the Ministry for the Environment, have responsibilities for reducing emissions of greenhouse gases.

1.3.1 What is covered by the guide?

The guide applies to the following:

- Roothing projects involving the upgrade of the existing state highway network and/or the construction of new stretches of state highway.
- The construction and operation phases of state highway improvement projects.
- Emissions of 'harmful' pollutants^c, such as fine particulate (PM₁₀) and nitrogen dioxide (NO₂), as opposed to greenhouse gases^d.
- Effects on ambient (external) air quality as well as in-tunnel air quality.

1.3.2 What is not covered by the guide?

The guide does **not** apply to the following:

Effects arising from the maintenance of state highway assets. The Transport Agency addresses these effects by requiring all contracted suppliers to develop and implement an Environmental and Social Management Plan, based on ISO 14001, for each state highway network management area⁰⁶.

Emissions of greenhouse gases, such as carbon dioxide (CO₂) and nitrous oxide (N₂O). These effects are largely managed elsewhere by the government^e although the Transport Agency does have an objective in the *State highway environmental plan*⁰⁴ to 'mitigate activities associated with the construction, operation and maintenance of state highways to effect a net reduction of greenhouse gases from transport'.

1.4 TARGET AUDIENCE

The guide is aimed at project managers, planners and air quality specialists. It will also be useful for environmental managers and contract managers.

It is intended to act as a bridge between:

- **Transport Agency project managers** to assist them to:
 - › understand the critical steps involved in undertaking an air quality assessment
 - › identify where these steps fit into the framework of business processes they follow when managing a state highway project
 - › make informed decisions regarding exceptions, additional work, and when to seek specialist advice on air quality matters at the various stages in the project lifecycle

and

- **planners and air quality specialists** to assist them to:
 - › understand the framework of the business processes followed for managing state highway projects
 - › produce robust and consistent air quality assessments that meet the Transport Agency's requirements
 - › liaise more effectively with Transport Agency project teams on air quality matters.

It embeds the critical phases of the air quality assessment processes into the framework of business processes the Transport Agency follows as part of managing a state highway project and highlights the key areas of interaction and decision making.

This guide lists the important areas or questions that need to be addressed in the various stages of the air quality assessment, which can then be checked by Transport Agency project managers to ensure that good practice methodology is followed and that an appropriately robust assessment of effects will be delivered.

The expectation is that important technical decisions are reviewed by a technical peer reviewer, but that the project manager is able to ensure that all of the critical areas have been addressed.

1.5 SUPPORTING MATERIAL

Supporting material to assist with undertaking air quality impact assessments is available from a number of sources.

1.5.1 NZ Transport Agency

All Transport Agency operational policies, strategies, standards and guidelines can be found on www.nzta.govt.nz and at hip.nzta.govt.nz.

In addition, the Transport Agency air quality website (www.nzta.govt.nz/air) provides a suite of information and tools specifically related to air quality effects of land transport. The site includes on-line tools for assessing the air quality effects from roading projects as well as guidance on transport-related air quality management and monitoring as follows:

- Air quality screening model⁰⁷.
- Background air quality⁰⁸.
- Vehicle emission prediction model (VEPM)⁰⁹.
- Meteorological dataset inventory¹⁰.
- Transport-related air quality monitoring system (TRAMS)¹¹.
- Guide to road traffic dispersion models¹².
- Guide to road tunnels¹³.
- Tunnel portal modelling guidance¹⁴.
- Construction air quality management plan template¹⁵.

Links to relevant standards, guidance and research are also provided.

1.5.2 Ministry for the Environment

The Ministry for the Environment (MfE) has a comprehensive array of guidance available from their website www.mfe.govt.nz to assist with air quality management in New Zealand as follows:

- National environmental standards for air quality¹⁶ and the associated users' guide¹⁷.
- Ambient air quality guidelines¹⁸.
- Good practice guide for assessing discharges to air from land transport⁰⁵.
- Good practice guide for assessing and managing dust¹⁹.
- Good practice guide for air quality monitoring and data management²⁰.
- Good practice guide for atmospheric dispersion modelling²¹.
- Good practice guide for assessing and managing odour²².

Other resources

Regional councils and unitary authorities in New Zealand have the primary responsibility for managing air quality in their regions. Most undertake ambient monitoring programmes and the data are published regularly or can be provided on request.

⁰⁷ NZ Transport Agency *Air quality screening model v2.0* and supporting technical reports. nzta.govt.nz/air

⁰⁸ NZ Transport Agency *Background air quality interactive map* and supporting technical reports. nzta.govt.nz/air

⁰⁹ NZ Transport Agency *Vehicle emissions prediction model and supporting technical reports*. nzta.govt.nz/air

¹⁰ NZ Transport Agency *ARC/NZTA Meteorological datasets for the Auckland region with other datasets available for locations across New Zealand*. nzta.govt.nz/air

¹¹ NZ Transport Agency (2015) *Transport-related air quality monitoring system (TRAMS)*. nzta.govt.nz/air

¹² NZ Transport Agency (2017) *Guide to dispersion modelling for state highway projects*.

¹³ NZ Transport Agency (2013) *Guide to road tunnels*. www.nzta.govt.nz

¹⁴ NZ Transport Agency (2014) *Tunnel portal modelling guidance for state highway projects*, draft.

¹⁵ NZ Transport Agency (2015) *Construction air quality management plan template*, draft.

¹⁶ Ministry for the Environment (2011) *Resource Management (National Environmental Standards for Air Quality) Regulations 2004*, including the 2011 amendments. www.legislation.govt.nz

¹⁷ Ministry for the Environment (2014) *Users' guide to the revised national environmental standards for air quality*. www.mfe.govt.nz

¹⁸ Ministry for the Environment and Ministry of Health (2002) *Ambient air quality guidelines*. www.mfe.govt.nz

¹⁹ Ministry for the Environment (2016) *Good practice guide for assessing and managing dust*. www.mfe.govt.nz

²⁰ Ministry for the Environment (2009) *Good practice guide for air quality monitoring and data management*. www.mfe.govt.nz

²¹ Ministry for the Environment (2004) *Good practice guide for atmospheric dispersion modelling*. www.mfe.govt.nz

²² Ministry for the Environment (2016) *Good practice guide for assessing and managing odour*. www.mfe.govt.nz

2

ROAD TRANSPORT-RELATED AIR QUALITY IMPACTS

Roading construction and motor vehicles travelling on highways can release air emissions, which impact negatively on air quality. If the emissions are not able to disperse due to poor meteorological conditions (eg no or low wind conditions) or geographical conditions (eg buildings in the way, valleys) then concentrations in the air can build up to high levels. If people or sensitive ecosystems are located nearby then their exposure to elevated concentrations over time can cause adverse effects, especially if the levels are above recommended standards and guidelines.

The air quality impacts and mitigation and management options relating to state highway activities are considered under three main headings:

- Operation of surface roads.
- Operation of tunnels.
- Construction.

2.1 SURFACE ROADS

2.1.1 Sources and pollutants

Air pollution from motor vehicles travelling on surface roads arises primarily from the combustion of fuels (eg petrol and diesel) but can also come from brake wear, tyre wear and road dust. Motor vehicle emissions are of concern because many of the associated pollutants are known to cause adverse health effects. These include:

- gases – eg carbon monoxide (CO) and volatile organic compounds (VOCs) such as benzene
- particulate matter in different size fractions – eg particles smaller than 10 micrometres (μm) and particles smaller than 2.5 μm ($\text{PM}_{2.5}$).

Despite the wide variety of pollutants in the emissions, most of the health effects result from fine particulate matter (PM_{10} and $\text{PM}_{2.5}$) and NO_2 . Information on other air pollutants is available at nzta.govt.nz/air or www.mfe.govt.nz.

PARTICULATE MATTER (PM_{10} AND $\text{PM}_{2.5}$)

Particulate matter (PM) is a collective term used to describe very small solid or liquid particles in the air, such as PM_{10} , dust, smoke or fog. PM_{10} and $\text{PM}_{2.5}$ are extremely small, with each particle a fraction of the size of a human hair.

PM_{10} and $\text{PM}_{2.5}$ are of concern because they are respirable and can be easily inhaled into the lungs where they may lodge in the respiratory system.

Adverse effects of PM_{10} and $\text{PM}_{2.5}$ include:

- affected health, especially in asthmatics, children, the elderly or those with existing heart or lung disease
- reduced lung function, which can lead to days off work or school, increased medication, increased hospitalisations and even premature death.

NITROGEN DIOXIDE (NO_2)

NO_2 is a brown acidic gas formed by the high temperature combustion of all fossil fuels (eg coal, oil and gas). Motor vehicles are a significant source of NO_2 in urban areas.

Adverse effects of NO_2 include:

- increased susceptibility and severity of asthma and lowered lung resistance to infections such as influenza
- reduced lung development and function in children
- at high levels, contributes to the formation of hazes and smog.

2.1.2 Mitigating surface road impacts

For some projects, actions may need to be considered to mitigate the potential for adverse air quality effects. These measures are usually centred on either reducing the exposure of people close to the project or reducing the emissions from the project but can sometimes involve both approaches. Some of the options that are available at a state highway project level include the following:

ROUTE SELECTION

- Choosing a route that moves the road away from sensitive receivers^f.

Generally this is only a realistic option, if at all, during the very early stages of a project, ie during indicative and detailed business case development.

BUFFER DISTANCES

- Maintaining or increasing the separation distance between the road and sensitive receivers.

This can be achieved by carefully considering the extent of the land use designation boundary sought in a 'Notice of Requirement' to the relevant consenting authority under the provisions of the Resource Management Act 1991.

LAND USE CHANGE

- Purchasing affected properties and/or re-zoning land adjacent to the state highway to avoid reverse sensitivity^g issues.

This option is generally more relevant where land is required for a project under the provisions of the Public Works Act 1981.

^f Highly sensitive receivers or receivers in locations where people or surroundings may be particularly sensitive to the effects of air pollution. Examples include residential houses, hospitals, schools, early childhood education centres, childcare facilities, rest homes, marae, other cultural facilities, and sensitive ecosystems

^g Reverse sensitivity is the vulnerability of an established activity to objection from a sensitive land use.

TRAFFIC FLOW CONDITIONS

- Promoting options for efficient traffic flow such as queue management, grade separation, bus priority lanes, etc.

The inclusion of such options in a project will generally be limited to large schemes in major urban areas and will typically be identified in the relevant regional land transport plans, ie prior to a state highway project being developed.

These mitigation options will likely have other implications in terms of other effects and so will have

to be considered in the wider context of the project, which may limit their applicability/validity.

Further guidance about reducing adverse air quality effects associated with projects can be found in the following Transport Agency documents:

- Integrated planning strategy²³.
- Planning and Investment knowledge base²⁴.
- Integrated planning toolkit²⁵.
- Planning policy manual²⁶.
- State highway environmental plan⁰⁴.

²³ NZ Transport Agency (2010). *Integrated planning strategy*. www.nzta.govt.nz

²⁴ NZ Transport Agency (2011). *Planning and Investment knowledge base*. www.nzta.govt.nz

²⁵ NZ Transport Agency (2013). *Integrated planning toolkit*. www.nzta.govt.nz

²⁶ NZ Transport Agency (2007). *Planning policy manual – for integrated planning and development of state highways, version 1, SPM/M/001*. www.nzta.govt.nz

CASE STUDY 1 - ROUTE SELECTION

MacKays to Peka Peka Expressway, Kapiti Coast

The alignment of the 17.8km MacKays to Peka Peka Expressway passes through Raumati, Paraparaumu and Waikanae on the Kapiti Coast. The four-lane expressway forms part of the Wellington Northern Corridor, which runs from Levin to Wellington Airport. Potential adverse air quality effects on the local community and a desire to avoid such effects was one of the early issues identified as a planning constraint when the project was at the scoping stage (project development).

Workshops were held with technical specialists and four expressway route options were identified, analysed and assessed. The options included following an existing designation, following the existing state highway and two other modified routes. A multi-criteria assessment (MCA) was undertaken in order to rank each of the options against a suite of criteria fulfilling the project objectives and statutory requirements.

When short-listing options, the project air quality specialist gave preference to routes that moved the road away from sensitive receivers. The existing Western Link road designation option passed close to two local primary schools (within 100m) and would have required the relocation of one school due to construction impacts. From the air quality rating in the MCA, Route 1 (which follows an alignment at the southern end that does not significantly impact the two local schools) was confirmed as the preferred option.



2.2 TUNNELS

2.2.1 Sources and pollutants

Any fully enclosed length of roadway may be called a road tunnel. Road tunnels 'collect' vehicle emissions that would otherwise have been emitted to the surroundings from surface roads. The collected emissions are diluted with fresh air and then discharged through stacks and/or portals, depending on the ventilation system in use.

Tunnels can be used to capture vehicle emissions and control their dispersion into the atmosphere providing a mechanism for reducing community exposure to elevated concentrations of air pollution. Conversely tunnels can also give rise to localised air quality issues. For example, transport-related air pollution may become elevated near a tunnel portal or create localised 'hot spots' as a result of the discharge of emissions from ventilation points or stacks.

The Transport Agency requires that road tunnels greater than 240m in length must meet the following air quality objectives:

- Ensuring the safety of public users in tunnels.
- Ensuring the safety of workers in tunnels.
- Monitoring compliance with consent conditions.
- Identifying trends in emissions.

For road tunnels, the pollutants of concern are typically the same as those described in section 2.1.1 for operational emissions from surface roads.

2.2.2 Mitigating road tunnel impacts

Options for mitigating and managing road tunnel emissions include:

DESIGN AND OPERATION

- Locating portals and/or stacks away from sensitive receivers.
- Designing stacks (where these are required^h) so they disperse emissions efficiently and effectively.
- Designing and operating ventilation systems so they meet in-tunnel and ambient air quality criteria.

SOURCE CONTROL

- Fining vehicles which emit excessive smoke ('gross emitters').
- Setting a minimum emissions standard (eg Euro 3) for vehicles wishing to use the tunnel.
- Requiring retrofitting of older heavy duty vehicles with emission control equipment, eg particulate filters.

^h Stacks would only be considered if indicated by the results of portal modelling. The requirement for portal dispersion modelling is determined by a risk assessment questionnaire detailed in section 6.4.3.

TUNNEL AIR TREATMENT

In some cases overseas, air treatment methods have been considered, eg using electrostatic precipitators to remove particulate matter or de-nitrification to reduce nitrogen oxide (NO_x) emissions in tunnel air. However, these methods are typically expensive, energy intensive and not very effective. Tunnel air treatment of this kind is not considered best practice in New Zealand, and should not be employed without a comprehensive assessment of the whole of life costs and benefits.

2.3 CONSTRUCTION

2.3.1 Sources and pollutants

Air pollution from road construction activities primarily relate to dust caused by earthworks but can include odour (eg where landfills might be disturbed). Concern can also be raised about effects associated with exhaust emissions released by construction vehicles or equipment, and air emissions from activities such as concrete batching plants on site. While these effects are generally negligible, they may need to be considered in some instances, particularly in urban areas when construction is occurring near sensitive receivers.

DUST

The potential health effects of dust are related to size. Human health effects of airborne dust are mainly associated with the fine particles (PM₁₀ and smaller). Nuisance effects are most commonly associated with particles larger than 20 µm and include:

- soiling of clean surfaces
- dust deposits on vegetation
- contamination of roof-collected water supplies
- visibility impacts
- loss of visibility is a particular safety concern under extreme conditions, especially for road traffic.

ODOUR

Offensive odours can cause nausea, headaches, frustration, annoyance and a range of other effects that can contribute to a reduced quality of life for the individuals exposed.

CONSTRUCTION VEHICLE/EQUIPMENT EXHAUST EMISSIONS

The pollutants of concern are typically the same as those described in section 2.1.1 for operational emissions from surface roads.

OTHER CONSTRUCTION-RELATED EMISSIONS

The key air pollutant from other construction activities, such as on-site concrete batching plants and rock-crushing, is typically dust (discussed earlier).

2.3.2 Managing construction impacts

Options for managing construction effects generally involve minimising emissions from earthworks, unpaved surfaces, paved surfaces, vehicles travelling in, to and from the construction area, and material stockpiles. They can include:

- wet suppression of unpaved areas using water carts or sprinklers
- limiting vehicle speeds using unpaved surfaces, eg to 15 km/h
- controlling the use of local roads by construction vehicles
- covering loads and storage areas with tarpaulins or enclosures
- locating storage areas away from sensitive areas or using water sprays to control dust
- minimising travel distances
- using wheel and truck wash facilities at site exits
- installing wind break fencing at appropriate locations.

Activities such as concrete batching plants and on-site rock crushing also have the potential to generate construction-related air emissions. Typically they will require resource consent approval in accordance with the relevant regional plan and will require a range of mitigation measures to be implemented.

For most projects, measures to address construction air quality effects should be addressed in the Construction Environmental and Social Management Plan (CESMP) developed in accordance with the *State highway environmental and social responsibility standard*²³. Generic dust and odour management requirements based on the relevant MfE good practice guides^{19,22} should be incorporated into the CESMP during project implementation.

Where the assessment process determines that construction air quality requires specific management, a Construction Air Quality Management Plan (CAQMP) should be developed (refer to section 6.4.4 for further information). The Transport Agency has developed a template to assist with preparing a CAQMP¹⁵.

Further guidance on construction air quality management can be found in the MfE *Good practice guide for assessing and managing dust*¹⁹, the MfE *Good practice guide for assessing and managing odour*²² and the Transport Agency's *State highway environmental plan*²⁴. In addition, the *Erosion and sediment control guidelines for state highway infrastructure*²⁷ covers dust control and includes complementary guidance about the control of erosion caused by wind.

²⁷ NZ Transport Agency (2014) *Erosion and sediment control guidelines for state highway infrastructure*. www.nzta.govt.nz

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LEGISLATION, STANDARDS AND GUIDELINES

There is a wealth of environmental and transport legislation and policy that relates to air quality assessments of roading projects but this chapter focusses on the most relevant of these.

3.1 THE LAND TRANSPORT MANAGEMENT ACT

The Land Transport Management Act 2003 (LTMA) sets out the planning and funding framework that directs central government funding into roading, public transport and traffic safety.

The purpose of the LTMA is to contribute to an effective, efficient, and safe land transport system in the public interest. Section 96 (1)(a) requires that the Transport Agency exhibit a sense of social and environmental responsibility.

3.2 THE RESOURCE MANAGEMENT ACT

The Resource Management Act 1991 (RMA) promotes sustainable development by managing the use, development and protection of natural and physical resources in a way, or at a rate, that enables people and communities to provide for their social, economic and cultural wellbeing and for their health and safety, while:

- sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations
- safeguarding the life-supporting capacity of air, water, soil and ecosystems
- avoiding, remedying or mitigating adverse effects of activities on the environment.

In all activities the Transport Agency has a duty to avoid, remedy or mitigate adverse environmental effects on the natural environment and on communities.

Regional (and unitary) councils have primary responsibility for air quality management in New Zealand and under the provisions in the RMA are able to develop regional plans that include controls on discharges into the air from a range of activities.

A resource consent is normally needed under the relevant provisions of a regional plan to control air discharges from roading project construction activities, such as the use of concrete batching plants and rock crushing activities. Applications for a resource consent must be accompanied by an Assessment of Environmental Effects (AEE) prepared under section 88 of the RMA.

By contrast, most regional plans permit discharges from 'mobile' sources (vehicles) and advocate for alternate national measures, eg the use of vehicle emission standards, to be used as the primary method of control for such air discharges.

As a requiring authority, the Transport Agency can lodge a Notice of Requirement (NoR) (proposed designation), which, if approved, will enable a designation or form of 'spot zoning' to be made in a district plan to enable a public work, project or work to be undertaken.

When lodging a NoR, the Transport Agency with a consenting authority must include documentation (effectively an AEE) that describes the effects that the work will have on the environment and the ways in which any adverse effects will be mitigated.

3.3 AIR QUALITY ASSESSMENT CRITERIA

Air quality effects are assessed against standards and guidelines that have been put in place to provide levels of protection for our health, including:

- air quality national environmental standards (AQNES)¹⁶
- ambient air quality guidelines (AAQG) set by the Ministry for the Environment¹⁸
- international air quality guidelines set by the World Health Organisation (WHO)²⁸
- regional air quality standards, guidelines and targets set by local authorities.

Ambient air quality standards, guidelines and targets specify maximum limits for air pollution concentrations for given averaging periods. In some cases, concentrations are allowed to exceed these levels but only for a specified number of times in an annual period. The averaging periods are related to exposure and usually each pollutant has a short-term (acute) limit and a long-term (chronic) limit. There are also criteria for in-tunnel air quality.

Recommended trigger levels for transport-related dust are used to protect amenity for people and property located near major roadways, especially during their construction. Odour is usually assessed on a case-by-case basis against relevant criteria.

Depending on the nature of the state highway project, all or a selection of these criteria may be used in the technical assessment discussed in section 7 of this guide.

3.3.1 Ambient air quality

Although there are a wide range of pollutants in motor vehicle emissions, most of the ambient air quality health effects result from a few key indicator pollutants - fine particulate matter (PM₁₀ and PM_{2.5}) and NO₂. The most relevant assessment criteria that apply to these pollutants are shown in table 1. The assumption is that if levels of the pollutants shown in table 1 meet the ambient air quality criteria shown, then levels of other pollutants, eg benzene, are also likely to meet acceptable criteria.

²⁸ World Health Organisation (2006) *Air quality guidelines global update 2005: particulate matter, ozone, nitrogen dioxide, and sulphur dioxide*. www.who.int/en/

Some local authorities (eg Auckland Council) also have specific regional targets and standards, which may also need to be considered in an assessment. If in doubt, check with the relevant local authority.

Information on the current state of air quality in New Zealand is available from www.mfe.govt.nz.

TABLE 1: KEY AMBIENT AIR QUALITY CRITERIA FOR ROAD-TRANSPORT RELATED AIR POLLUTANTS

AIR POLLUTANT	LIMIT	AVERAGING TIME	PROTECTION	STANDARD/GUIDELINE
NO ₂	200 µg/m ³	1 hour	General population	AQNES (Note A), WHO
	100 µg/m ³	24 hour	General population	AAQG
	40 µg/m ³	Annual	General population	WHO
PM _{2.5}	25 µg/m ³	24 hour	General population	AAQG, WHO
	10 µg/m ³	Annual	General population	WHO
PM ₁₀	50 µg/m ³	24 hour	General population	AQNES (Note B), WHO
	20 µg/m ³	Annual	General population	AAQG

Notes:

A. Nine exceedances allowed in a 12-month period.

B. One exceedance allowed in a 12-month period.

3.3.2 In-tunnel air quality and visibility

In-tunnel air quality and visibility are assessed against criteria developed by the Transport Agency¹³, shown in tables 2 and 3, respectively.

Air quality impacts of stack and portal emissions from road tunnels are assessed against ambient air quality criteria (section 3.3.1).

TABLE 2: NZ TRANSPORT AGENCY IN-TUNNEL AIR QUALITY CRITERIA

AIR POLLUTANT	LIMIT	AVERAGING TIME	PROTECTION	APPLICATION
Carbon monoxide	200 ppm	15 min	Workplace	Design and compliance monitoring
	87 ppm	15 min	General population	
	30 ppm	8 hour	Workplace	
Nitrogen dioxide	1.0 ppm	15 min	Workplace and general population	Design criterion only

Note: All Transport Agency air quality criteria are exposure limits and are based on NIWA recommendations²⁹ apart from the nitrogen dioxide criterion, which is based on the NIWA recommended level (1.0 ppm) and the averaging period adopted for road tunnels in France (15 min).

TABLE 3: NZ TRANSPORT AGENCY IN-TUNNEL VISIBILITY CRITERIA

TRAFFIC SITUATION	EXTINCTION COEFFICIENT (m ⁻¹)	TRANSMISSION (BEAM LENGTH: 100m)
Planned maintenance work in a tunnel under traffic	0.003	75%
Fluid peak traffic 50-100 km/h	0.005	60%
Daily congested traffic Standstill on all lanes	0.007	50%
Exceptional congested traffic standstill on all lanes	0.009	40%
Closing of the tunnel	0.012	30%

Note: The Transport Agency visibility criteria are exposure limits and are based on PIARC recommendations³⁰. The criteria provide a surrogate measure for particulate matter and are primarily intended to manage potential road safety issues inside tunnels by ensuring adequate visibility is maintained in front of vehicles.

²⁹ National Institute of Water and Atmospheric Research Ltd (2010) *Guidance for the management of air quality in road tunnels in New Zealand*. www.nzta.govt.nz/air

³⁰ World Road Association (PIARC) (2012) *Road tunnels: vehicle emissions and air demand for ventilation*. www.piarc.org

3.3.3 Dust

Dust emissions resulting from state highway construction activities are typically assessed against guidelines set by MfE¹⁹ as shown in table 4.

TABLE 4: MfE RECOMMENDED TRIGGER LEVELS FOR ROAD-TRANSPORT-RELATED DUST

DUST TYPE	PROTECTION	CRITERIA
Deposited particulate (DP)	All areas	4 g/m ² /30 days (above background concentrations)
Total suspended particulate (TSP)	High	60 µg/m ³ (24-hour rolling average) 200ug/m ³ (1-hour average) 250ug/m ³ (5 minute average)
	Moderate	80 µg/m ³ (24-hour rolling average) 250ug/m ³ (1-hour average)
	Low	100 µg/m ³ (24-hour rolling average)

The 24-hour rolling average MfE values in table 4 are typically used to assess the overall ability of a project to comply with the commonly used phrase 'no offensive or objectionable discharges of dust beyond the boundary of the project area'. The short-term (1 hour and 5 minute) monitoring trigger values can be used to assist project staff with maintaining effective dust control during the working day.

3.3.4 Odour

Odour emissions resulting from state highway construction activities are assessed on a case-by-case basis against guidelines set by MfE²².

However, in general, there is a requirement that any odour associated with construction activities will not result in 'odour that are offensive, objectionable or noxious' beyond the boundary of the works (designation).

4

TRANSPORT AGENCY ROADING PROJECT PROCESSES

This section introduces the business processes that the Transport Agency follows for roading projects and where the different levels of air quality impact assessment are integrated into these processes. Specific details on the assessment stages - in terms of who undertakes them, what should be covered and how they should be done - are covered in sections 5, 6 and 7. Monitoring is discussed in section 8.

4.1 PROJECT DEVELOPMENT AND DELIVERY

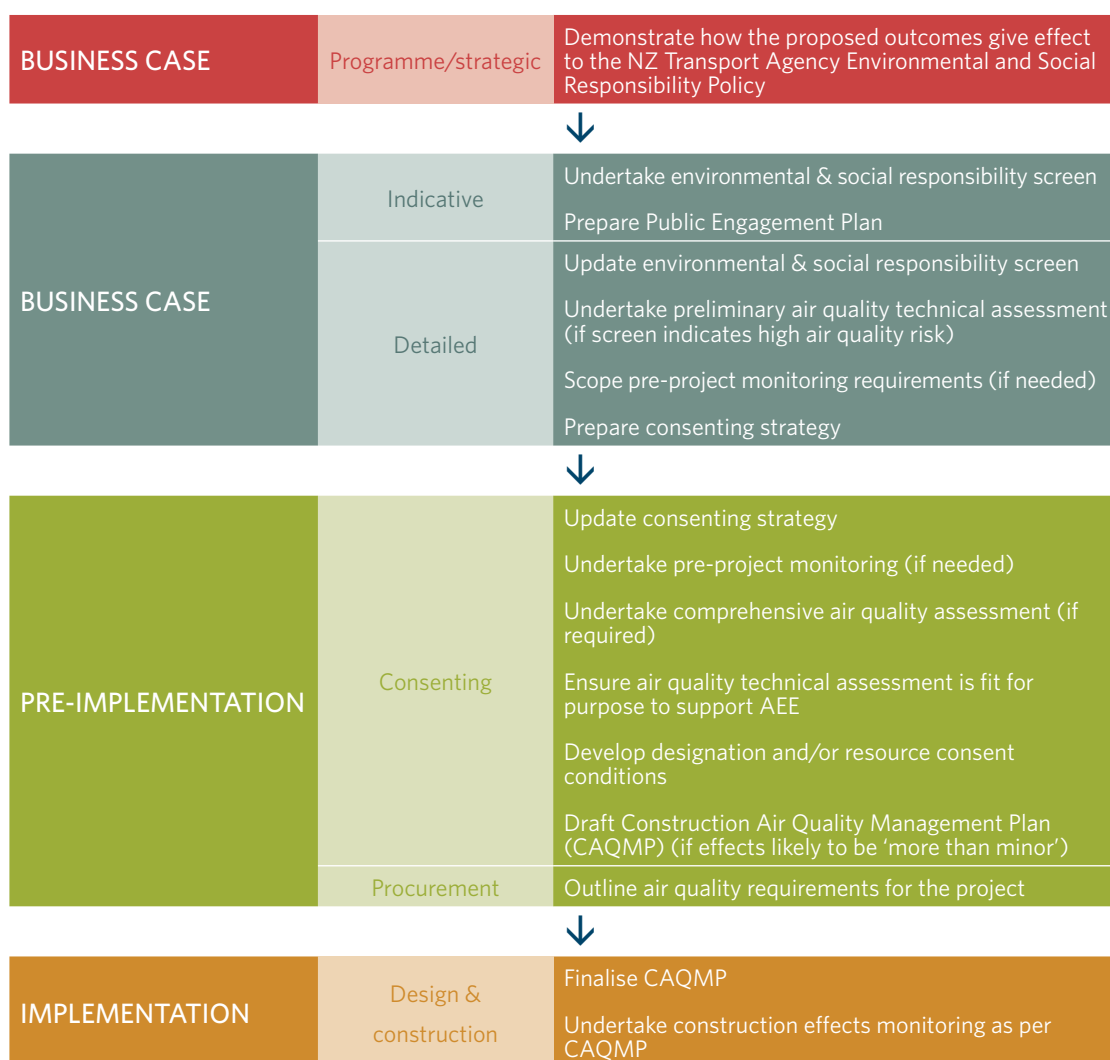
The Transport Agency’s project development and delivery process is guided by the development of a project’s business case, with the key steps as they relate to air quality shown in figure 2.

The business case is built progressively beginning at a strategic level and progressing to a detailed level. There are decision points along the way to determine whether the investment is worthwhile in relation to the desired outcomes. Further information on Transport Agency processes, standards and procedures is available on the **highways information portal**.

Impact assessments assist in evaluating options, making decisions to progress a project, as well as supporting statutory approvals for approved projects. Impact assessments are potentially undertaken at three different points along the project lifecycle:

- Indicative business case development (project development).
- Detailed business case development (project development).
- Pre-implementation (project delivery).

FIGURE 2: THE STEPS IN A TYPICAL LIFECYCLE OF A TRANSPORT AGENCY ROADING PROJECT THAT INVOLVE AIR QUALITY EFFECTS



4.2 PROJECT IMPACT ASSESSMENT

Air quality is only one of many potential environmental impacts resulting from the construction and operation of roads. However, for state highway projects air quality can be a significant area of community concern.

The Transport Agency assesses all potential environmental effects (including air quality) of roading projects in accordance with the *State highway environmental and social responsibility standard*¹⁰³ (ESR). This follows a staged assessment process:

- Environmental and social responsibility screen
- preliminary technical assessment
- technical assessment.

The first level of assessment undertaken in a project's life is the ESR screen. This consists of a simple checklist of questions and is carried out for all projects during the indicative business case. The ESR screen is discussed further in section 5.

As the project develops, the ESR screen is updated and may also be supplemented with results of the air quality screening model and other air quality risk assessment tools to form a preliminary technical assessment. The preliminary technical assessment is discussed further in section 6.

Finally, the updated ESR screen or preliminary technical assessment (where relevant) is used to scope the level of detail required in the assessment of environmental effects (AEE). Depending on the air quality risk posed by the project, the AEE may be able to utilise results directly from the preliminary technical assessment (using the air quality screening model and other simple checklists) or may require a detailed air quality technical assessment. The AEE is required in the project consenting (pre-implementation) phase. The technical assessment is discussed further in section 7.

Any technical assessment should be tailored to the project lifecycle phase and carried out at the appropriate level of detail. Each level of assessment should focus on issues that are needed to inform the decision that is to be taken and on the risks and opportunities associated with the project.

5

ENVIRONMENTAL AND SOCIAL RESPONSIBILITY SCREEN

All projects and options under consideration are assessed using the environmental and ESR screen. A separate screen should be completed for each option being considered.

5.1 PURPOSE

The purpose of the ESR screen is to identify opportunities, inform the risk management process and ensure the environmental and social matters of a state highway roading project have been addressed during development of the business case.

5.2 WHEN IS IT DONE? BY WHO?

The ESR screen is first carried out for all projects during the indicative business case phase and should be able to be completed using existing project information and easily accessible information. The screen is then updated during the detailed business case as shown in figure 3.

The screen is designed to be completed by Transport Agency project staff without the need for assistance for an air quality specialist. Transport planners with input as needed from resource management planners should easily be able to complete the screen for low complexity projects/options. More complex projects may require multidisciplinary teams.

Assistance to complete the screen is also available from the Transport Agency’s environmental specialists at environment@nzta.govt.nz

5.3 WHAT IS COVERED?

The ESR screen is divided into two parts: questions and summary. The first part of the screen contains a series of questions to help identify relevant social, natural environment, human health, culture and heritage and urban design matters. The questions have been designed to identify effects, sources of risk and project opportunities.

The summary section allows for a qualitative description of potential impacts and opportunities. It should be used to not only summarise key responses to the questions but to elaborate on important issues and identify further actions required to address issues identified by the questions.

5.4 METHODOLOGY

The methodology for the ESR screen is described in the *State highway environmental and social responsibility screen: explanation guide*³¹.

5.4.1 Undertaking the ESR screen

Air quality issues are primarily flagged in the human health and general sections of the ESR screen as shown in table 5.

³¹ NZ Transport Agency (2015). *State highway environmental and social responsibility screen: explanation guide*. hip.nzta.govt.nz

FIGURE 3: WHERE THE ESR SCREEN FITS INTO THE TRANSPORT AGENCY ROADING PROJECT LIFECYCLE

BUSINESS CASE	Indicative	Undertake environmental & social responsibility screen Prepare Public Engagement Plan
	Detailed	Update environmental & social responsibility screen Undertake preliminary air quality technical assessment (if screen indicates high air quality risk) Scope pre-project monitoring requirements (if needed) Prepare consenting strategy

TABLE 5: ESR SCREEN QUESTIONS WHICH CAN HIGHLIGHT POTENTIAL AIR QUALITY RISK

NUMBER	QUESTION	ANSWER	
G1	What is the zoning of adjacent land?	Rural <input type="checkbox"/>	Commercial <input type="checkbox"/>
		Industrial <input type="checkbox"/>	Residential <input type="checkbox"/>
		High density residential <input type="checkbox"/>	Parks/open spaces <input type="checkbox"/>
G3	What is the construction timeframe?	> 18 months <input type="checkbox"/>	< 18 months <input type="checkbox"/>
HH1	What is the One Network Road Classification?	National <input type="checkbox"/>	Regional <input type="checkbox"/>
HH2	Is the area of interest designated as a non-compliant airshed?	Yes <input type="checkbox"/>	No <input type="checkbox"/>
HH3	Are there medical sites, rest homes, schools, child care sites, residential properties, marae or other sensitive receivers located within 200m of the area of interest?	Yes <input type="checkbox"/>	No <input type="checkbox"/>
HH4	Does land use within 200m of the area of interest include industrial sites, chemical manufacturing or storage, petrol stations, vehicle maintenance, timber processing/treatment, substations, rail yards, landfills or involve other activities that may result in ground contamination? OR Are there HAIL or SLUR (contaminated) sites within 200m of the area of interest?	Yes <input type="checkbox"/>	No <input type="checkbox"/>

G1. What is the zoning of adjacent land?

Zoning of adjacent property provides an indication of land use that may be sensitive to air quality health and amenity effects. Sensitive land use may include residential, certain recreational and community land use, and also areas with sensitive ecological receivers.

If the answer is a **Residential** or **High Density Residential** this indicates the potential for a high number of sensitive receivers adjacent to the site, which may be at **risk to exposure to vehicle emissions**.

G3. What is the construction timeframe?

Prolonged construction periods may have greater potential effects associated with dust discharges and other construction air emissions.

If the answer is **greater than 18 months** then **construction air emissions may be an issue**.

HH1. What is the One Network Road Classification?

Vehicle emissions are related to traffic volume and the percent heavy vehicle movements. The screen uses the One Network Road classification as a proxy for traffic flow and heavy vehicle movements.

If the answer is **national or regional road** this indicates a high number of vehicle and truck movements, which may present an **operational air emissions risk**.

HH2. Is the area of interest designated as a non-compliant airshed?

Gazetted (noncompliant) 'airsheds' have been identified by regional councils and unitary authorities as areas, which are not compliant or may not be compliant with air quality standards.

If the answer is **yes (non-compliant)** then there is a greater risk that **the incremental effect of additional vehicle movements may cause human health effects**, and also make it **more difficult to meet air quality standards**.

HH3. Are there medical sites, rest homes, schools, child care sites, residential properties, marae or other sensitive receivers located within 200m of the area of interest?

This question considers the number of receivers at risk to exposure, and the proximity of the option to receivers, in particular to 'sensitive' receivers. Sensitive receivers are those that are more susceptible to health effects, and include old and young people, people already in poor health, and those that may be exposed to the effect for long durations, such as residential exposure or exposure in schools.

Receivers may also be sensitive due to social and cultural land use, such as parks, maraes and places of worship. In some instances, ecological receivers and horticultural land use may be sensitive to air pollution and dust. In general, the greater the number of potential receivers, and the closer the option is to sensitive receivers, the higher the risk of the option.

If the answer is a **yes** then there are sensitive receivers adjacent to the site, which may be at **risk to exposure to vehicle emissions**.

HH4. Does land use within 200m of the area of interest include industrial sites, chemical manufacturing or storage, petrol stations, vehicle maintenance, timber processing/treatment, substations, rail yards, landfills or involve other activities that may result in ground contamination? OR Are there HAIL or SLUR (contaminated) sites within 200m of the area of interest?

The screen considers the potential for the option to result in disturbance of contaminated sites by asking about the type of land use in the area. High risk land uses are identified on the Hazardous Activities and Industries List (HAIL)³². Regional councils will typically hold information or maintain a register of historic land use that may have resulted in contaminated land (eg., a selected land use register or SLUR). Disturbance (in particular bulk earthworks) of contaminated sites can result in the discharge of odours and airborne contaminants (primarily during construction but also in some instances post construction), which may result in risk to site workers, sensitive receivers and ecological receivers.

If the answer is a **yes** then there are sensitive receivers adjacent to the site, which may be at **risk to exposure to airborne contaminants**.

5.4.2 Data sources

Data sources for accessing the information required to complete the ESR screen, include:

- project information
- state highway activity management plan
- Transport Agency GIS tools, eg MapHub
- MfE and regional council websites
- regional and district plans.

5.5 OUTPUT/REPORTING

After the screen questions have been answered, a summary must be prepared of the responses together with any necessary actions to be taken to meet the Transport Agency environmental and social requirements.

This summary needs to be reviewed by the Transport Agency project manager working with the Transport Agency's environmental specialists. The screen informs both the indicative and detailed business cases for an improvement project, including the consenting strategy.

5.6 WHAT HAPPENS NEXT?

Where the results of the ESR screen indicate a high risk in terms of air quality impacts or where air quality issues may create a project consenting risk and/or risk to the reputation of the Transport Agency, the project or option will need to be more rigorously investigated and a preliminary air quality technical assessment should be undertaken utilising the air quality screening model and other risk assessment tools (refer section 6).

Where no significant air quality risks are identified by the screen, no further assessment of air quality effects is required. The ESR screen is updated during the detailed business case. At this stage of project development, a short list of options is considered in greater detail. The ESR screen is updated to reflect any changes or additional information that was not available during the indicative business case phase.

5.7 CONSULTATION AND PUBLIC ENGAGEMENT

Effective stakeholder engagement is integral to the assessment process and a critical part of addressing and managing air quality effects associated with state highway projects. The Transport Agency has Public engagement guidelines,³³ which contain useful information on the recommended approach for engaging with the public and stakeholders. These guidelines should be followed to ensure that the Transport Agency's commitments with respect to consultation and public engagement are met.

Engagement with stakeholders should occur as early as possible in a project's lifecycle but from an air quality perspective should be related to the potential or actual impacts posed by the project.

For projects with multiple options under consideration, it may be impracticable or misleading to proceed with consultation immediately as it may give rise to premature landowner or occupier concerns when the possibility of particular properties being directly affected may well be greatly reduced or removed during the selection of the preferred project option(s).

For new roads in particular, engagement should commence when the details of a project are far from being 'set in concrete', when there is still flexibility to influence the alignment of the preferred option. Public engagement is a 'two-way process' and requires commitment from the Transport Agency. Engagement should be undertaken during the early phases of project investigation; however, the form of this engagement will depend on the scale and impacts of the project – not all projects will require wide public consultation.

If there is likely to be a high level of community concern about the potential air quality impacts of a project, then commence a wide level of engagement early as it more likely to be positive. Be clear about what is being engaged on and what is not. It is ideal to work together with community and stakeholders to identify the challenges before moving into potential solutions.

³² Ministry for the Environment (2011) *Hazardous activities and industry list (HAIL)*. www.mfe.govt.nz

³³ NZ Transport Agency (2016) *Public engagement guidelines*. www.nzta.govt.nz



CASE STUDY 2 - CONSULTATION

Waterview Connection, Auckland

The Waterview Connection project in Auckland is the largest roading project in New Zealand in recent times. The project, which opened in July 2017, was built in a sensitive urban and coastal environment in west Auckland. It includes 4.5km of new state highway connecting SH20 with SH16, of which 2.5km is in tunnels, as well as alterations to 7km of the existing SH16. The section of the project between SH20 and SH16 is expected to carry more than 80,000 vehicles per day while the existing SH16, which includes a causeway, has been improved to cater for more than 130,000 vehicles per day.

Given the nature of the design and the location of the project, the Transport Agency invested a considerable amount of effort and time consulting with the local community and engaging stakeholders throughout the various project development stages. This included consultation about how potentially adverse air quality effects could be addressed especially with regard to the operation of the tunnel and the siting of ventilation stacks at either end of the tunnel (in particular the northern stack, which was proposed to be constructed near to the local Waterview Primary School).

In 2008, prior to seeking consent for the project, the Transport Agency held specific community workshops about air quality after the air quality technical assessment report had been made publicly available on the Transport Agency website.

The air quality workshops were held in two locations within the project area and were independently facilitated. Air quality and health experts presented project specific and supporting information. Members of the community who had submitted concerns relating to air quality were invited to attend, as well as running advertisements in the local paper. The workshops provided an opportunity for the community to ask the experts questions and these were recorded and followed up, where necessary, afterwards.

Focused stakeholder consultation was also carried out during the Waterview Connection project. Recognising the very technical nature of the air quality assessment report, the Transport Agency consultation manager and the project air quality specialist visited key stakeholders to discuss air quality issues associated with the project. These stakeholders included:

- Owairaka School
- Waterview School
- St Francis School
- Auckland Kindergarten Association
- Ministry for Education
- Auckland District Health Board Unitec (a tertiary education institute located near to the project).

6

PRELIMINARY TECHNICAL ASSESSMENT

Once the indicative business case for a project has been approved, the project options can be refined. Where the results of the initial ESR screen indicated a high risk in terms of air quality impacts or where air quality issues may create a project consenting risk and/or risk to the reputation of the Transport Agency, the project or option will need to be more rigorously investigated.

The first step is to update the ESR screen using the latest project data. A preliminary air quality technical assessment, which evaluates the operational effects from surface roads and any tunnels as well as construction effects against set triggers, then needs to be undertaken. The results of the preliminary air quality technical assessment are used to determine any requirements for pre-project monitoring (section 8) and also to scope whether or not further information will need to be generated for the final air quality technical assessment, which will inform the AEE to be lodged with a NoR and/or resource consent application (section 7).

A preliminary technical assessment is only necessary where the preferred solution for a project is likely to cause adverse air quality effects or where public engagement has identified that there is a significant degree of public concern about air quality issues. The latter is often the case for new road alignments in areas that have not been affected by roads previously.

The first stage of the process can be undertaken by Transport Agency project staff utilising the checklists and web-based tools discussed in section 6.4 without the need for assistance from an air quality specialist. The results should then be checked by one of the Transport Agency’s environmental specialists. Depending on the results of the checklists and web based tools, further assistance from an air quality specialist may be required.

6.1 PURPOSE

A key purpose of the preliminary air quality technical assessment is to establish whether the predicted project (relative air quality impact) or cumulative air quality impact (from the road project when combined with

background air quality) is likely to result in relevant air quality criteria being exceeded. While the assessment is focussed upon operational air quality effects, construction air quality effects should also be considered at this stage. Most large state highway improvement projects in urban areas that will involve a NoR being lodged with a consenting authority for a new or altered designation will need to produce a preliminary air quality technical assessment. For improvement projects with a low air quality risk, the results of the ESR screen are likely to be sufficient for any AEE to be lodged with a NoR and/or resource consent application.

6.2 WHEN IS IT DONE? BY WHO?

A preliminary technical assessment is usually carried out during development of the detailed business case (as shown in figure 4) where the preferred transport solution has been determined but detailed solutions or alignments are still being considered.

6.3 WHAT IS COVERED?

Following on from the results of the updated ESR screen, the preliminary technical assessment is undertaken to confirm the likelihood of effects resulting from:

- operation of surface roads
- operation of road tunnels (if applicable)
- construction activities.

The first stage utilises readily available information, a series of checklists and web-based tools, in particular the Transport Agency’s air quality screening model. The screening model estimates air quality near roadways, combining the contribution of the road together with the background air quality to arrive at a cumulative concentration.

The preliminary air quality technical assessment should indicate whether any pre-project monitoring is required and also scope the likely level of detail required in the final technical assessment of air quality effects that will inform the AEE.

FIGURE 4: WHERE THE PRELIMINARY TECHNICAL ASSESSMENT FITS INTO THE TRANSPORT AGENCY ROADING PROJECT LIFECYCLE

BUSINESS CASE	Indicative	Undertake environmental & social responsibility screen Prepare Public Engagement Plan
	Detailed	Update environmental & social responsibility screen Undertake preliminary air quality technical assessment (if screen indicates high air quality risk) Scope pre-project monitoring requirements (if needed) Prepare consenting strategy

6.4 METHODOLOGY

6.4.1 Background air quality

Background air quality is the level of contaminant across the airshed from all sources. This includes contributions from natural sources (eg volcanoes, forest fires, wind-blown dust, etc) and from anthropogenic sources such as industry, domestic heating and 'remote'ⁱ roads.

Background air quality is used to assess the cumulative impact of a discharge to air. In the case of a roading project, the air pollution coming from the road being improved (the relative impact) needs to be added to the background concentration of air pollution (ie background air quality excluding nearby roads) to allow the cumulative (or absolute) impact of the project to be calculated.

Background concentrations of PM₁₀ and NO₂ are already close to, and in some locations exceeding, air quality assessment criteria in around 20-30 airsheds in New Zealand. This means that the conclusions of a preliminary technical assessment, which is concerned with the cumulative concentrations of contaminants, and whether these exceed assessment criteria, are highly dependent on the choice of background data.

In order to provide consistency in the use of background air quality data to assess project impacts, the Transport Agency has developed a set of default values of background air quality⁰⁸. These default background values are intended to be used to assess whether predicted air quality impact from the road project, combined with background air quality, is likely

to result in air quality criteria being exceeded. These background values are available for every location in New Zealand and can be accessed via an interactive map or a list from the Transport Agency website nzta.govt.nz/air.

Default background air quality values are needed to run the air quality screening model, which is discussed in the next section.

6.4.2 Air quality screening model for surface road effects

The initial risk assessment of likely effects resulting from the operation of surface roads is based on the web-based Transport Agency air quality screening model. The model is designed to provide a worst case assessment of air quality impacts from a single road for two key transport-related air pollutants – PM₁₀ and NO₂. It is relatively easy to be applied by a non-specialist once all of the input data has been gathered.

The air quality screening model is based on the annual average daily traffic (AADT), proportion of heavy vehicles (%HV), average vehicle speed, and distance to the nearest highly sensitive receiver for each link^k. The screening model connects to interactive maps with the default background concentrations included. Together with the other input shown in figure 5, the screening model then automatically outputs the road contribution and the cumulative impact.

ⁱ 'Remote' roads are any roads that are not state highways within 100m or a busy local road within 50m of the receiver of interest.

^j In a road network, a link is a portion of a road between two intersections, junctions, interchanges or nodes. Its basic characteristics are length, vehicle speeds, travel times and number of lanes.

FIGURE 5: INPUT REQUIRED TO RUN THE AIR QUALITY SCREENING MODEL

Details		Results Summary	
Location:	<input type="text"/>	Assessment year:	2014
Description:	<input type="text"/>	Census area name or ID:	<input type="text"/>
AADT:	<input type="text"/> * vpd	Heavy vehicles:	<input type="text"/> *
Average Speed:	<input type="text"/> * km/h	Distance to nearest highly sensitive receptor:	<input type="text"/> * m
PM ₁₀ 24hr average:	<input type="text"/> * µg/m ³	Enter values for the background air quality in the area of interest. These values can be determined either from the interactive map or the following page .	
NO ₂ annual average:	<input type="text"/> * µg/m ³		
Hover over text with an underline for additional information			
		PM₁₀	24hr average
		Assessment guideline (NES):	50.0 µg/m ³
		Background air quality:	0.0 µg/m ³
		Road contribution:	0.0 µg/m ³
		Cumulative contributions:	0.0 µg/m ³
		Project contribution = 0% of guideline Cumulative contribution = 0% of guideline	
		NO₂	annual average
		Assessment guideline (WHO):	40.0 µg/m ³
		Background air quality:	0.0 µg/m ³
		Road contribution:	0.0 µg/m ³
		Cumulative contributions:	0.0 µg/m ³
		Project contribution = 0% of guideline Cumulative contribution = 0% of guideline	
		<input type="button" value="Graphs"/>	<input type="button" value="Print"/>

Table 6 shows the various assessment scenarios that should be undertaken for each project option under consideration.

TABLE 6: AIR QUALITY SCENARIOS FOR A PRELIMINARY TECHNICAL ASSESSMENT

SCENARIO	YEAR	DESCRIPTION
Existing	Current	Air quality at the date of assessment (should be specified) for each link affected by the project.
Without project	Opening year and design year*	The predicted air quality for each link affected by the project at both the predicted opening year and the design year, assuming no alterations are made to the existing road.
With project	Opening year and design year*	The predicted air quality for each link affected by the project at both the predicted opening year and the design year, with the project implemented

* The design year is usually assumed to be ten years after the opening year of the project.

The basic traffic data needed for the assessment include:

- annual average daily traffic
- 24-hour average speed or level of service
- traffic composition especially the proportion of heavy vehicles (for current and predicted future conditions, where data are available)
- traffic growth forecasts for the assessment years being considered in table 6 (ideally over a 10 to 20-year period).

Figure 6 shows an example output from the screening tool for a hypothetical high air quality risk project. In this example, the background air quality values for both PM₁₀ and NO₂ are high as the project is located in a heavily populated urban area where air quality is already impacted by emissions from remote roads and other sources. The project contribution is that from the road/link under assessment only. The cumulative contribution is that from the project and the background.

The risk of an adverse air quality impact associated with improvements to a surface road is determined by comparing the screening model output for each link under consideration with the significance criteria in table 7.

Note: the air quality screening model assesses the impact one link at a time so if the project involves more than one link then the screening model will need to be run multiple times. Further guidance on how to assess multiple links and general information on the air quality screening model is available in the *air quality screening model users' notes*⁰⁷.

FIGURE 6: TYPICAL OUTPUT FROM THE AIR QUALITY SCREENING MODEL

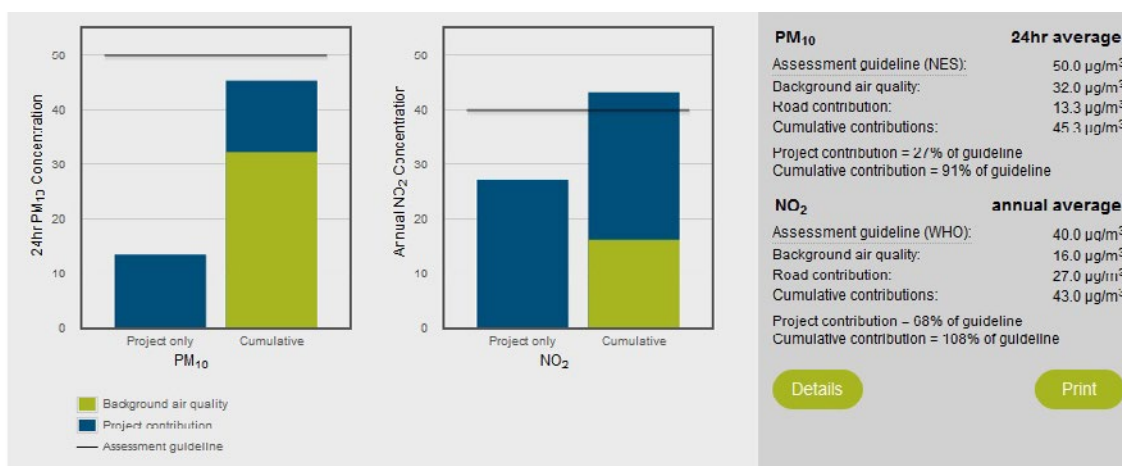


TABLE 7: AIR QUALITY SIGNIFICANCE CRITERIA

AIR POLLUTANT	LIMIT	AVERAGING TIME	PROJECT ^A CONTRIBUTION	CUMULATIVE ^B CONTRIBUTION
NO ₂	40 µg/m ³	Annual	10%	90%
PM ₁₀	50 µg/m ³	24-hour	10%	90%

Notes:

- A. The project contribution is the concentration predicted for only the road/link under consideration as a percentage of the relevant guideline.
- B. The cumulative contribution is the concentration predicted for the project plus the estimated background air quality at that location as a percentage of the guideline.

If the results of the air quality screening model indicate that the air quality risk is likely to be low (ie it is predicted to be below the thresholds in table 7), then further modelling work is generally not required and the model output is likely to provide sufficient detail for the air quality technical assessment that will inform the assessment of environmental effects.

However, if the significance criteria shown in table 7 are triggered by any link in the preferred option then air quality risk is elevated and the results need to be reviewed by the Transport Agency environmental specialists. The review will determine what further modelling work is required to finalise the air quality technical assessment^k and ultimately what documentation is necessary to support a Notice of Requirement for a new or altered designation.

^k The scope of any detailed technical assessment shall be agreed with the Transport Agency's environmental specialists.

Projects with an elevated air quality risk from the operation of surface roads should also consider appropriate mitigation and management options (section 2.1.2).

6.4.3 Risk assessment for road tunnels

Air pollutants are discharged inside a tunnel by vehicles as they travel between the entrance and exit portals. How these pollutants are discharged to the atmosphere is determined by the tunnel ventilation

system, and whether the discharge occurs from the tunnel portals or ventilation stacks.

Where a tunnel is included in the project, the initial risk assessment of likely effects resulting from the operation of a road tunnel is undertaken by answering the questions in table 8. The overall tunnel air quality risk rating is then established using table 9 and used to determine the next steps. Based on the overall tunnel air quality risk rating:

- for projects classified as **high risk**, dispersion modelling will definitely be required and a tunnel air quality effects assessment should be prepared as part of a comprehensive air quality technical assessment
- for projects classified as **medium risk**, a tunnel air quality effects assessment should also be prepared. However, in some cases dispersion modelling may not be necessary
- tunnel portal dispersion modelling is not required for **low risk** projects.

Projects with a medium or high air quality risk from the operation of road tunnels should also consider appropriate mitigation and management options (section 2.2.2).

TABLE 8: TUNNEL AIR QUALITY RISK ASSESSMENT QUESTIONNAIRE

KEY QUESTIONS	INDIVIDUAL RATING		
	LOW	MEDIUM	HIGH
Is the project in an area where PM ₁₀ AQNES is exceeded? or Does the annual average NO ₂ at the nearest equivalent roadside site exceed 30 ug/m ³ ?	No	n/a	Yes
How many highly sensitive receivers are located within 200m of the point of discharge?	<10	10-50	>50
What is the AADT (vehicles per day) at the year of opening?	<10,000	10,000-50,000	>50,000

TABLE 9: OVERALL TUNNEL AIR QUALITY RISK RATING

INDIVIDUAL RATING (from table 9)	OVERALL RATING
Two or more Low results	Low
Two Medium results OR One Low, one Medium and one High result	Medium
Two or more High results	High

6.4.4 Checklist for assessing construction impacts

The potential air quality risk associated with road construction impacts is largely determined by the number of HSRs within 200m of the route/s under consideration. While the sensitivities of people to dust soiling effects is slightly different to the sensitivity of people (or land uses) to health effects, for the purposes of assessing the risks of construction impacts the same HSR definition is suitable. Where appropriate, other land uses (eg car showrooms) may also need to be included and professional judgement should be used.

Table 10 presents a checklist of key questions to that need to be answered in order to evaluate the construction air quality risk.

If the answer to all the questions is no, then the risk is likely to be low. If more than one answer is yes, then the risk is likely to be high. Otherwise the risk is likely to be moderate.

Where the construction air quality risk is:

- **low**, construction impacts will most likely be able to be managed by generic dust and odour clauses within a construction environmental and social management plan (CESMP)
- **moderate**, a separate construction air quality management plan (CAQMP) should be prepared
- **high**, a separate construction air quality management plan (CAQMP) should be prepared. In addition, the CAQMP will require independent peer review and include a comprehensive risk-based quality assurance/quality control (QA/QC) programme to ensure risks are appropriately managed.

Projects with a moderate or high air quality risk arising from construction activities should consider appropriate mitigation and management options (section 2.3.2).

6.5 DATA SOURCES

Data sources for the information required to complete a preliminary technical assessment, include:

- Project information detailing:
 - › the alignment of any proposed routes and the likely traffic flows on those routes in terms of vehicle numbers (AADT), average vehicle speeds, and percentage heavy vehicles
 - › the likely scale of the construction activities.
- Transport Agency GIS tools, eg MapHub to determine:
 - › annual average NO₂ concentrations measured by the Transport Agency national network
 - › locations and numbers of highly sensitive receivers (eg schools, houses, hospitals).
- Transport Agency air quality web-based tools, eg nzta.govt.nz/air for:
 - › the air quality screening model
 - › background air quality concentrations.
- MfE and regional council websites for:
 - › the state of the local airshed with regards to the PM₁₀ AQNES.
- Regional and district plans websites for any locally significant planning provisions.

TABLE 10: CONSTRUCTION AIR QUALITY RISK ASSESSMENT CHECKLIST

TOPIC	KEY QUESTION
Scale of earthworks	Is the total site area > 10,000 m ² or the total volume of material to be moved > 100,000 m ³ ?
Proximity to highly sensitive receivers	Are there more than 50 HSRs within 200 m?
Anticipated truck movements	Will there be more than 50 outward truck movements per day?

6.6 OUTPUT/REPORTING

The results of the air quality screening model, the tunnel air quality risk assessment (if required) and the evaluation of construction air quality impacts are recorded in a preliminary technical assessment report for the option(s) under consideration in the detailed business case and used to help prepare the project's consenting strategy.

The preliminary technical assessment should include (but not necessarily be limited to):

- a description of the options or project being assessed
- a description of the receiving environment, including current land uses, current and future zones, existing air quality and potentially affected HSRs
- methodology and assumptions, including detail of traffic data, background air quality concentrations and percentage heavy traffic used in the exposure estimates
- summary of the outputs from the screening model, with detailed inputs and outputs in appendices.
- a discussion of tunnel air quality effects (if relevant)
- a preliminary assessment of the construction impacts
- an assessment of the effects on the HSRs
- recommendations for any specific air quality mitigation and management requirements for addressing air quality effects from the operation of surface roads, road tunnels (if applicable) and construction.

The report should also include:

- preliminary recommendations on whether a more detailed assessment is required and what pre-project monitoring should occur if relevant.

Often the outputs of the preliminary technical assessment are likely to be sufficient to support the preparation of an AEE. Where the results of preliminary technical assessment indicate the potential for significant air quality impacts, such as for large scale urban projects, further analysis of the air quality impacts may be required to support consenting activities (air quality technical assessment) and summarised in the main assessment of environmental effects.

6.7 WHAT HAPPENS NEXT?

The preliminary air quality technical assessment is the primary tool for determining what happens in the next stage of the project's lifecycle – consenting of the project during pre-implementation. It forms the foundation for scoping both the requirements of any pre-project monitoring (section 8) as well as the requirements for finalising the air quality technical assessment, which will inform the AEE to be lodged with a NoR and/or resource consent (section 7). It also flags whether specific conditions may be required to mitigate air quality effects as part of the project's consenting strategy.

The increased level of detail in a preliminary air quality technical assessment also enables better identification of potentially affected parties compared to the outputs from the ESR screen, supporting consultation and public engagement. As mentioned in section 5.7, consultation should occur throughout the various project development stages to ensure the community understand and can comment on aspects of the project's design that may impact them.

7

TECHNICAL ASSESSMENT FOR RMA ASSESSMENT OF ENVIRONMENTAL EFFECTS

7.1 TECHNICAL ASSESSMENT SCOPE

All projects lodging a NoR with a consenting authority for a new or altered designation (or seeking a resource consent for an activity that will discharge contaminants to the air) must prepare an AEE. The AEE is prepared during the pre-implementation phase of the improvement project and needs to include a level of detail appropriate to the level of air quality risk posed by the project.

The output from the ESR screen and/or a preliminary air quality technical assessment (section 6) may be sufficient for an AEE if the project has a relatively low air quality risk. If this is the case the findings from these assessments should form the basis of the final air quality technical assessment and/or the content in the AEE to be lodged with the NoR.

For projects with an elevated air quality risk there may be a need to assess air quality effects in more detail as covered in this chapter. Typically, additional information is only required for projects with a high risk in terms of air quality impacts or where air quality issues may create a project consenting risk and/or risk to the reputation of the Transport Agency, eg large projects in urban areas.

For projects with a high risk in terms of air quality impacts, the technical assessment will require independent peer review. The peer review should be a specific peer review in accordance with the Engineering New Zealand Practice Note 2 and should be completed prior to submission to any statutory authority.

FIGURE 7: SCOPE OF TECHNICAL ASSESSMENT TO SUPPORT AEE



This section describes the additional information that is considered appropriate for a comprehensive air quality technical assessment where a project has an elevated air quality risk. The methodology outlined in this chapter is based on the *Good practice guide for assessing discharges to air from land transport*⁰⁵ together with other guidance available from the Ministry for the Environment (MfE) at www.mfe.govt.nz.

7.2 PURPOSE OF COMPREHENSIVE TECHNICAL ASSESSMENT

The purpose of generating additional information for a final technical air quality assessment, as outlined in this chapter, is to comprehensively evaluate all air quality impacts (and opportunities) arising from the project, feed this information back into the design process (to the extent possible) and inform the preparation of the AEE. It should also include information on how significant air quality construction or operational effects can be mitigated, which may involve a reduction in emissions or a reduction in exposure or both.

Any proposed mitigation measures should be discussed with the Transport Agency’s project manager, planner and environmental specialists.

7.2.1 When is it done? By who?

Comprehensive air quality technical assessments should be carried out during the pre-implementation phase of a project (as shown in figure 8).

FIGURE 8: WHERE AN AIR QUALITY TECHNICAL ASSESSMENT FITS INTO THE TRANSPORT AGENCY ROADING PROJECT LIFECYCLE

PRE-IMPLEMENTATION	Consenting	Update consenting strategy Undertake pre-project monitoring (if needed) Undertake comprehensive air quality assessment (if required) Ensure air quality technical assessment is fit for purpose to support AEE Develop designation and/or resource consent conditions Draft construction air quality management plan (CAQMP) (if effects likely to be 'more than minor')
	Procurement	Outline air quality requirements for the project

As indicated above, additional information for an air quality technical assessment will typically only need to be generated for large projects located in urban environments and should be undertaken by a suitably qualified air quality specialist (such as those that meet the Transport Agency's Independent Professional Advisor criteria). Contact the Transport Agency's environmental specialists at environment@nzta.govt.nz for further advice.

Note: Additional detail to inform a technical assessment may also be required if significant community concern are raised during the consultation process creating a consenting or reputational risk.

7.2.2 What is covered?

Depending on the results of the preliminary technical assessment (section 6), additional information may be required to finalise a technical assessment in order to comprehensively assess the effects resulting from:

- operation of surface roads
- operation of road tunnels (if applicable)
- construction activities.

7.3 METHODOLOGY FOR COMPREHENSIVE AIR QUALITY ASSESSMENT

The key steps of generating additional information are outlined in figure 9 and discussed in the following sections. All tools referred to are available on the Air Quality website nzta.govt.nz/air or www.nzta.govt.nz.

7.3.1 Assessing surface road air quality effects

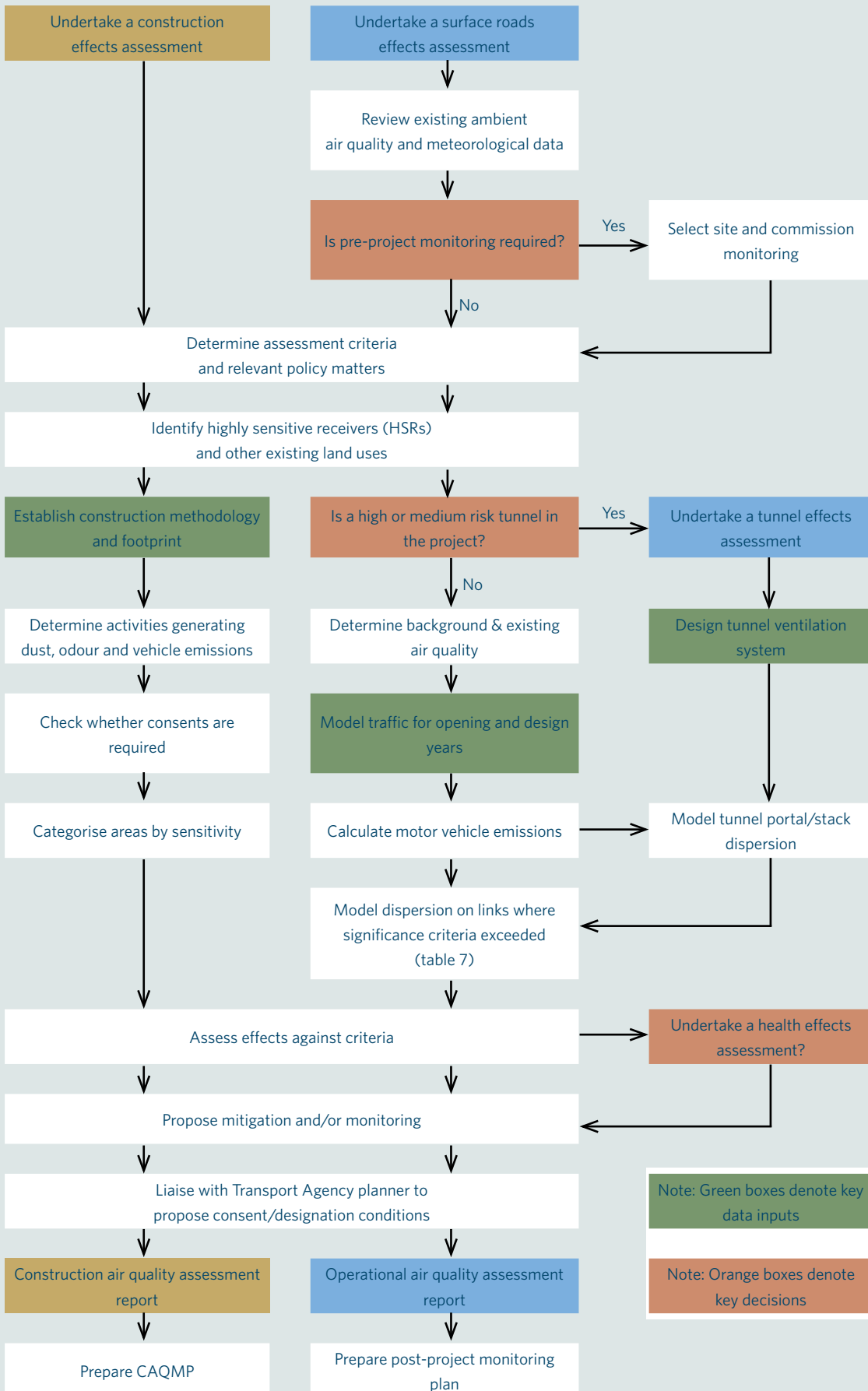
STEP 1: REVIEW EXISTING AMBIENT AIR QUALITY AND METEOROLOGICAL DATASETS

Depending on the location of the project, existing ambient air quality and meteorological monitoring data may be available from a number of sources including:

- regional councils
- Transport Agency background air quality⁰⁸
- Transport Agency transport-related air quality monitoring system (TRAMS)¹¹
- Transport Agency meteorological dataset inventory¹⁰
- air quality GIS layers on the Transport Agency air quality web pages.

This information is needed in subsequent steps to determine background air quality (step 6) and undertake dispersion modelling (step 9).

FIGURE 9: COMPREHENSIVE AIR QUALITY ASSESSMENT PROCESS



The Transport Agency background air quality values provide an alternative, cost-effective, method of determining existing and/or background air quality that could avoid the need for undertaking specific monitoring exercises. These background values provide rural and urban air quality information for all airsheds in New Zealand and can be accessed via an interactive map or a list from the Transport Agency website at nzta.govt.nz/air.

Other useful sources of air quality monitoring data include the Transport Agency national ambient air quality (nitrogen dioxide) monitoring network,³⁴ which has undertaken monthly passive sampling of NO₂ since 2007 at up to 130 sites across New Zealand. These results together with regional council data are summarised in the Transport Agency transport-related air quality monitoring system (TRAMS). The TRAMS webpage at nzta.govt.nz/air allows users to search, view and export the summary air quality data by region and air pollutant, as well as the site metadata.

Note: The concentration of nitrogen dioxide is highly dependent on proximity to roads. It is therefore important to select background or existing air quality sites carefully with specialist input.

The Transport Agency also has a meteorological dataset inventory available at nzta.govt.nz/air, which lists existing datasets that are available around the country that may be useful in air quality assessments for state highway projects, including a specific dataset developed by the Transport Agency and Auckland Council for use in Auckland.

STEP 2: DECIDE ON WHETHER PRE-PROJECT MONITORING IS REQUIRED

For some projects, in the absence of robust local data, specific pre-project monitoring is needed to provide information about existing and/or background air quality so that the likely impact of the project can be more accurately predicted and assessed.

If this is the case, a monitoring program should be commissioned (see section 8 for further guidance).

Note: The time taken to collect sufficient data is typically at least 12 months if not longer after a monitoring site has been installed. Therefore, the need for pre-project monitoring is usually flagged as part of the preliminary technical assessment so that monitoring equipment can be deployed while the final project design details are being confirmed. Ideally, sufficient suitable ambient and meteorological data should be available before starting the technical assessment.

STEP 3: DETERMINE ASSESSMENT CRITERIA AND RELEVANT POLICY MATTERS

Air quality effects are assessed against standards and guidelines that have been put in place to provide levels of protection for our health (section 3.3). Consequently the first step is to identify which pollutants will be assessed and then identify which standards, guidelines or targets apply. National standards and guidelines exist for key transport-related air pollutants but some local authorities also have specific regional targets and standards, which may also need to be considered in an assessment. If in doubt, check with the local authority.

The criteria used to protect human health differ from those used to assess air quality effects on ecology. The Ministry for the Environment has published a report discussing the potential effects of air contaminants on ecosystems in New Zealand, and recommends guideline values to help those responsible for monitoring and managing the impacts of air pollution on ecosystems¹⁸.

In addition to assessment criteria, there may be other policy matters that need to be addressed. These include specific requirements in district and regional plans and policy statements. Information on relevant policies and provisions is available from the relevant local authorities.

STEP 4: IDENTIFY HIGHLY SENSITIVE RECEIVERS AND OTHER EXISTING LAND USES

Highly sensitive receivers (HSRs) or receivers are locations where people or surroundings may be particularly sensitive to the effects of air pollution. Examples include residential houses, hospitals, schools, early childhood education centres, childcare facilities, rest homes, marae, other cultural facilities, and sensitive ecosystems.

The number and location of HSRs that may be exposed to surface road effects will have been identified in the preliminary technical assessment (section 6) but all details should be confirmed in case any changes have been made to the project design. Air pollution concentrations are a function of distance away from the roadway so accurate information is important.

STEP 5: DETERMINE BACKGROUND AND EXISTING AIR QUALITY

Before assessing the likely effects of any roading project, existing air quality needs to be determined. Existing air quality at any location is the air quality now and is made up of:

- **background air quality** – the concentration for the pollutants of interest across the airshed from all sources (excluding nearby roads)
- **nearby road contribution** – the contribution from any state highways within 100m together with the contribution from any busy local roads within 50m.

³⁴ NZ Transport Agency
Ambient air quality (nitrogen dioxide) monitoring network
www.nzta.govt.nz/air

Technical air quality assessments can use default values but may also require the use of either pre-project monitoring data, or representative continuous monitoring data to better define background air quality. However, before commissioning any pre-project monitoring the default values should be considered. The default values are conservative but may be sufficient (when combined with the likely contribution of the project) to provide a reasonable estimate of the cumulative effects and therefore avoid the need to undertake a specific monitoring campaign, **if the predicted air quality impact turns out to be low.**

In all cases where the cumulative concentration predicted by the preliminary technical assessment exceeds air quality assessment criteria, a detailed assessment of background air quality will be required.

The Transport Agency's *Background air quality guide*³⁵ discusses the use of default values and recommends procedures for specific monitoring (if warranted) for determining background air quality for technical assessments.

STEP 6: MODEL TRAFFIC FOR OPENING AND DESIGN YEARS

The key assessment scenarios that require modelled traffic data are shown in table 11. These are the same as those used previously in the preliminary technical assessment but the scenarios will require updating and more detailed information added as discussed below.

The updated traffic data needed for the assessment include:

- annual average daily traffic
- average speed or level of service by time of day (hourly at the minimum)
- traffic composition especially the proportion of heavy vehicles (for current and predicted future conditions, where that data are available)
- traffic growth forecasts for the assessment years being considered in table 11 (ideally over a 10 to 20-year period).

STEP 7: CALCULATE MOTOR VEHICLE EMISSIONS

In order to assess the air quality effects of road projects, motor vehicle emissions need to be estimated. This is typically done by applying emission factors which represent the mass of pollutants – eg grams of particulate matter – emitted per kilometre driven.

Vehicle emissions are primarily dependent on the vehicle type and fuel. For example, emissions of CO and hydrocarbons (HC) from petrol vehicles are much higher compared with diesel vehicles, while diesel vehicles tend to have much higher emissions of PM and NO_x.

Vehicle emissions are also dependent on the driving conditions. For example, emissions are different for any given vehicle under acceleration or deceleration, at different speeds and engine loads.

Various vehicle emissions models have been developed internationally with different levels of complexity for different uses. The NZ vehicle emissions prediction model (VEPM)⁹⁹ is an average speed model developed by the Transport Agency and Auckland Council to predict emissions from vehicles in the New Zealand fleet under typical road, traffic and operating conditions.

VEPM is the Transport Agency's preferred model to provide estimates that are suitable for an air quality technical assessment.

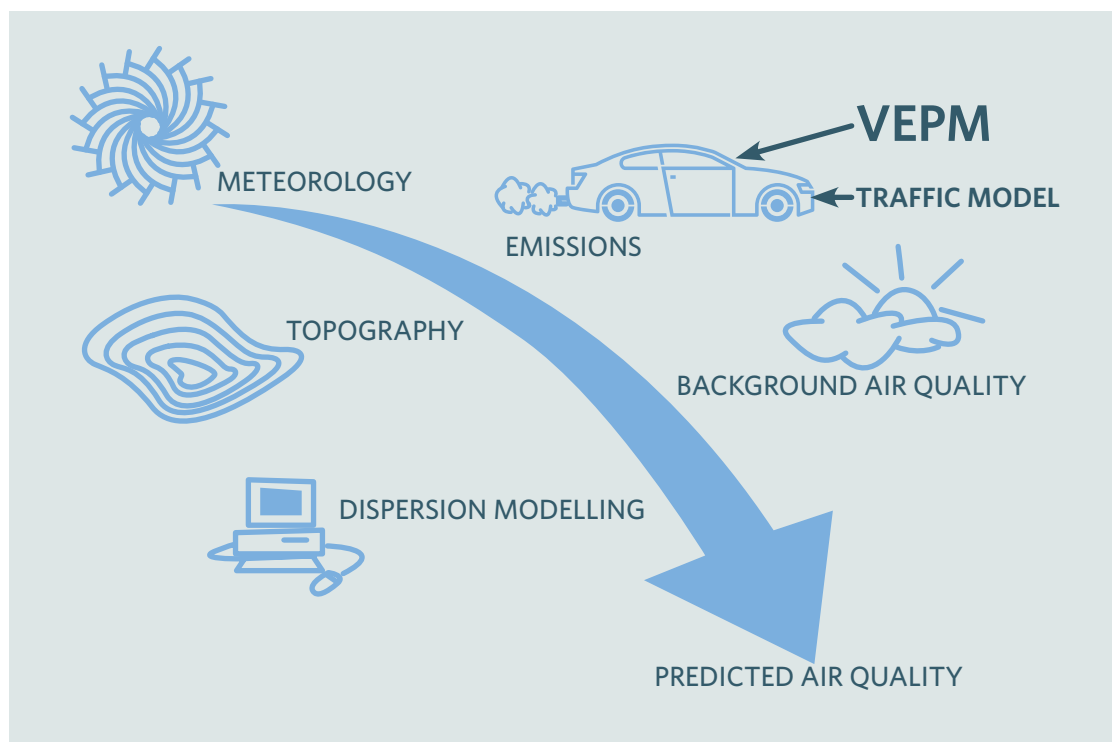
VEPM is a critical tool used in assessments of air quality effects for road projects. The model provides vehicle emission factors, which are used in conjunction with traffic models and air dispersion models to predict air pollutant concentrations downwind of the road as shown in figure 10. VEPM emission factors are also used in the Transport Agency's *Air quality screening model*⁹⁷ which is used in preliminary technical assessments.

³⁵ NZ Transport Agency (2014) *Background air quality guide*, draft. nzta.govt.nz/air

TABLE 11: AIR QUALITY SCENARIOS FOR A TECHNICAL ASSESSMENT

SCENARIO	YEAR	DESCRIPTION
Existing	Current	Air quality at the date of assessment (should be specified) for each link affected by the project.
Without project	Opening year and design year*	The predicted air quality for each link affected by the project at both the predicted opening year and the design year, assuming no alterations are made to the existing road.
With project	Opening year and design year*	The predicted air quality for each link affected by the project at both the predicted opening year and the design year, with the project implemented.

* The design year is usually assumed to be 10 years after the opening year of the project.

FIGURE 10: VEPM AND THE ASSESSMENT PROCESS

VEPM does not currently estimate evaporative or crank case emissions.

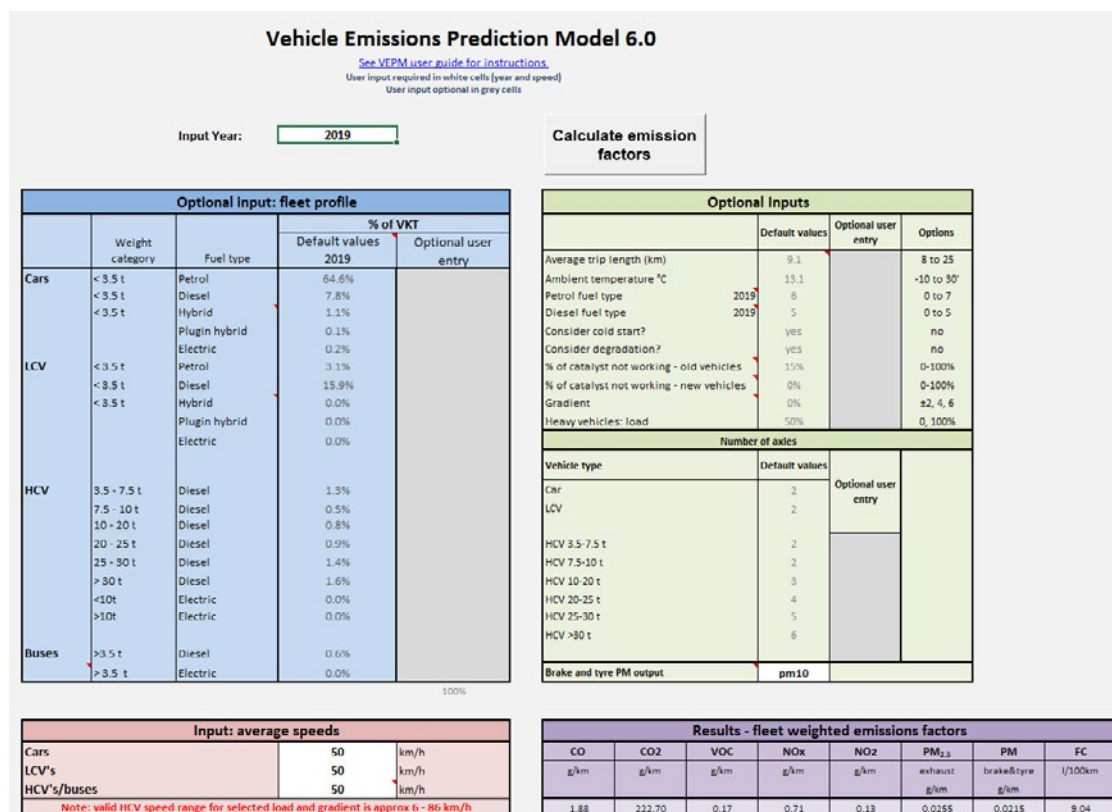
VEPM provides tailpipe exhaust emission factors for CO, HC, NO_x, NO₂, CO₂ and PM, as well as PM from brake and tyre wear¹ for the fleet for years between 2001 and 2040. VEPM includes default fleet profiles developed from actual national fleet data collected by Ministry of Transport (MoT) together with the MoT predictions of future fleet trends.

The typical input screen for VEPM is illustrated in figure 11 showing the entry data required. Users can accept the defaults or modify the relative proportions of key sectors in the fleet based on local conditions.

The Transport Agency has prepared a user guide,⁹⁹ which describes the development of VEPM with its key assumptions and limitations and includes full instructions on how to run the model for a range of applications. Additional supporting technical information can be found in the research reports, which are referenced from the user guide at nzta.govt.nz/air.

The model provides estimates that are suitable for air quality assessments as well as regional emission inventories.

FIGURE 11: VEPM INPUT SCREEN SHOWING ENTRY DATA REQUIRED



STEP 8: MODEL DISPERSION ON LINKS WHERE SIGNIFICANCE CRITERIA ARE EXCEEDED

Atmospheric dispersion modelling should be undertaken to better predict operational air quality impacts, where significance criteria are exceeded. Atmospheric dispersion models use mathematical equations that simulate the physical (and sometimes chemical) processes, which occur in the atmosphere that influence the dispersion of pollutants. Dispersion models are used to predict air pollutant concentrations at locations ('receivers') downwind of emission sources. Commonly used roadway dispersion models include the CALINE series of models, AUSROADS, BREEZE ROADS and ADMS Roads.

The dispersion of pollutants from vehicles can be influenced by a number of road specific factors including the following:

- Mechanical turbulence due to vehicle wakes.
- Thermal turbulence due to the heat discharged from vehicle exhaust.
- The road type, eg whether road is elevated or depressed with respect to the surrounding land or bridges.
- The effect of surrounding structures, eg noise barriers and nearby buildings (for instance urban canyon effect).

Roadway dispersion models take some of these factors into account when modelling pollutant dispersion but different roadway models use different methods to account for these effects. Consequently, atmospheric dispersion modelling must be undertaken by an appropriately qualified air quality professional^m

(such as those that meet the Transport Agency's independent professional advisor (IPA) criteria) with a good understanding of which model best applies to the project situation under assessment.

The key questions that should be asked before beginning a dispersion modelling assessment include:

- which geographical area or areas will be covered by the dispersion model? The scale will determine which emission sources and receivers need to be included in the model, and the level of detail to which these need to be defined in the model
- which dispersion model should be used
- which traffic scenarios are to be modelled
- which pollutants are to be assessed and which assessment criteria are appropriate
- how are traffic emission rates going to be calculated and what inputs will be required
- what project specific data are available to configure the model
- what are the uncertainties in this data and how will these uncertainties affect predictions.

Further guidance on the use of roadway dispersion models for air quality technical assessments is available in the Transport Agency's *Guide to road traffic dispersion models*¹² and the *MfE Good practice guide for atmospheric dispersion modelling*²¹. This document should be referred to when carrying out roadway dispersion modelling for a Transport Agency project.

^m Refer to CASANZ Modelling Special Interest Group for further information www.casanz.org.au

STEP 9: ASSESS EFFECTS AGAINST CRITERIA

The assessment criteria for long and short-term exposure to the key pollutants relevant to the project will have been identified in step 3.

For long-term (annual) averaging times, simple addition of the background air quality and the predicted contribution of nearby roads to ambient concentrations is appropriate for estimating cumulative effects.

However, for short-term concentrations, the location and timing of elevated background concentrations may not coincide with high concentrations from roads. This is particularly important for PM_{10} , which tends to be dominated by emissions from domestic heating sources. This means that for short-term air quality criteria, simple addition of the maximum road contribution to peak background concentrations can overestimate cumulative concentrations.

To address these issues, the Transport Agency's *Background air quality guide*³⁵ and the MfE *Good practice guide for assessing discharges to air from land transport*⁶⁵ recommend using 1-hour, sequential representative ambient air quality monitoring data and then adding the hour-by-hour predicted concentrations. This method is recommended for Transport Agency assessments where the addition of the maximum road contribution to peak background values of PM_{10} (either measured or default values) exceeds short-term air quality assessment criteria.

STEP 10: PROPOSE MITIGATION AND/OR POST-PROJECT MONITORING

For some roading projects, mitigation options may need to be considered to reduce the potential for adverse air quality effects. These measures are usually centred on either reducing the emissions from the project or reducing the exposure of people close to the project but can sometimes involve both approaches.

Options for mitigating impacts from surface roads are discussed in section 2.1.2.

Ideally, the potential need and opportunities available for mitigation should be highlighted early in the project so alternatives can be suggested in the design phase before decisions, particularly those involving route selection, have been made. Mitigation should be flagged as a potential requirement preferably in the ESR screen (section 5) or in the preliminary technical assessment (section 6) at the latest.

STEP 11: PROPOSE CONSENT/DESIGNATION CONDITIONS

Conditions for addressing surface road effects are typically only proposed for projects with a high air quality risk.

In these instances, the conditions usually centre on defining the requirements for any air quality monitoring to be undertaken after the project has been fully opened to traffic (post-project monitoring). The purpose of the monitoring is to verify the predicted air quality effects of the project made at the time of consenting.

Examples of conditions that can be considered as proposed conditions during the statutory approval process can be obtained by contacting the Transport Agency's environmental specialists at environment@nzta.govt.nz

STEP 12: PREPARE OPERATIONAL AIR QUALITY ASSESSMENT REPORT

The key elements to be included in an air quality technical assessment report into surface road effects are discussed in section 7.5.

7.3.2 Assessing road tunnel ambient air quality effects

Air pollutants are discharged inside a tunnel by vehicles as they travel between the entrance and exit portals. How these pollutants are discharged to the atmosphere is determined by the tunnel ventilation system, and whether the discharge occurs from the tunnel portals and/or ventilation stacks.

Step 5: Establish whether a tunnel effects assessment is needed

As part of the preliminary technical assessment, projects involving road tunnels undergo an initial risk assessment (section 6.4.3).

This exercise should be repeated with the updated project details to confirm the overall risk rating. Projects rated as medium or high risk will need to undertake a specific tunnel effects assessment. Projects rated as low risk just need to record the confirmation of the risk rating.

- for projects classified as high risk, dispersion modelling will be required and a tunnel air quality effects assessment should be prepared
- for projects classified as medium risk, a tunnel air quality effects assessment should also be prepared; however, judgement may be used, and in some cases dispersion modelling may not be necessary. In such circumstances the Transport Agency's environmental specialists should be consulted to confirm the extent of modelling required
- tunnel portal dispersion modelling is not required for low risk tunnel projects.

STEP 1: DESIGN TUNNEL VENTILATION SYSTEM

This step involves liaising with the project team to obtain the details on the tunnel design and, most importantly, whether portal and/or ventilation stacks emissions are likely.

Portal emissions are influenced by the piston effect of the air being pushed through the tunnel by vehicles, (which in turn is affected by traffic volumes, tunnel geometry and structure, tunnel ventilation system, and whether traffic flows are uni- or bi-directional), the buoyancy effect of the air discharge, and the effect that surrounding structures have on directing air flows. Tunnel ventilation stack emissions behave in the same way as industrial stack emissions. The key parameters include emission rates (which depend on traffic volumes, average speed, and fleet composition), stack height, stack diameter, exit velocity, and exit temperature.

Tunnels can be a form of mitigation and do not create emissions *per se*. Road tunnels take vehicle emissions that would have been dispersed to surroundings near a surface road, mix them with fresh air coming in then discharge the resulting mixture through ventilation stacks and/or portals.

STEP 2: MODEL PORTAL/STACK DISPERSION

A number of different methods are available to predict dispersion of discharges from tunnel portals including the following:

- Simplified screening methods, eg look-up tables and nomogrammes.
- Common regulatory dispersion models applying empirical methods to simulate the portal discharge jet, eg Ginzburg and Schattenek.
- Dispersion models specifically developed for portals discharge simulations, eg the Graz Lagrangian Model (GRAL).
- Complex modelling systems, eg Computational Fluid Dynamics (CFD) models or hybrid models.

Of these, the Graz Lagrangian Model has undergone the most development and has also been the most extensively validated for tunnel portals.

The Transport Agency has developed specific guidance on the modelling of tunnel portal emissions for air quality technical assessments¹⁴. This guide advises on:

- the key factors which influence pollutant dispersion from tunnel portals
- the different methods for modelling portal discharges
- the advantages and limitations of these methods.

This guide should be referred to when carrying out dispersion modelling for Transport Agency projects.

Dispersion of emissions from tunnel ventilation stacks is modelled using the same standard methods that apply to industrial stacks. General guidance for modelling these stack emissions is available in the *MfE Good practice guide for atmospheric dispersion modelling*²¹.

STEP 3: ASSESS EFFECTS AGAINST CRITERIA

Ambient air quality impacts of stack and portal emissions from road tunnels are assessed against ambient air quality criteria (section 3.3.1).

In-tunnel air quality and visibility are assessed against criteria developed by the Transport Agency¹³ (section 3.3.2).

STEP 4: PROPOSE MITIGATION

For tunnels, mitigation options typically involve optimising the location of tunnel ventilation stacks and portals away from sensitive receivers. It may also be possible to modify the design or operation of the ventilation system.

Options for mitigating impacts from road tunnels are discussed in section 2.2.2.

As for surface roads, the potential need and opportunities available for mitigating any adverse effects of road tunnels should be highlighted early in the project so alternatives can be suggested in the design phase before decisions, particularly those involving the location of portal and ventilation stacks, have been made. Mitigation should be flagged as a potential requirement preferably in the ESR screen (section 5) or in the preliminary technical assessment (section 6) at the latest.

STEP 5: PROPOSE CONSENT/DESIGNATION CONDITIONS

Conditions for addressing road tunnel effects are typically only proposed for projects with a high air quality risk (ie those involving tunnels longer than 1 km carrying high volumes of traffic in urban areas).

In these instances, the conditions usually include requiring ambient air quality near tunnel portals to meet health-based standards (using those for NO₂) and preparing a tunnel traffic operation plan to manage a range of effects generated by the vehicles in the tunnel, not solely air quality.

Examples of conditions that can be considered as proposed conditions during the statutory approval process can be obtained by contacting the Transport Agency's environmental specialists at environment@nzta.govt.nz

STEP 6: PREPARE OPERATIONAL AIR QUALITY ASSESSMENT REPORT

The key elements to be included in an air quality technical assessment report into road tunnel effects are discussed in section 7.5.

7.3.3 Assessing construction air quality effects

STEP 1: DETERMINE ASSESSMENT CRITERIA AND RELEVANT POLICY MATTERS

As discussed in section 3.3.3, dust emissions and odour emissions resulting from state highway construction activities are typically assessed against guidelines set by MfE.

In addition to these assessment criteria, there may be other policy matters that need to be addressed. These include specific requirements in district and regional plans and policy statements. Information on relevant policies and provisions is available from the relevant local authorities.

STEP 2: IDENTIFY HIGHLY SENSITIVE RECEIVERS (HSR) AND OTHER EXISTING LAND USES

The number and location of HSRs that may be exposed to construction effects will have been identified in the preliminary technical assessment (section 6) but all details should be confirmed in case any changes have been made to the project design. The distance from the construction works to each HSR is particularly important.

Note: In assessing what is a sensitive receiver to dust emissions, it is necessary to consider a wider definition that includes some horticultural activities.

STEP 3: ESTABLISH CONSTRUCTION METHODOLOGY AND FOOTPRINT

There are a number of methodologies that can be employed for determining whether receivers are likely to be affected by construction emissions. However, the Transport Agency recommends the Dust Risk Index method for projects with a high air quality risk. This standardised technique, involves considering a number of factors and then assigning a risk value based on this. Appendix B describes the methodology for applying the Dust Risk Index.

The level of detail required for assessing construction effects depends on the overall dust risk calculated for the project.

STEP 4: DETERMINE ACTIVITIES GENERATING CONSTRUCTION EMISSIONS

Examples of activities that can result in construction emissions (eg dust, odour and vehicle emissions) include:

- vegetation removal
- piling operations
- excavator cutting and shaping of natural ground
- pavement construction
- fill shaping and compaction – bulldozer
- fill placement
- haul operations
- excavation of odorous material
- rock crushing
- operation of concrete batching plant.

The project should be reviewed to identify all of the construction-related activities that may apply.

STEP 5: CHECK WHETHER CONSENTS ARE REQUIRED

This step involves checking whether specific consents are required for each of the activities identified in step 4.

Most regional and district councils have recognised the need for controls on dust nuisance, and attempt to do so through rules in regional and district plans, and through conditions in resource consents.

STEP 6: CATEGORISE AREAS BY SENSITIVITY

Although HSRs will have been identified in step 2, other receivers of differing sensitivity may also be affected by construction emissions and need to be identified.

Tables 4 and 5 (section 3.3.3) show trigger levels and guidelines for dust, which depend on the sensitivity of the receiving environment. The limits and the classifications of sensitive, moderately sensitive and insensitive are from the MfE *Good practice guide for assessing and managing dust*¹⁹.

A sensitive area typically has significant residential development, whereas a sparsely populated rural area may be relatively insensitive to some construction emissions. The judgement of sensitivity will be somewhat subjective, depending on the specific circumstances in each case, eg a Totora stand containing green mistletoe affected by the Puhoi to Warkworth project was considered a sensitive receiver in terms of dust.

STEP 7: ASSESS EFFECTS AGAINST CRITERIA

Dust emissions resulting from construction activities are typically assessed against guidelines set by MfE (section 3.3.3).

Odour emissions resulting from construction activities are assessed on a case-by-case basis against guidelines set by MfE (section 3.3.4). However, in general, there is a requirement that any odour associated with construction activities will not result in 'odour that are offensive, objectionable or noxious' beyond the boundary of the works (designation).

Construction vehicle/equipment emissions (if significant) are assessed against ambient air quality criteria (section 3.3.1).

STEP 8: PROPOSE MITIGATION

Options for managing construction effects generally involve minimising emissions from earthworks, unpaved surfaces, paved surfaces, vehicles travelling in, to and from the construction area, and material stockpiles.

Options for mitigating impacts from construction activities are discussed in section 2.3.2.

For many projects, measures to address construction air quality effects will be addressed in the Construction Environmental and Social Management Plan (CESMP) and can utilise generic dust and odour management requirements based on the relevant MfE good practice guides^{19,22}.

However, where the air quality effects are moderate or high risk as determined by table 10 in section 6.4.4, a CAQMP should be developed. The Transport Agency has developed a template to assist with preparing a CAQMP¹⁵.

Where the air quality effects are identified as high risk, a CAQMP will require independent peer review and include a comprehensive risk-based quality assurance/quality control (QA/QC) programme to ensure risks are appropriately managed. The peer review should be a specific peer review

in accordance with the Engineering New Zealand Practice Note 2 and should be completed prior to starting relevant works or submission to any statutory authority.

STEP 9: PROPOSE CONSENT/DESIGNATION CONDITIONS

Conditions for addressing construction effects depend on the air quality risk posed by the project.

Examples of conditions that can be considered as proposed conditions during the statutory approval process can be obtained by contacting the Transport Agency's environmental specialists at environment@nzta.govt.nz

STEP 10: PREPARE FINAL CONSTRUCTION AIR QUALITY TECHNICAL ASSESSMENT REPORT

The key elements to be included in the final air quality technical assessment report relating to construction effects are discussed in section 7.5 and in Appendix B.

7.3.4 Undertaking health risk and health impact assessments

Two other types of assessment that are often mentioned in road transport applications are health impact assessments and health risk assessments.

Health impact assessment (HIA) is defined as a combination of procedures, methods and tools by which a policy may be assessed and judged for its potential effects on the health of the population, and the distribution of those effects within the population³⁶. Although HIA can be applied at the project level, it is more potentially influential at the policy level and has been used in the development of strategic documents, such as regional land transport strategies³⁷ and the introduction of the air quality national environmental standards. Detailed guidance on undertaking HIA, but principally from a policy perspective, is available from the National Health Committee (nhc.health.govt.nz).

Health risk assessment (HRA) is the process of quantifying the probability of a harmful effect to individuals or populations from certain human activities. It involves determining the nature of the potential adverse effects of the air pollutant (hazard identification), determining the relationship between dose and the probability or the incidence of effect (dose-response assessment), and then determining the amount of a pollutant (dose) that individuals and populations will receive (exposure quantification). In most situations, it is sufficient to assess the effects of road-transport-related air pollution by comparing model predictions to air quality assessment criteria, because these are all health-based standards.

HIA and HRA are specialised activities that require expert assistance, advice should be sought from the Transport Agency's environmental specialists before undertaking these assessments.

7.3.5 Assessing effects on sensitive ecosystems

Sensitive ecosystems are included in the definition of highly sensitive receivers, which should already have been identified in the ESR screen (section 5) and the preliminary air quality technical assessment (section 6).

³⁶ Public Health Advisory Committee (2005) *A guide to health impact assessment: a policy tool for New Zealand*, 2nd edition. www.moh.govt.nz

³⁷ Auckland Regional Council (2009) *RLTS2010/WP13 Health Impact Assessment*. www.aucklandcouncil.govt.nz

Currently, there is little information on the effects of air pollutants on native New Zealand flora and fauna and therefore the robustness of any assessment will suffer from these knowledge gaps. Nonetheless, a technical assessment should include at least some commentary on potential effects on any sensitive ecosystems, where they are likely to arise.

The MfE *Good practice guide for assessing discharges to air from land transport*⁶⁵ refers to a number of documents that provide advice on critical levels for protecting ecosystems from common road transport-related air pollutants including the effects of air pollution on New Zealand ecosystems¹⁸.

7.4 DATA SOURCES

Data sources for the information required to complete the comprehensive technical assessment, include:

- Project information detailing:
 - › the alignment of any proposed routes and the likely traffic flows on those routes in terms of vehicle numbers (AADT), average vehicle speeds, and percentage heavy vehicles
 - › the likely scale of the construction activities.
- Transport Agency GIS tools, eg MapHub to determine:
 - › annual average NO₂ concentrations measured by the Transport Agency national network
 - › locations and numbers of highly sensitive receivers (eg schools, houses, hospitals).
- Transport Agency air quality web-based tools, eg nzta.govt.nz/air for:
 - › the air quality screening model
 - › background air quality concentrations.
- MfE and regional council websites for:
 - › the state of the local airshed with regards to the PM₁₀ National Environmental Standard.
- Regional and district plans websites for:
 - › relevant planning provisions.

7.5 OUTPUT/REPORTING

The following key elements form the scope for commissioning a comprehensive air quality assessment:

- Designing and recommending a pre-project monitoring programme as early as possible (if required).
- Conducting a site visit to confirm the existing environment.
- Gathering ambient air quality data, meteorological data, traffic modelling data, fleet profile, vehicle emissions data, construction methodology and construction footprint.
- Assessing operational air quality effects.
- Assessing construction air quality effects.
- Liaising with the tunnel designers to inform tunnel design and assess tunnel air quality effects (if project involves a tunnel assessed as being medium or high risk).
- Preparing the air quality pages of a Construction Environmental and Social Management Plan or a specific Construction Air Quality Management Plan (if required).
- Designing and recommending a post-project monitoring programme (if required).
- Recommending appropriate consent/designation conditions using the Transport Agency air quality model consent conditions (contact environment@nzta.govt.nz).
- Preparing an appropriate AEE air quality technical assessment report.
- Assisting with community/stakeholder consultation (as appropriate and outlined in the project's Public Engagement Plan).
- Preparing /presenting evidence and conference with other experts as required for the RMA consenting processes.

Figure 12 outlines the level of detail that should be included in a comprehensive air quality technical assessment, prepared in accordance with this section, to support an assessment of environmental effects for a Notice of Requirement.

FIGURE 12: EXAMPLE TABLE OF CONTENTS FOR A COMPREHENSIVE AIR QUALITY TECHNICAL ASSESSMENT**TABLE OF CONTENTS TEMPLATE**

1	Executive summary
2	Introduction
3	Methodology
3.1	Approach to assessment of effects
3.2	Air quality assessment criteria
4	Assessment matters
4.1	RMA matters
4.2	Land Transport Management Act
4.3	NZ Transport Agency (State Highway) Environment Plan
5	Description of project
6	Existing environment
6.1	Scope
6.2	Land use and topography
6.3	Sensitive receivers
6.4	Meteorology
6.5	Background ambient air quality
7	Traffic and emissions modelling
7.1	Traffic modelling
7.2	Emission modelling methodology
7.3	Traffic volumes and speeds
7.4	Vehicle fleet profile
7.5	Vehicle emission rates
8	Dispersion modelling
8.1	Dispersion modelling method(s)
8.2	Modelling input data
8.3	Surface roads in the modelling domain
9	Effects assessment operation of project
9.1	Surface roads (project)
9.2	Surface roads (affected links)
9.3	Regional effects
10	Mitigation of operational effects
10.1	Route selection
10.2	Traffic flow
10.3	Land use separation
10.4	Land use change
10.5	Post-construction monitoring
11	Effects assessment construction activities
11.1	Potential sources of dust during construction
11.2	Construction methodology
12	Mitigation of construction effects
12.1	Construction Air Quality Management Plan
12.2	Construction monitoring
13	Consultation
14	Summary and conclusions
	References
	Glossary of terms

Note: The aim of this structure is to provide an example of the approach that should be considered for all Transport Agency projects. However, it is recognised that some modifications may be necessary depending on individual assessment and project characteristics. For example, some of the technical detail may be included in appendices.

Based on figure 12, the various sections should cover the following:

1. **Executive summary:** a one-page statement of the key features and results. This may be the only part of the report that some users read, so it should be succinct and clear.
 2. **Introduction:** who has commissioned the project, and why, including the intended outcomes. As this is likely to be the Transport Agency, there should be some coverage of the Transport Agency's policy context for the project. A brief description of the project and some background to the issues and the relevance of any previous work should also be mentioned.
 3. **Methodology:** a description of the processes used, any models employed, assumptions made, any statistics or analysis used, and the assessment criteria used for the effects of vehicles operated on the road and in any road tunnels and the effects of road construction.
 4. **Assessment matters:** a discussion of the relevant legislative and policy matters considered as part of the assessment.
 5. **Description of project:** a description of the project and the area of influence of the project (that is, the extent of roads or links that would be directly or indirectly affected by the project).
 6. **Existing environment:** a description of the receiving environment, including land use, topography, sensitive receivers, meteorology, and background air quality. Where possible, maps and photographs should be included to highlight all relevant features, especially the location relative to the project of all sensitive receivers, such as residences, schools, early childhood education centres, etc.
 7. **Traffic and emissions modelling:** the sources and validity of all input data, including traffic flow data, fleet profiles, emission factors, with all assumptions, references, potential errors and uncertainties clearly stated.
 8. **Dispersion modelling:** detailed description of the methodology used, with all assumptions, references, potential errors and uncertainties clearly stated. Detailed input/output files should be attached in appendices.
 9. **Operational effects assessment:** the outcomes of the assessment of the operation of the project (emissions from vehicles travelling on the affected roads and in any road tunnels), with as much as possible of the information in tabular and graphic form. The emphasis should be on key results that can inform decision-making, including the likely impact of vehicles predicted to use the road network as modified by the project on regional air quality. All assumptions, references, potential errors and uncertainties should be clearly stated and detailed results should be given in an appendix.
 10. **Mitigation of operational effects:** discussion of all options considered to reduce the potential for adverse air quality effects from the operation of the project, such as land use, traffic flows, tunnel ventilation systems, location of portals/stacks etc. Any recommendations for post-project monitoring should also be discussed.
 11. **Construction effects assessment:** the outcomes of the assessment of the construction of the project (dust emissions), with as much as possible of the information in tabular and graphic form. All assumptions, references, potential errors and uncertainties should be clearly stated and detailed results should be given in an appendix.
 12. **Mitigation of construction effects:** discussion of all options considered to reduce the potential for adverse air quality effects from the construction of the project, such as the development of a dust management plan. Any recommendations for dust monitoring should also be discussed.
 13. **Consultation:** a description of any consultation carried out, and its outcomes.
 14. **Summary and conclusions:** a summary of the scope, method, results and implications, with any uncertainties and critical assumptions highlighted. An overall statement of the likely adverse effects of the project on air quality needs to be made.
- References:** all material used should be referenced explicitly, and should include web-based links where appropriate.
- Glossary of terms:** a comprehensive list defining clearly the meaning of all important and technical terms (based on this standard). All abbreviations used, including those for organisations, should also be listed.
- Appendices:** any detailed calculations or results that are used. This should include model input and output files.

SPECIAL MENTION OF THE TREATMENT OF ACCURACY AND UNCERTAINTY

Section 8.6 of the MfE *Good practice guide for assessing discharges to air from land transport*⁰⁵ deals with important considerations regarding accuracy and checking of detailed technical assessments as follows:

Careful consideration of accuracy is especially important in transport assessments, which usually rely on models to estimate traffic and vehicle emission factors as well as dispersion. With three or more levels of modelling there is plenty of room for error and – perhaps more importantly – mistrust of results. It is important that errors and uncertainty be considered throughout the assessment, and that the report clearly demonstrates this.

The MfE guide also emphasises the importance of quality control, such as data checking, and the use of sensitivity analyses, if it is difficult to quantify the uncertainty.

The Transport Agency endorses the importance of defining accuracy and uncertainty and recommends that these are addressed in a clear and comprehensive manner in the relevant sections throughout a technical assessment.

7.6 WHAT HAPPENS NEXT?

The comprehensive air quality technical assessment report will be used to support the project's assessment of environmental effects for completing statutory approvals in the next phase of the project's lifecycle.

8

MONITORING

Monitoring of air quality effects resulting from a state highway roading project is undertaken at various stages throughout the project lifecycle and for a variety of purposes.

This section covers why and when the various types of air quality monitoring is required, what issues need to be addressed, how monitoring should be undertaken and where the information gathered feeds back into the overall project lifecycle. It also discusses the key issues to be considered before scoping the requirements for any monitoring undertaken.

8.1 PRE-PROJECT MONITORING

8.1.1 Purpose

The purpose of pre-project monitoring is to determine the current air quality so the likely impact of the project can be more accurately predicted and assessed. For some projects, it is often also needed to provide critical data (eg meteorological conditions) for dispersion modelling, if the scale or complexity of the project is likely to warrant a comprehensive technical assessment.

Wherever possible, actual measurements taken at the potentially affected locations should be used to characterise the current air quality.

8.1.2 When and for how long?

If pre-project monitoring is required it should be undertaken as early as possible in the project timeline to enable sufficient lead in for information to be available. It provides critical information which can be used to fine tune the design options, such as the horizontal and vertical alignment, at an early stage thereby reducing the eventual impact of the project.

For large projects, where it is clear from the ESR screen that the scale of the project will ultimately require a detailed assessment of air quality effects for the AEE, pre-project monitoring can be justified and commenced very early. In most other cases, pre-project monitoring will only be flagged after a preliminary technical assessment has been completed (if it is warranted).

Pre-project monitoring should be undertaken as soon as practicable in the project lifecycle, so as to get maximum value from the data. Getting permission to monitor at sites can be very time-consuming and may require a significant lead time.

Once monitoring has commenced, it should run continuously for at least 12 months, but preferably 24 months, in order to account for inter-annual variability in meteorological conditions. It is not unusual to have significant year by year differences in average wind speed and wind direction and these can have a marked influence on the dispersion of emissions and the resultant air quality in an area.

8.1.3 Where?

The ESR screen (section 5) and/or the preliminary technical assessment (section 6) will identify highly sensitive receivers. These are the locations that are likely to be the most impacted by the project's air quality effects, either through proximity (closeness to the emissions) or increased susceptibility (the elderly, children, and the infirm).

Monitoring should be undertaken preferably at, or very near to, the location of the most affected sensitive receiver or, for complex situations, at a limited number of representative locations if the scale of the project means the air quality may differ greatly across the distances involved. It is important that any monitoring site selected not only represents the most appropriate receiver but is also suitable for validating the outputs of any modelling that is likely to be undertaken in the detailed technical assessment.

The MfE *Good practice guide for air quality monitoring and data management*²⁰ recommends that sites for monitoring contaminants associated with vehicle emissions be located between 2 and 5m from the side of the relevant road but also highlights other considerations such as:

- avoiding sites with restricted air flow such as locations close to buildings, trees, or walls
- ensuring sites have good access, are close to a suitable power supply, and are protected from vandalism.

8.1.4 What?

According to the MfE *Good practice guide for assessing discharges to air from land transport*⁶⁵:

'Ambient air quality monitoring should determine the concentrations of the critical indicator contaminants (generally CO, NO_x and PM₁₀ and possibly benzene). It is recommended that traffic counting, ambient air quality monitoring and meteorological monitoring be undertaken simultaneously to provide adequate data for trend analysis.'

AMBIENT AIR POLLUTANTS

The ambient air pollutants to be included in a pre-project monitoring campaign should generally follow from the preliminary technical assessment (or the ESR screen if it involves a large project), which has trigger levels for:

- NO₂
- PM₁₀

If the contribution of the project is greater than or equal to the 10% threshold (in table 8) and/or the airshed is degraded for a pollutant (cumulative concentration greater than or equal to the 90% threshold) then that pollutant should be included as part of a monitoring campaign. For example, if the predicted 24-hour average concentration of PM₁₀ resulting from the preferred option exceeds 5.0 µg/m³ at the nearest receiver then PM₁₀ should be monitored.

Generally, pre-project monitoring will be confined to one or more of these two 'trigger' pollutants but others may also need to be monitored as follows:

- PM_{2.5} - if PM₁₀ is flagged for monitoring.
- Carbon monoxide - if either NO₂ or PM₁₀ is flagged for monitoring.
- Benzene - if either NO₂ or PM₁₀ is flagged for monitoring and the roading project has a significant traffic flow (in excess of 25,000 vehicles per day).

Concentrations of PM₁₀, PM_{2.5} and CO are measured by continuous analysers, which are the regulatory method for assessing compliance against standards or guidelines. Concentrations of NO₂ are usually measured by continuous analysers for assessing compliance but can also be measured by passive samplers for initial screening. Passive sampling is the method used by the Transport Agency to monitor monthly average concentrations at 130 sites across New Zealand³⁴.

All continuous air quality monitoring should be conducted in accordance with the MfE *Good practice guide for air quality monitoring and data management*²⁰, using the appropriate:

- monitoring method
- siting criteria
- equipment calibration and maintenance procedures
- data management and quality assurance protocols.

All passive air quality monitoring of NO₂ should be conducted in accordance with the Transport Agency *Ambient air quality (nitrogen dioxide) monitoring network - operating manual*³⁸, using the identical type of passive tubes. If a different type of sampler is to be used then a co-location exercise will be required to establish the correlation between the Transport Agency passive tubes and the alternative sampler.

³⁸ NZ Transport Agency (2017) *Ambient air quality (nitrogen dioxide) monitoring network - operating manual 2017/18*. www.nzta.govt.nz/air

Prior to confirming the scope of the monitoring programme advice should be sought from the Transport Agency's environmental specialists.

METEOROLOGY

Meteorology has a profound effect on the dispersion of traffic-related air emissions and the resulting concentrations of air pollutants in the surrounding environment. For example, temperature inversions during winter can significantly increase air pollution levels even if emissions are constant throughout the year.

Meteorological monitoring is essential to understanding air quality in an area and good quality data are also critical for dispersion modelling.

For all state highway projects, the critical meteorological parameters are:

- wind speed, wind direction and air temperature.

For complex or large scale projects, additional meteorological parameters that can provide an improved understanding include:

- relative humidity, solar radiation, rainfall and a temperature profile at two heights.

All meteorological monitoring should be conducted in accordance with the MfE *Good practice guide for air quality monitoring and data management*²⁰ and undertaken at the same time as the air quality monitoring.

The Transport Agency has access to certain meteorological data. The availability and suitability of this data should be confirmed prior to conducting site-specific monitoring.

ⁿ The Vehicle Emission Prediction Model⁹⁹ has default national fleet statistics but the percentage of heavy commercial vehicles can be adjusted to better represent the local fleet keeping the profiles of the vehicles within the light and heavy vehicle fractions the same.

³⁹ NZ Transport Agency (2004) *Traffic monitoring for state highways manual, SM052*. www.nzta.govt.nz

TRAFFIC PARAMETERS

Air pollutant concentrations in the local environment are a function of the source (the emissions) and the dispersion (the meteorology and, to a lesser extent, the topography). For emissions from vehicles using roads, the emissions are in turn a function of the characteristics of the vehicles (fleet parameters) and the way the vehicles are travelling (traffic flow parameters). An understanding of the fleet and the traffic flow parameters enables the emissions to be characterised for the current road layout and modelled for future changes.

For all state highway projects, the critical fleet parameter is:

- the percentage of heavy commercial vehicles. National fleet profiles can then be 'calibrated' for the local fleet based on this percentageⁿ. However, some projects may have additional information available such as visual observations, close circuit TV records or video monitoring which can be used to validate the whole fleet profile, not just the heavy/light vehicle split.

For all state highway projects, the critical traffic flow parameters are:

- hourly average traffic counts and hourly average speeds.

These are usually recorded in 15 minute bins, which may be used instead of the hourly data if they can be matched to coincident air quality and meteorological data.

All traffic monitoring should be conducted in accordance with the Transport Agency's *Traffic monitoring for state highways manual (SM052)*³⁹ and undertaken at the same time as the air quality and the meteorological monitoring. The SM052 manual describes the current methodology for traffic monitoring, the technology involved, conventions, survey guidelines, calculations and an overview of the software system. For bi-directional roads, traffic flow parameters will need to be monitored for each direction and differentiated for a typical weekday, Saturday and Sunday.

The traffic monitoring will need to be organised by the project manager, in consultation with the Transport Agency's traffic monitoring team.



CASE STUDY 3 - PRE-PROJECT MONITORING

MacKays to Peka Peka, Kapiti Coast

The alignment of the 17.8km MacKays to Peka Peka Expressway passes through Raumati, Paraparaumu and Waikanae on the Kapiti Coast. The four lane state highway forms part of the Wellington Northern Corridor, which runs from Levin to Wellington Airport and passes within a few hundred metres of over 300 residential properties.

During the early stages of the project, a decision was made to commission an ambient air quality monitoring station in the project area. Pre-project monitoring was considered necessary due to the proximity of residential areas to the project, the absence of other representative monitoring data from which an air quality baseline could be established, and concern from local residents in the Raumati South area about winter time air pollution from domestic fires. Pre-project monitoring was also considered appropriate given the level of public concern about the project.

A monitoring site was established in a residential area close to the project's proposed route. Site selection was influenced by practical considerations including vehicle accessibility, proximity to a power supply and land ownership issues (the land where the monitoring station was sited was owned by Transport Agency). Concentrations of the key pollutants, PM_{10} , CO and NO_x , as well the meteorological parameters of wind speed, wind direction, temperature and relative humidity were recorded over a 12 month period.

Results from the monitoring programme were very useful when establishing baseline pollutant levels for the project area. An important outcome of the monitoring programme was showing current air pollutant levels in the vicinity of the project were below the National Environmental Standard criteria levels. In contrast, PM_{10} levels recorded at a temporary Greater Wellington Regional Council monitoring site located in the nearby Raumati South suburb exceeded the standard's criteria levels twice during the 70 days the

site was operating.

Locating the project's monitoring site down prevailing wind from the main residential area may have resulted in an overestimate of background levels. Monitoring of $PM_{2.5}$ would also have likely allowed for a greater understanding of the relative contribution from combustion and non-combustion sources (eg sea spray, aerosols, and dust) to PM_{10} . While this would not have altered the assessment of background PM_{10} level it would have improved the general understanding of the factors that influence air quality in the project area.

Importantly from a value for money perspective, data from the MacKays to Peka Peka monitoring station was also able to be used by the team developing the scheme and preparing the consents for the neighbouring Peka Peka to Otaki project. This not only reduced project costs but also addressed programme issues relating to availability of data.

8.2 CONSTRUCTION EFFECTS MONITORING

8.2.1 Purpose

The purpose of construction effects monitoring is to ensure that air quality effects are appropriately managed and mitigated during construction. For most projects monitoring involves undertaking and reporting the results of daily inspections. However, for projects with a high air quality risk it may involve using real-time monitoring instruments. Such monitoring can enable immediate remedial action, eg increasing the wet suppression of unpaved areas, to be undertaken before effects thresholds are exceeded.

8.2.2 When and for how long?

In the case of projects with a high risk of adverse air quality effects arising from construction activities, instrumental monitoring should begin as soon as possible following the start of construction and run for the duration of the construction period. The monitoring programme should recognise that some activities may be seasonal (eg earthworks) and therefore may not be continuous throughout the year.

Note: The timing and duration for construction effects monitoring may be stipulated in a condition of a designation or resource consent, in which case those stipulations will take precedence over the recommendations here. Approval process can be obtained by contacting the Transport Agency's environmental specialists at environment@nzta.govt.nz

8.2.3 Where?

The requirements for the siting of equipment used for monitoring the effects of construction will be similar to those for the pre-project monitoring (section 8.1.3). Monitoring should be undertaken preferably at, or very near to, the location of the most affected sensitive receiver or, for complex situations, at a limited number of representative locations if the scale of the project means the air quality may differ greatly across the distances involved.

8.2.4 What?

The key parameters to be included in a construction effects monitoring campaign are typically:

- total suspended particulate (TSP)
- wind speed and wind direction.

Monitoring of PM_{10} and proxies for odour (such as volatile organic compounds - VOCs) may also be required depending on where the project is located and/or if soil disturbance is likely to result in the release of odour or other contaminants.

Construction effects monitoring is typically linked to real-time notification to enable immediate remedial action, eg increasing the wet suppression of unpaved areas, to be undertaken before effects thresholds are exceeded.



CASE STUDY 4 - CONSTRUCTION EFFECTS MONITORING

Victoria Park Tunnel, Auckland

The Victoria Park Tunnel (VPT) project involved the construction of a 450m cut and cover tunnel within a very busy and densely populated part of the Auckland central business district.

The Construction Environmental Management Plan (CEMP) detailed mitigation measures to control dust and odours generated as a result of the construction process. Ambient air quality monitoring requirements before, during and after the tunnel's construction were also defined by the designation conditions.

Odour management was an issue. Contaminated soil (associated with a former gas works site) was excavated during construction causing staff onsite and, on occasions, people offsite to be affected by unpleasant odours.

Construction also involved relocating a large existing sewer main and this generated odour close to residential apartments. Odour was managed through the CEMP, measures included implementing VOC monitoring within the deep excavations with alarms set to maintain workplace exposure standards, regular 'odour walks' by construction staff to assess odour at the construction site boundary and odour masking sprays as a contingency measure.

Designation conditions requiring monitoring were very prescriptive and required total suspended particulate (TSP) to be monitored at the same fixed location where pre-project and post-project continuous PM_{10} monitoring was to also occur. However, construction activities occurred over a relatively large project area and the areas where dust was generated moved with the moving front of the road tunnel works.

Consequently TSP levels measured at the monitoring site could not accurately reflect dust levels experienced at sensitive receivers located close to working areas and therefore this was supplemented by visual assessments of dust.

8.3 POST-PROJECT MONITORING

Post-project monitoring can be either mandatory as a stipulated condition of a designation or resource consent, or voluntary, eg in response to community concerns. It may also be a requirement of a land acquisition agreement.

Note: All of the requirements for post-project monitoring are typically specified in a condition of a designation or resource consent, in which case those stipulations will take precedence over the recommendations here. Contact the Transport Agency's environmental specialists at environment@nzta.govt.nz for conditions that might apply.

8.3.1 Purpose

The purpose of post-project monitoring is to compare actual post-project data with the predictions of what the air quality would be in the area after the road began operation. Post-project monitoring:

- offers assurance to the community, the Transport Agency and the consenting authority that there have not been any adverse health impacts, and
- provides key learnings to the Transport Agency about how to refine the assessment process for future roading projects.

8.3.2 When and for how long?

Post-project monitoring takes place typically one year after the road has been opened to enable traffic flows to normalise as drivers get accustomed to the change in the state highway network.

Once monitoring has commenced, it should run continuously for at least 12 months, but preferably 24 months, in order to account for inter-annual variability in meteorological conditions. It is not unusual to have significant year-by-year differences in average wind speed and wind direction, and these can have a marked influence on the dispersion of emissions and the resultant air quality in an area.

8.3.3 Where?

The monitoring site(s) should be in the same airshed and be representative of the assessment location selected for the pre-project monitoring (if applicable).

8.3.4 What?

The parameters that should be considered are likely to be the same as those measured in pre-project monitoring (section 8.1) and will include:

- ambient air pollutants
- meteorology
- traffic parameters.

8.4 SCOPING MONITORING PROGRAMMES

Monitoring of air quality effects should be undertaken by a suitably qualified air quality specialist (such as those that meet the Transport Agency's Independent Professional Advisor criteria). Contact the Transport Agency's environmental specialists for further advice.

Clear monitoring objectives should be established at the outset of any monitoring programme so that the contaminants to be measured, the location of monitoring sites, methodology and timeframes can be determined. A good understanding of these issues is critical before engaging an air quality specialist to undertake the programme.

Note: Where monitoring is a requirement of a resource consent or designation, much of the scope may have already been determined.

The key questions that need to be addressed when scoping a monitoring programme include:

1. **Why.** Determine the purpose of the monitoring. Assessing project impacts? Managing construction effects? Dispersion model validation?
2. **When and for how long.** This will depend on the purpose. Pre-project monitoring should be undertaken as early as practicable in the project lifecycle and is usually continuous for at least 12 months but preferably 24 months, in order to account for inter-annual variability in meteorological conditions. Construction monitoring may or may not be necessary for the complete construction period. Post-project monitoring is carried out during operation and is usually continuous for at least 12 months but preferably 24 months, in order to account for inter-annual variability in meteorological conditions.
3. **What.** Determine which air pollutants and other parameters (eg meteorology and traffic) are to be measured and how. Pre- and post-project monitoring will likely involve monitoring PM_{10} , NO_2 , wind speed, wind direction, number of vehicles, average vehicle speeds and the proportion of heavy commercial vehicles. If the purpose of the monitoring is to measure construction effects, as well as dust monitoring (particulate matter), it may be necessary to monitor odour if construction is being carried out on contaminated land.
4. **Where.** Do you need to monitor where there are highly sensitive receivers or are you looking for a benchmark site for long-term trends? What is the most appropriate location if you are using the data to validate a dispersion model?

All monitoring should be conducted in accordance with relevant best practice, including:

- *Good practice guide for air quality monitoring and data management*²⁰.
- *Ambient air quality (nitrogen dioxide) monitoring network – Operating manual*³⁸.
- *Traffic monitoring for state highways manual*³⁹.

8.5 REPORTING REQUIREMENTS

The output from a monitoring campaign should consist of a report including:

- a full description of the methodology used, including site selection, instrumentation used, parameters measured and data processing techniques and quality assurance procedures used
- a summary of any exceedances or breaches of the relevant air quality criteria
- a tabulated summary of results and summary plots for each of the pollutants measured over the period, presented in accordance with the relevant best practice
- a summary of the meteorological data for the period and an assessment as to whether meteorological conditions have been conducive to high pollutant levels ('worst case conditions') during the monitoring period
- a summary of the other data – such as the traffic flow, fleet mix etc – measured for the same period and any other information considered necessary or appropriate for interpreting the results and conclusions.

The report should also note any local air pollution sources that are not road transport-related.

A full set of raw and processed data should also be supplied in a suitable format that enables it to be easily uploaded into the transport-related air quality monitoring system (TRAMS)¹¹ and other relevant Transport Agency databases.

Note: For some projects, the monitoring results may also need to be summarised into a presentation for the local community. This may be to support public engagement activities or to meet a condition of a designation or resource consent or a requirement of a land acquisition agreement.

GLOSSARY

TERM	DEFINITION	TERM	DEFINITION
AADT	Annual average daily traffic flow in vehicles per day, usually required for the opening year of the project but also for design year in detailed assessments.	Emission	The release of a substance (eg an air pollutant) from a source (eg transport, industry or domestic fires). Emissions are often expressed in units per activity (eg grams per kilometre driven g/km or grams per kilogram fuel burnt g/kg).
AAQG	Ambient air quality guidelines (Ministry for the Environment)	EPA	Environmental Protection Authority
AEE	Assessment of environmental effects	ESR	Environmental and social responsibility
Airshed	An area designated by regional councils for the purposes of managing air quality and gazetted by the Minister for the Environment.	ESR screen	The first level of assessment required in a project's life. It is undertaken during the indicative business case to highlight potential air quality risk factors associated with the transport solutions under consideration. It is equivalent to what is generally referred to as a tier 1 impact assessment.
State highway improvement projects	Projects relating to improving the state highway network as defined by the funding activity class used in the Government Policy Statement on Land Transport and the National Land Transport Programme.	Exceedance	An occasion when the concentration of an air pollutant exceeds a standard or permissible measurement.
AQNES	National environmental standards for air quality, which set standards for ambient air quality for key air pollutants to protect health. The AQNES apply to any location outdoors where people are likely to be exposed. The full title is Resource Management (National Environmental Standards for Air Quality) Regulations 2004.	Existing air quality	Existing air quality is the air quality now. For the purposes of this guide it is the sum of background air quality and the nearby road contribution.
Background air quality	Background air quality is the level of contaminant across a geographical area (eg census area unit, airshed) from all sources. This includes contributions from natural sources (eg volcanoes, forest fires, wind-blown dust) and from man-made sources such as industry, domestic heating and 'remote' roads.	Exposure	The concentration of air pollution experienced by a person for a set duration, usually expressed as a time averaged concentration (eg 1 hour average or annual average). Air quality guidelines and standards are usually set for two extremes of exposure – a short-term or acute exposure level and a long-term or chronic exposure level.
Bol	Board of inquiry	Extinction coefficient (K)	Related to opacity. The higher the extinction coefficient (expressed as m ⁻¹) the poorer the ability for light to pass through.
Busy local roads	Busy local roads are any roads with AADT greater than 20,000 vehicles per day.	FIDOL	FIDOL stands for Frequency, Intensity, Duration, Offensiveness and Location. These factors can be used to assess the impact of construction activities or odour resulting from a proposed project on the surrounding environment.
CAQMP	Construction Air Quality Management Plan.	GIS	Geographic information system
CAU	Census area unit. A Statistics New Zealand classified area, which either defines, or aggregates to define regional councils, territorial authorities, urban areas and statistical areas.	HC	Hydrocarbon
CESMP	Construction Environmental and Social Management Plan.	HIA	Health impact assessment
CO	Carbon monoxide	HIP	Highways Information Portal hip.nzta.govt.nz .
CO ₂	Carbon dioxide	HSR	Highly sensitive receivers are defined as a location where people or surroundings may be particularly sensitive to the effects of air pollution. Highly sensitive receivers are defined in table 6.2 of the <i>Good practice guide for assessing discharges to air from land transport</i> , Ministry for Environment, 2008 and include: hospitals, schools, childcare facilities, rest homes, residential properties, marae, other cultural facilities, sensitive ecosystems, certain horticultural sites, open space used for recreation, as well as land used for tourist, cultural and conservation land uses.
Comprehensive air quality technical assessment	An assessment that may be required in a project's life to provide a comprehensive assessment of the likely air quality impacts associated with the final design of the project. Typically, such assessments are undertaken where there is a high air quality risk and utilise model outputs of traffic, emissions and dispersion patterns to predict the air quality impacts from the proposed project. It is equivalent to what is generally referred to as a tier 3 impact assessment and will require independent peer review..	%HV	Proportion of heavy vehicles (ie vehicles with a gross vehicle mass of over 3.5 T).
Concentration	The amount of a substance in a mixture. For air pollution, concentration is reported as either a volumetric measure (eg parts per million PPM) or as a mass measure (eg micrograms per cubic metre µg/m ³).	Km	Kilometres
Continuous monitoring	Air quality monitoring undertaken by continuously collecting and measuring airborne gases or particles using a vacuum source in order to (usually) demonstrate compliance with an applicable regulation (eg a chemiluminescent NO ₂ analyser).	Link	In a road network, a portion of a road between two intersections, junctions, interchanges or nodes. Its basic characteristics are length, vehicle speeds, travel times and number of lanes.
Design year	10 to 20 years after the opening of the new or altered road.	Local authority	A regional council or unitary authority
Designation	A provision made in a district plan to give effect to a requirement made by a requiring authority (eg the Transport Agency) for a public work, project or work.	LTMA	Land Transport Management Act 2003, and its subsequent amendments. The purpose of this act is to contribute to an effective, efficient, and safe land transport system in the public interest.
		MfE	Ministry for the Environment
		MM	Micrometre
		MoT	Ministry of Transport

TERM	DEFINITION	TERM	DEFINITION
Nearby roads	Nearby roads are any state highways within 100m and any busy local roads within 50m.	Reverse sensitivity	Reverse sensitivity is the vulnerability of an established activity to complaint from a new sensitive land use. In the Transport Agency's case, this typically means the vulnerability of operating the state highway to legal claims from nearby land uses such as houses.
Nearest equivalent roadside monitoring site	A roadside monitoring site that is preferably on the actual state highway being assessed close to where the project is located or, barring that, on another state highway or local road but one with comparable traffic flow and dispersion characteristics.	RMA	Resource Management Act 1991, and its subsequent amendments. The purpose of this act is to promote the sustainable management of natural and physical resource.
NO ₂	Nitrogen dioxide, an air pollutant produced from the high temperature combustion of fossil fuels used in transport. NO ₂ is considered to be a key transport-related indicator pollutant.	Road controlling authority	Entity responsible for controlling a particular road under the provisions of the Land Transport Management Act. The Transport Agency is the road controlling authority for the state highway network.
Notice of Requirement (NoR)	A notice of requirement is a notice given by a requiring authority (eg Transport Agency) to a territorial authority (eg a city or district council) of the requiring authority's (eg Transport Agency) requirement for a designation for a public work, project or work. A proposed designation is referred to as a requirement for a designation.	Road tunnel	In the Transport Agency <i>Guide to road tunnels</i> : <ul style="list-style-type: none"> any covered roadway less than 80m in length is considered an underpass and is therefore not covered by the tunnel guide any tunnel between 80m and 240m in length is assessed to determine what, if any, fire safety provisions may be required all tunnels over 240m in length are assessed against all requirements in the tunnel guide.
NO _x	Nitrogen oxides, the collective term for air pollutants containing a mixture of nitrogen and oxygen.	Technical assessment	Technical information required to support RMA assessment of environmental effects. For projects with an elevated air quality risk there may be a need to assess air quality effects in more detail and complete a comprehensive air quality assessment in order to produce a technical assessment that is fit for purpose.
NZ Transport Agency	Formed in July 2008, the NZ Transport Agency is a road controlling authority and the agency responsible for the building and operation of New Zealand's state highway network, among other duties. Previously state highways were managed by Transit New Zealand.	Territorial authority	A city or district council
Opening year	The year in which the state highway improvement is completed and opened for public use.	µg	Microgram
Passive monitoring	Air quality monitoring undertaken by collecting airborne gases through a diffusion barrier onto a sorbent medium without the use of a vacuum source, eg diffusion tubes.	µg/m ³	Microgram per cubic metre
PM _{2.5}	Fine particulate matter less than 2.5 µm in diameter, an air pollutant produced from the combustion of fossil fuels, primarily diesel, used in transport.	VOC	Volatile organic compounds
PM ₁₀	Fine particulate matter less than 10 µm in diameter, an air pollutant produced from the combustion of fossil fuels, primarily diesel, used in transport. PM ₁₀ is commonly used in air quality assessments as it is covered by an AQNES and more comprehensive monitoring records exist.	WHO	World Health Organisation
ppm	Parts per million	With project	The predicted air quality risk for each link affected by the project at both the predicted opening year and the design year, with the project implemented.
Pre-implementation phase	The first stage of project delivery, during which AEEs are prepared and statutory approval is sought.	Without project	The predicted air quality risk for each link affected by the project at both the predicted opening year and the design year, assuming no alterations are made to the existing road.
Predicted air quality	Predicted air quality refers to air quality in the future including background air quality and the nearby road component with or without project.		
Preliminary air quality technical assessment	The second level of assessment that may be required in a project's life. It is undertaken during the detailed business case to indicate whether an air quality guideline or standard is likely to be exceeded by the preferred option/s under consideration by utilising the screening model. It is also used to scope the requirements of a full technical assessment (if required). It is equivalent to what is generally referred to as a tier 2 impact assessment.		
Receiver	A location where a person may be exposed to pollution from the road for 1-hour or more, irrespective of whether or not that person is considered to be sensitive to the effects of air pollution eg an industrial or commercial building.		
Remote roads	Remote roads are any roads that are not defined as nearby roads.		

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11 APPENDICES



APPENDIX A: KEY LESSONS FROM THE WATERVIEW CONNECTION BOARD OF INQUIRY HEARING 2011



Western Ring Route:
Waterview Connection
(SH16-20) - sector diagram



In 2010, the Transport Agency sought to obtain designations and resource consents for the Waterview Connection project in Auckland. The project is the largest roading project in New Zealand to be consented in recent times and was the first roading project that involved the consent application being submitted to the Environmental Protection Authority (EPA) under the provisions of the RMA national consenting process.

A Board of Inquiry (BoI) was appointed and met in 2011 to consider designation and resource consent application to enable a new section of SH20 to be constructed that will complete the Auckland 'Western Ring Route' through a combination of surface road and tunnel; and also enable works to be undertaken that will increase the capacity and resilience of an existing section of SH16.

From an air quality perspective the project has a high risk largely due to the highly sensitive urban receiving environment (central west Auckland) and the high traffic volumes using SH20 and SH16 (some of the busiest sections of motorway in New Zealand). Management of air quality in and around the tunnel, especially near the proposed northern portal, which is close to Waterview Primary School, ensured that the project had a high public profile from the very early stages.

The scale and complexity of the project design as well as the long-running nature of the project development phase (almost 10 years from scheme assessment to the final designated route) meant the assessment of air quality effects was very detailed.

This included:

- 3 years of pre-project ambient air quality and meteorological monitoring at two project specific sites, 6 months of fine particulate (PM_{2.5}) monitoring and a huge network of passive nitrogen dioxide (NO₂) monitoring throughout the project area
- establishment of a project-specific ambient air quality existing baseline
- dispersion modelling of surface roads, tunnel ventilation stacks and tunnel portals
- health effects assessment for receivers close to the new motorway.
- concrete batching and crushing construction air quality management plans.

The approach to the air quality assessment, the BoI hearing process and the Board's final determination gave rise to a number of key learnings that should be considered when consenting future roading projects that have a high air quality risk.

Pre-project monitoring

The large database of pre-project monitoring was exceptional and provided multiple benefits, not only for the Waterview Connection project, but it also led to the development of a regression model for derivation of urban background concentrations of NO₂, which has much wider applications⁴⁰. The NO₂ passive monitoring network proved to be a cost effective way of providing broad coverage across a large project area and provided the ability to demonstrate the localised nature of traffic related air quality impacts.

⁴⁰ National Institute of Water and Atmospheric Research Ltd (2014). *A regression approach to assessing urban NO₂ from passive monitoring - application to the Waterview Connection.*
nzta.govt.nz/air

Designation boundary

Property purchase was a key issue, with the need to balance the desire to minimise property purchase and associated social effects that this entails with the need to mitigate potential adverse environment effects. Prior to lodging the consent application, and as part of the process of developing the assessment of environment effects for the project, there were several residential properties close to the proposed surface alignment of SH20 not originally identified for inclusion in the proposed designation. The assessment identified a range of potentially adverse effects at these residences including air quality, noise, visual and social impacts. Given the extent of these effects, a decision was made by the Transport Agency to address these effects by including the properties within the proposed designation footprint enabling their purchase (under the Public Works Act 1981 if required).

Tunnel portal emissions

One of the key air quality outcomes sought by the Transport Agency throughout the Bol hearing process was the development of designation conditions that did not preclude flexible operation of the tunnel ventilation system. The primary reason for this was to ensure that energy usage can be actively managed by either reducing the speed or turning off the ventilation fans during periods of low traffic volumes – providing air quality criteria inside and outside the tunnel would be still be met.

The final designation conditions relating to tunnel portal emissions have been captured within the Transport Agency ‘model conditions’. The condition includes performance-based criteria to ensure that air quality effects are appropriately managed around the portals without dictating how the criteria should be achieved. This allowed the design of the tunnel ventilation system to be further refined and optimised as the projects moved into the detailed design phase prior to construction.

A complimentary designation condition requiring a ‘Tunnel Traffic Operation Plan’ to be prepared means the Transport Agency will have to demonstrate how the operation of the ventilation system will be managed and refined once the tunnel is open. This could include, for example, optimising the effect of the ‘piston effect’ created by moving vehicles inside the tunnel to reduce the need for forced ventilation to be used as well as having data feedback loops to ensure that air quality, meteorological, traffic and ventilation measurements are routinely reviewed and taken into account when developing and implementing tunnel operation procedures.

Offsets

During the Bol hearing, there was a lot of discussion around the potential use of offsets to mitigate PM₁₀ and PM_{2.5} generated by vehicles using the motorway. The project air quality assessment predicted exceedances of the Auckland Council PM_{2.5} regional target in the Oakley Creek valley, due to the existing air quality already exceeding the target. Offset proposals put forward by and experts acting for the Bol included a reduction of domestic fire emissions and controls on heavy duty diesel vehicles using the route.

Although in agreement that the concept of offsetting has merit, the Transport Agency noted that there are significant issues around the legality, feasibility, practicality, costs, benefits and efficacy of applying such a scheme to a roading project. In the context of a road, the Resource Management Act 1991 effectively puts the responsibility for air discharges from vehicle exhausts on the operator of the vehicle and not on a road controlling authority (RCA) such as the Transport Agency. On this basis, any requirement for the Transport Agency to offset ‘their’ discharge of vehicle emissions does not make legal sense.

In the case of the Waterview Connection project the argument against offsets was compounded by the fact that Auckland Council (or the former Auckland Regional Council) did not have an air quality offset policy in their plan provisions. The Bol subsequently decided not to include a condition requiring offsets. Since the Bol the National Environmental Standard for Air Quality has been amended to include provisions for air quality offsets where industry is seeking air discharge consents. This does not alter the situation for RCAs as discussed above.

APPENDIX B: DUST RISK INDEX METHODOLOGY

This appendix describes the Dust Risk Index (DRI) approach to assessing air quality effects resulting from construction activities.

The DRI generates a number that identifies the risk of dust generation during construction. The greater the DRI, the higher the likelihood of dust related issues. The DRI is calculated using the following formula:

$$DRI = (E+P+T+WS+D+A)*M*WD$$

Where:

- E = surface exposure
- P = exposure period
- T = time of year
- WS = wind speed
- D = distance to nearest receiver
- A = construction activity
- M = mitigation
- WD = wind direction.

Surface exposure

This factor recognises that the degree of surface disturbance will influence the potential for dust to be generated. A value of 1 is used when the area is less than 1 hectare, 5 when it is between 1 and 5 hectares and 10 when it is greater than 10 hectares.

Exposure period

This factor recognises that the potential for effects exists as long as the surface is un stabilised and therefore available to generate dust.

A value of 1 is used when exposure times are less than 1 month, 5 when works will be between 1 and 5 months, 10 when exposure could be up to 1 year and 20 when exposure will be greater than 1 year.

Mitigation

This factor recognises that mitigation measures can be put in place to control dust issues. These could include wet or chemical suppression, wind controls etc.

A value of 0.5 is used when there are effective mitigation measures that will control 90% or more of dust. A value of 0.8 is used when mitigation will control more than 50% of dust; 1 is used when either no data are available on exactly how effective mitigation will be or no mitigation is available.

Time of year

This factor recognises that certain periods of the year are more likely to be periods of higher risk due to low soil moisture levels or higher wind speeds.

If it is known when the project is to occur, the following factors can be used, otherwise the default is 10. June to September are assigned a value of 0; a value of 20 is used for April, May, October and November; and a value of 50 for the months of December to March.

Wind speed

Wind is a significant factor in dust generation, with a direct relationship between increased wind speeds and increased dust emissions.

If the project is in an exposed area susceptible to high wind speeds, the following weightings can be applied:

Project exposed to prevailing winds	100
Project in moderately exposed location	50
Project in sheltered location	10
If no information is available a value of 100 is used.	

Wind direction

This factor recognises that the potential for effects is strongly influenced by whether sensitive receivers are up or down wind of prevailing winds.

Where the wind direction is such that the receiver is downwind of the work under a prevalent wind direction then a value of 1 has been assigned to the factor. However, where the prevailing wind is blowing away from the sensitive receiver then the value assigned is 0. If no information is available, a value of 1 is used.

Distance to the nearest receiver

The distance from works to sensitive receivers is one of the primary factors in determining the potential for dust effects.

The following values have been assigned to this factor:

0-50m	100
51-100m	50
101-150m	10
151-200m	5
> 200m	0

Construction activity

The final factor recognises that certain construction activities are more or less likely to contribute to dust related issues. As such the following groups of construction activities have been assigned differing values. Where there are other activities occurring, choose the most similar activity.

Vegetation removal	5
Piling operations	5
Excavator cutting and shaping of natural ground	20
Pavement construction	20
Fill shaping and compaction - bulldozer	50
Fill placement	100
Haul operations	100
Excavation of odorous material	100
Operation of concrete batching plant	100

Overall DRI value

Once the DRI has been calculated for a particular location, it needs to be assigned to a risk value using the following table.

TABLE 12: CONVERSION VALUES FOR DRI TO DUST RISK

DRI VALUE	RISK
0 to 100	Low
100 to 200	Moderate
200 to 300	High

If the overall dust risk for the project is low then it is unlikely that a more detailed assessment is required. Section 6.4.4 outlines the methodology for determining if a project has a low or high construction risk and therefore if mitigation is provided through a Construction Environmental and Social Management Plan or a Construction Air Quality Management Plan (CAQMP).

If the construction risk for the project is high, the DRI should be used to refine the CAQMP as it is developed during the projects implementation phase i.e. post consenting.

This typically involves splitting the scheme up into logical individual sections (eg rural or urban areas) and describing for each of those sections the works that are being undertaken, the potential effects on the receivers and the mitigation measures that will be required.

It is likely that the overall assessment of the potential for construction effects will be carried out using a FIDOL qualitative assessment^o.

It is also likely that the report will specify specific instrumental monitoring techniques that will be implemented in high risk locations to ensure that dust mitigation measures are effectively implemented.

Other matters that may need to be addressed include:

- quantity of water required for dust control and sources
- control measures for ancillary activities such as concrete batching plants
- contingency measures that may be required
- drawings indicating construction buffers and sensitive areas .

A draft CAQMP will be required to be prepared and included with the technical assessment.

^o The FIDOL factors are frequency, intensity, duration, offensiveness and location.



If you have further queries, call our contact centre on 0800 699 000 or write to us:

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