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Air Quality Assessment of Specified Infrastructure Projects – Overarching Technical Document

PE-ENV-01106
December 2025

PE Planning & Evaluation

Technical

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Contents

Updates to TII Publications resulting in changes to

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Date:	December 2025
Page No:	Pages 12, 13, 23, 33, 35, 40, 43, 49, 57, 62 and Appendix C (pages 82 to 97)
Section No:	Sections 2.1, 2.2, 4.2.2, 4.6.2, 4.6.3, 4.6.6, 4.9.1, 4.10.3.1, 5.2 and Appendix C.

Amendment Details:

The following sections have been updated:

- Section 2.1 European Directives and Section 2.2 National Legislation. Updated to reflect the revised EU Ambient Air Quality Directive 2024/2881/EU air quality limit values (AQLV).
- Section 4.2.2 Scheme Specific Monitoring. Removal of the requirement to monitor ammonia.
- Section 4.6.2 Background Information, Relationship between the annual mean and short-term standards for NO_2, PM_{10} and $PM_{2.5.}$ Updated annual mean concentrations below which the daily and hourly standards (where appropriate) for each pollutant are unlikely to be exceeded for the new AQLV.
- Section 4.6.2 Background Information, Background Pollutant concentrations and Appendix C. Updated methodology to determine appropriate future background concentrations.
- Section 4.6.3, Table 4.5 TII REM Model Inputs and Outputs. Fleet database updated to describe the scenarios to include in the main air quality assessment and those that can be included in the appendices (if appropriate).
- Section 4.6.6 Collaborative Working. Section added to outline the collaborative working approach with the noise, climate and population and human health practitioners.
- Section 4.9.1 Approach and Processes, Step 2 Assess the Risk of Dust Impacts. Updated approach to determine the dust emission magnitude for schemes.
- Section 4.10.3.1 Phase 1 Concept and Feasibility MCA and Section 5.2 TII Phase 1 (Concept & Strategic Assessment). Updated to include the requirements of the air quality practitioner for Phase 1.

Minor updates have been made throughout the document.

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Glossary of Terms

Term	Definition
Active Travel Infrastructure	All types of pedestrian and cycle facilities which improve conditions for people walking, wheeling, and cycling.
Affected Road Network (ARN)	All roads which trigger the traffic screening criteria.
Annual Average Daily Traffic (AADT)	A description of daily traffic characteristics for the representative average 7-day period (Monday to Sunday).
CO_2e	Carbon dioxide equivalent" or "CO_2e" is a term for describing different greenhouse gases in a common unit. For any quantity and type of greenhouse gas, CO_2e signifies the amount of CO_2 which would have the equivalent global warming impact.
Competent Practitioner for Biodiversity	Proposed Scheme lead for biodiversity.
Consenting Authority	The authority which determines the application for consent, permission, licence, or other authorisation to proceed with a proposal. The authority must consider the environmental information before granting any kind of authorisation.
Cumulative Effects	Effects that result from incremental changes caused by other past, present or reasonably foreseeable actions together with the proposed road project, to create larger and more significant effects. In terms of air quality, cumulative effects should ensure that the predicted concentrations include emissions from existing traffic as well as committed Schemes (i.e. schemes which have planning approval and funding approval) as part of the do-minimum and do-something scenarios.
Cycleway	An offline public road reserved for the exclusive use of people cycling or people walking, wheeling, and cycling (see also definitions of 'Greenway' and 'Shared Use Active Travel Facility'). All mechanically propelled vehicles, other than mechanically propelled wheelchairs and electric bikes, are prohibited from entering except for the purpose of maintenance and access.
Cycle Track	A part of the road carriageway, including adjacent to a footway, which is reserved for the use of cycles and from which all mechanically propelled vehicles, other than mechanically propelled wheelchairs and electric bikes, are prohibited from entering except for the purpose of maintenance and access. A cycle track can be off-road, on-road (see definition of 'Cycle Lane') or shared (see definition of 'Shared Use Active Travel Facility').
Cycle Lane	An on-road part of the road pavement reserved for use by cycles. The cycle lane forms part of the road pavement, and it is thus located within the contiguous road surface. It is not a cycleway and therefore, generally not for the exclusive use of cycles.
Design Year	15 years after the first year of operation of the scheme
Designated Habitat	Internationally, nationally and locally designated sites of ecological conservation importance on protected species and on habitats and other species identified as being of principal importance for the conservation of biodiversity

Term	Definition
Directive	A directive is a legal act of the European Union, which requires member states to achieve a particular result without dictating the means of achieving that result. It can be distinguished from regulations which are self-executing and do not require any implementing measures. An example is the updated CAFE Directive 2024/2881/EC legislation which was published by the EU in October 2024 in order to improve the quality of air in Europe and limit exposure to air pollution. These rules include how we should monitor, assess, and manage the ambient air quality.
Do–minimum scenario	The scenario that represents the situation that would occur without the proposed scheme in operation, which includes permitted developments as per Section 2.6.3 of the TII Project Appraisal Guidelines Unit 4.0 PE-PAG-02013.
Do-something scenario	The scenario that represents the situation that would occur with the proposed scheme in operation, which includes permitted developments.
Earthworks	Covers the processes of soil-stripping, ground-levelling, excavation and landscaping.
Effects	Any change in the receiving physical, natural, or cultural environment brought about by the proposed scheme (see also: ‘impact’).
Environmental Impact Assessment (EIA)	The process to systematically assess the potential environmental effects of proposed development. An environmental impact assessment is a legal requirement for certain public and private projects in countries within the European Union under Directive 2011/92/EU, as amended by Directive 2014/52/EU.
Environmental Impact Assessment Report (EIAR)	The Environmental Impact Assessment Report is the document prepared by the Developer that presents the output of the assessment. It contains information regarding the project, the likely significant effect of the project, the baseline scenario, the proposed alternatives, the features and measures to mitigate adverse significant effects as well as a non-technical summary and any additional information specified in Annex IV of the EIA Directive.
Greenway	A cycleway that caters for people walking, wheeling and cycling in a mainly recreational environment.
Haul Route	Temporary road provided within a contractor’s site area to allow for the movement of construction material, construction machinery and/or construction labour around the site.
Heavy Duty Vehicles	Vehicles greater than 3.5 tonnes, including buses and coaches.
In-combination effects	In-combination effects arise where air quality receptors are affected by a combination of a number of environmental effects, e.g. noise etc.
Local Planning Authority	The local authority or council that is empowered by law to exercise planning functions.
Magnitude (of effect)	A term that combines judgements about the size and scale of the effect, the extent of the area over which it occurs, whether it is reversible or irreversible, and whether it is short or long term in duration.
Monin-Obukhiv length	Used to limit stable stratification in an urban area i.e. the height at which turbulence is generated more by buoyancy than by wind shear.

Term	Definition
Motorway Service Area	Areas provided at regular intervals along motorways allowing drivers to park and rest. Facilities typically include fuel stations and canopies, toilets, convenience shops, and can also include a café/restaurant/food outlet, showers, tourist information, and play areas for children. They are usually well lit and may include some landscaping.
Motorway	The highest category of road in Ireland; major linear transport infrastructure for fast flowing traffic with multiple lanes connecting cities/regions.
National Roads	The national primary and secondary road network in Ireland which TII operates, maintains and improves.
Natura 2000	Natura 2000 is a network of core breeding and resting sites for rare and threatened species, and some rare natural habitat types which are protected in their own right. It stretches across all 27 EU countries, both on land and at sea. The aim of the network is to ensure the long-term survival of Europe's most valuable and threatened species and habitats, listed under both the EU Birds Directive and the EU Habitats Directive.
Non-Technical Summary	A report which briefly describes the main points discussed in the EIAR without the use of technical language.
Nuisance	The term nuisance dust is often used in a general sense when describing amenity dust. However, this term also has a specific meaning in environmental law: (a) Statutory nuisance, as defined in section79(1) of the Environmental Protection Act 1990 (as amended). (b) Private nuisance, arising from substantial interference with a person's enjoyment and use of his land. (c) Public nuisance, arising from an act or omission that obstructs, damages or inconveniences the rights of the community. Each of these applying in so far as the nuisance relates to the unacceptable effects of emissions. It is recognised that a significant loss of amenity may occur at lower levels of emission than would constitute a statutory nuisance.
Opening Year	First year of operation.
Park and Ride	A public transport system in which car drivers may leave their cars in car parks outside the city centre and utilise public transport for the remainder of the journey.
Project	Projects funded through TII and/or TII is the Approving Authority, unless otherwise instructed by TII. It refers to the range of stages of the development and delivery of proposed schemes.

Term	Definition
Project Manager	As defined in TII Project Management Guidelines (PE-PMG-02041). To summarise the Project Manager's duties include: • Overall responsibility for the management, delivery and implementation of the Project; • Developing and maintaining the PEP and supervising its execution through the planning, design and construction phases; • Checking all documentation produced for publication for compliance with TII policies, guidelines and requirements in advance of submission to TII; • Managing the procurement and appointment of Technical Advisors, Service Providers and Contractors, as required; • Liaising with and providing status reports to the Sponsoring Agency, Steering Group and Stakeholders (as required) and ensuring the Project meets their needs; and • Obtaining Approving Authority approvals and other statutory approvals necessary to progress the Project.
QA/QC	The technical review of data and deliverables.
Re-alignment	The modification of the horizontal alignment of linear infrastructure route.
Risk	The likelihood of an adverse event occurring.
Scoping	An initial stage in the environmental impact assessment process to determine the nature and potential scale of environmental effects arising as a result of a proposed development, and an assessment of what further studies are required to establish their potential environmental impacts and effects.
Shared Use Active Travel Facility	A cycleway or cycle track that is provided for people walking, wheeling, and cycling.
Specified Infrastructure Projects	Include National Roads, motorway service areas and toll schemes, as well as light rail, metro, and rural cycleways (offline & greenways).
Trackout	The transport of dust and dirt from the construction/demolition site onto the public road network, where it may be deposited and then re-suspended by vehicles using the network. This arises when heavy duty vehicles (HDVs) leave the construction/demolition site with dusty materials, which may then spill onto the road, and/or when HDVs transfer dust and dirt onto the road having travelled over muddy ground on site.
Traffic Study Area	The Traffic Study Area (TSA) is the area of traffic identified as reliable for inclusion in an environmental assessment i.e. the data had undergone a level of analysis/sense checking to assess model 'noise', location of zone connecters and the level of calibration/validation in the model. The competent practitioner from traffic and air quality teams should define the TSA and ensure it covers areas that are likely to be sensitive to changes in air quality e.g. where there are monitored exceedances of the air quality thresholds.

Abbreviations and Acronyms

List of Acronyms and Abbreviations	
AADT	Annual Average Daily Traffic Flow
ABP	An Bord Pleanála
ARN	Affected Road Network
ALPHA	Adapted Low-cost Passive High Absorption
AQA	Air Quality Assessment
AQAP	Air Quality Action Plan
AQEG	Air Quality Expert Group
AQLV	Air Quality Limit Values
AQTAG	Air Quality Technical Advisory Group
APIS	Air Pollution Information System
BSI	British Standards Institute
CAFE	Clean Air for Europe
CBA	Cost Benefit Analysis
CEMP	Construction Environmental Management Plan
CERC	Cambridge Environmental Research Consultants
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CREAM	Calculator for Road Emissions of Ammonia
DEFRA	Department for the Environment, Food & Rural Affairs
DELTA	DEnuder for Long-Term Atmospheric sampling
DM	Do-Minimum
DMRB	Design Manual for Roads and Bridges
DMUG	Dispersion Modellers User Group
DoT	Department of Transport
DS	Do-Something
EC	European Commission
EEA	European Environment Agency
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EFT	Emissions Factors Toolkit
EPA	Environmental Protection Agency
EU	European Union
FDMS	Filter Dynamics Measurement System
HDV	Heavy Duty Vehicles
IAQM	Institute of Air Quality Management

List of Acronyms and Abbreviations	
km	Kilometres
kg N/ha/yr	Kilograms of nitrogen deposition per hectare per year
km/yr	Kilometres per year
LAQM.TG	Local Air Quality Management Technical Guidance
LV	Limit Value
MCA	Multi-Criteria Assessment
N deposition	Nitrogen deposition
NAEI	National Atmospheric Emissions Inventory
NAPCP	National Air Pollution Control Programme
NDP	National Development Plan
NECD	National Emissions Ceiling Directive
NEE	Non-Exhaust Emissions
NH_3	Ammonia
NHA	Nature Heritage Areas
NIFTI	National Investment Framework for Transport in Ireland
NO_2	Nitrogen dioxide
NO_X	Nitrogen oxides
NPF	National Planning Framework
NRMM	Non-Road Mobile Machinery
NRN	National Roads Network
NTA	National Transport Authority
NTS	Non-Technical Summary
O_3	Ozone
OTD	Overarching Technical Document
PAG	Project Appraisal Guidelines
PEP	Project Execution Plan
$PM_{2.5}$	Particulate Matter (with a diameter < 2.5μm)
PM_{10}	Particulate Matter (with a diameter < 10μm)
PMG	Project Management Guidelines
pNHA	Proposed Nature Heritage Areas
pSAC	Proposed Special Area of Conservation
pSPA	Proposed Special Protected Area
QA/QC	Quality Assurance/Quality Control
REM	Road Emissions Model
RMSE	Root Mean Square Error
RPGs	Regional Planning Guidelines
RSES	Regional Spatial Economic Strategies

List of Acronyms and Abbreviations	
SAC	Special Area of Conservation
SARs	Strategic Assessment Reports
SCR	Selective Catalytic Reduction
SPA	Special Protection Area
SD	Standard Document
SO_2	Sulphur dioxide
TEOM	Tapered Element Oscillating Microbalance
TII	Transport Infrastructure Ireland
TII REM	Transport Infrastructure Ireland Roads Emission Model
TSA	Traffic Study Area
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UUNN	UK Urban NO_2 Network
$\mu g/m^3$	Micrograms per meter cubed
WHO	World Health Organisation

1. Introduction

This *"Overarching Technical Document"* (OTD) **PE-ENV-01106,** provides guidance on the methodology, scope and processes underlying the air quality assessment (AQA) for Specified Infrastructure Projects.

The document describes the use of the AQA to evaluate the existing air quality conditions within a study area, the methodology to predict the air quality effects at human receptors and sensitive designated habitats and provides advice on determining the significance of these effects.

1.1 Application of Guidelines

OTD **PE-ENV-01106** sets out the approach of AQA to all TII projects, whilst the Standards Document (SD) **PE-ENV-01107** sets out the required standards for proposed National Roads, motorway service areas, and toll schemes. They are applicable to Projects which are funded through TII and/or where TII is the Approving Authority.

The NTA is the Approving Authority for Public Transport Projects, in such cases the Project Approval Guidelines for Projects Funded by the NTA shall apply. Where TII is the Sponsoring Agency, then agreement shall be reached at Project outset with the relevant Approving Authority as to the applicability of these guidelines.

These Guidelines should be applied for Specified Infrastructure Projects where the proposed scheme results in a significant change in traffic flow/composition or alignment of a road.

For each of these schemes, the pollutants of most concern in relation to emissions from road traffic are nitrogen dioxide (NO_2) and particulate matter (PM_{10} and $PM_{2.5}$). In addition, the effects of ammonia (NH_3) and nitrogen oxides (NO_x) should be considered with respect to the potential effects on sensitive designated habitats. During construction works dust emissions are also of concern.

Box 1: Specified Infrastructure and Air Quality

Specified Infrastructure and Air Quality

- **National Road schemes** may change traffic flows and air quality. Schemes may reduce traffic and improve air quality in bypassed locations (e.g. bypasses).
- **Toll schemes** may alter driver behaviour changing traffic and air quality for toll and non-toll routes.
- **Motorway services** may change air quality through the introduction of new entry and exits on existing routes.
- **Light rail and metro** may affect air quality by:
  - Changes in road alignments (e.g. new bridges to accommodate tracks).
  - Modal shift, encouraging car users to shift mode to public or active transport thereby improving air quality.
  - Increased trips on some routes as commuters travel to any new transport hubs.
  - Reducing available road capacity (e.g. along a route causing traffic to divert to alternative routes).
- **Rural cycleways (offline & greenways)** are least likely to result in changes in traffic and air quality:
  - Greenways with car parking facilities may have limited additional trips.
  - Cycleways that affect available road space could also affect air quality (as described above).
  - Modal shift, encouraging car users to shift mode to active transport may improve air quality.

All of the above types of Specified Infrastructure Projects are considered likely to generate dust during construction.

It should also be noted, light rail and metro in the context of this guidance are electrified and do not result in additional emissions to local air quality.

All of the above types of Specified Infrastructure Projects are considered likely to generate construction dust and require a construction phase AQA.

1.2 Purpose of the Guidelines

The purpose of this document is to provide a key reference for the methodologies and theory underlying the AQA. It should be noted that where UK based guidance is referred to within the SD and OTD this is in the absence of equivalent Irish guidance.

Together with the SD **PE-ENV-01107**, the intent is to deliver consistency in the approach to the consideration and description of air quality and to the assessment and mitigation of likely significant effects of Specified Infrastructure Projects:

- OTD to provide the theory and methodology.
- SD to provide the standard approach to the analysis and production of AQA and outputs / documents being prepared for use in National Roads and related infrastructure. Note that consideration of public transport and rural cycleways (offline & greenways) is excluded from the SD.

Box 1: Purpose of these Guidelines

In terms of Specified Infrastructure Projects, these Guidelines (and the key references in the bibliography):

- Set out the principles and processes underlying the AQA as they apply to Specified Infrastructure Projects.
- Introduce guidance on the methodology for undertaking AQA to ensure consistent and appropriate description, and evaluation of the baseline environment relevant to Specified Infrastructure Projects.
- Provide guidance on the methodology for AQA for the planning, design and assessment phases of delivering Specified Infrastructure Projects.
- Promote a context-sensitive approach to the design of appropriate mitigation measures for likely significant air quality effects of Specified Infrastructure Projects.

1.3 Organisation of the Guidelines

These Guidelines are organised as detailed in Figure 1.1 below and are intended for use by suitably qualified Air Quality Professionals (as defined in Appendix B) carrying out an AQA for Specified Infrastructure Projects for which Chapters 3 to 5 are of relevance.

These Guidelines are also intended as a reference for individuals with a direct involvement in the planning, design and assessment of Specified Infrastructure Projects. This includes the project manager, local authorities and other authorities, infrastructure engineers, biodiversity professionals, and human health professionals *etc*, for which all chapters are of relevance.

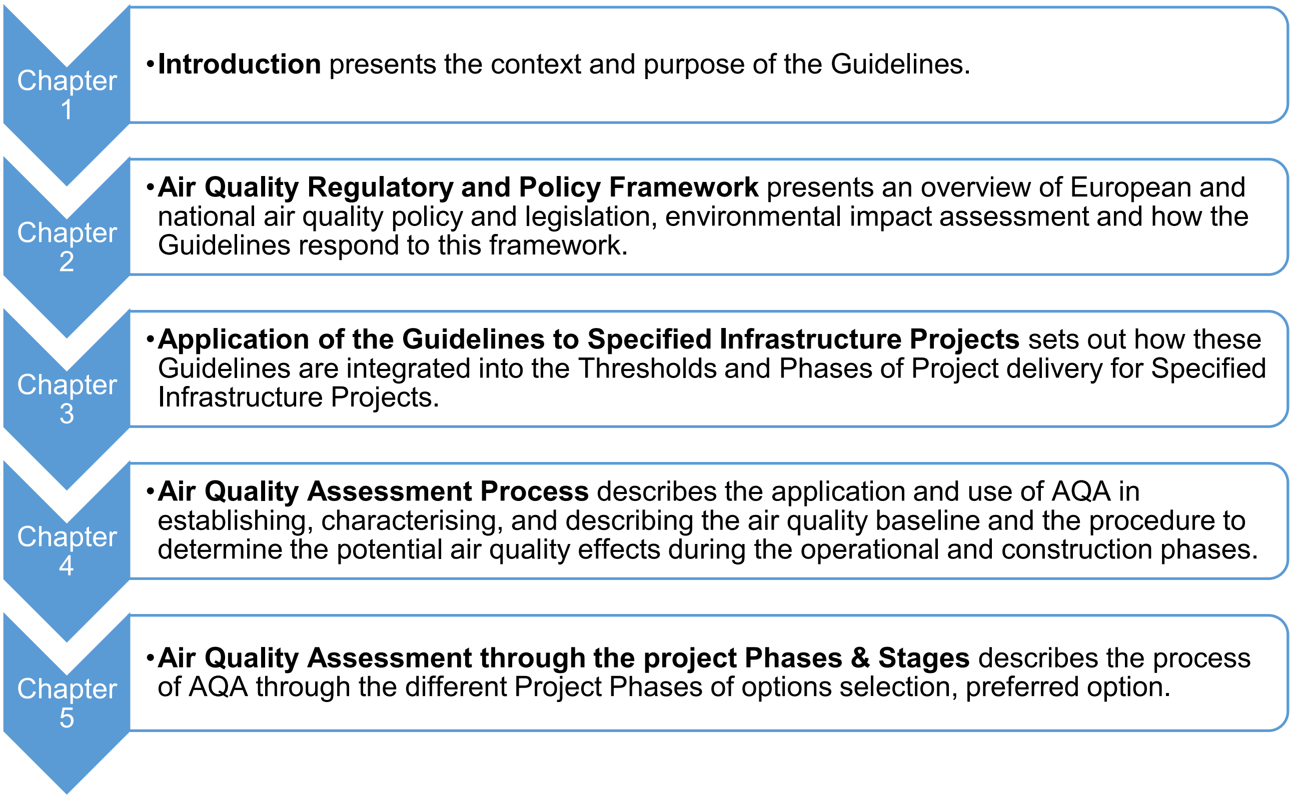

Figure 1.1 Organisation of Guidelines

1.4 Requirements of the Air Quality Practitioner

Directive 2011/92/EU, as amended by Directive 2014/52/EU, stipulates that the Environmental Impact Assessment Report (EIAR) and assessments must be carried out by competent practitioners. Where required for Specified Infrastructure Projects, the AQA will be carried out for Phase 2 and Phase 3 (and any AQA updates in Phase 4) by a suitably qualified and competent Air Quality Professional. An Air Quality Practitioner may be required at Project Phase 1 at discretion of the Project Manager. Further information with regards to Projects Phases is provided in Section 3.2. The Air Quality Professional will have appropriate qualifications and previous experience in this field. More specifically, the requirements of the Air Quality Technical Lead, who has overall responsibility for the air quality deliverables are outlined in Appendix B of this document.

1.5 Related Documents and Tools

The following documents and tools are of relevance to air quality practitioners undertaking AQA (Table 1.1).

The Climate OTD and SD are relevant, as air quality practitioners will be required to use these documents to guide the provision of road user carbon emission calculations to Climate teams.

The Population and Human Health SD is relevant as the air quality baseline and outputs from the air quality assessments for each Phase are required to support the Population and Human Health assessment.

TII have developed the TII Road Emissions Model (REM) and the TII Carbon Tool, for use in the assessment of air quality and climate effects for Specified Infrastructure Projects and these are described in the OTD and SD for air quality and climate respectively. TII should be contacted[1] by the project team to request access to these tools.

Table 1.1 Relevant Documents and Tools

Document	Reference	Description
Air Quality SD	PE-ENV-01107	Sets out the methodology for the AQA for developments on National Roads, including motorway service areas and toll schemes.
Climate OTD	PE-ENV-01104	Provides guidance on the methodology, scope and processes underlying climate assessment for Specified Infrastructure Projects.
Climate SD	PE-ENV-01105	Sets out the methodology for Climate Assessment for proposed National Roads, including motorway service areas and toll schemes.
Population and Human Health SD	PE-ENV-01108	Sets out the methodology for Population and Human Health Assessment for proposed National Roads, including motorway service areas and toll schemes.
TII REM-Model Development Report*	GE-ENV-01107	The TII REM tool calculates greenhouse and non-greenhouse gas emissions from road transport integrating traffic volumes and speeds for light and heavy vehicles on the Irish national road network with Irish fleet composition information.
TII Carbon Tool - User Guidance Document*	GE-ENV-01106	The TII Carbon Tool is used for the calculation of emissions arising from the construction (e.g., embodied carbon in construction materials, energy, and fuel use) and maintenance emissions. The TII Carbon Tool uses a series of calculations, emission factors and assumptions to calculate a carbon footprint for proposed road and light rail projects.

** Please note that in order to get access to the REM and Carbon Tools, prospective users should email climatetools@tii.ie to be set up as an authorised user on the TII Web Application Portal.*

[1] Please note that in order to get access to the REM Tool, prospective users should email climatetools@tii.ie to be set up as an authorised user on the TII Web Application Portal.

2. Air Quality Regulatory and Policy Framework

Section 2 presents an overview of European and national air quality policy and legislation, environmental impact assessment and how the Guidelines respond to this framework.

2.1 European Directives

European Union (EU) air quality legislation is provided within The Ambient Air Quality and Cleaner Air for Europe (CAFÉ) Directive 2008/50/EC, which is transcribed into Irish legislation by the Air Quality Standards Regulations 2022.

The European Commission set down the principles to this approach in 1996 with its Air Quality Framework Directive. Four "daughter" directives lay down limits for specific pollutants:

- 1st Daughter Directive: Sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead;
- 2nd Daughter Directive: Carbon monoxide and benzene;
- 3rd Daughter Directive: Ozone; and
- 4th Daughter Directive: Polyaromatic hydrocarbons, arsenic, nickel, cadmium and mercury in ambient air.

In May 2021, the European Commission (EC) adopted the EU Action Plan: ‘Towards Zero Pollution for Air, Water and Soil’ (EC, 2021), as a key deliverable of the European Green Deal (EC, 2019).

The EU Action Plan sets out the zero pollution vision for 2050; ‘a healthy planet for all’, where air, water and soil pollution is reduced to levels no longer considered harmful to health and natural ecosystems and that respect the boundaries our planet can cope with, thus creating a toxic-free environment.

To steer the EU towards the 2050 vision, the EU Action Plan sets out key 2030 targets to speed up pollution reduction. Relevant to air quality, the EU should reduce by 2030, more than 55% the health impacts (premature deaths) of air pollution.

The main objective of the EU Action Plan is to provide a compass for including pollution prevention in all relevant EU policies. Although the Action Plan states that the EU has a robust regulatory framework in place to cap ambient air pollution, the number of premature deaths and other diseases attributed to air pollution remains high.

In September 2021 the World Health Organisation (WHO) updated their air quality guidelines based on the latest scientific evidence for the protection of human health and the environment (WHO, 2021). This was the first global update of air quality guidelines since 2005 and reflects the growing volume of understanding and medical evidence showing the impact of air pollutants at increasingly lower concentrations.

In October 2024, the EU revised the Ambient Air Quality Directive 2024/2881/EU to include more stringent Air Quality Limit Values (AQLV) and align with interim target (IT) 4 of the WHO air quality guidelines. This was a key milestone towards the EU adopting cleaner air quality targets. The limit values for these pollutants are presented in Table 2.1.

Table 2.1 Relevant Air Quality Standards

Pollutant	Averaging Period	Interim Limit Value	To be attained by 1st January 2030
		To be attained by 11th December 2026	
Nitrogen Dioxide (NO_2)	1 hour	200 µg/m³ not to be exceeded more than 18 times per calendar year	200 µg/m³ not to be exceeded more than 3 times per calendar year
	24 hour	-	50 µg/m³ not to be exceeded more than 18 times per calendar year
	Annual Average	40 µg/m³	20 µg/m³
Particulate Matter (PM_{10})	24 Hour	50 µg/m³ not to be exceeded more than 35 times per calendar year	45 µg/m³ not be exceeded more than 18 times per calendar year
	Annual Average	40 µg/m³	20 µg/m³
Particulate Matter ($PM_{2.5}$)	24 hour Average	-	25 µg/m³ not to be exceeded more than 18 times per calendar year
	Annual Average	25 µg/m³	10 µg/m³
Nitrogen Oxides (NO_x) Protection of Vegetation	Annual Average	-	30 µg/m³

The revised Air Quality Directive also includes the requirement for air quality roadmaps to be prepared ahead of 2030 where there is a risk that Member States will not attain the limit values or, where appropriate, target values by that date, in order to ensure that levels of pollutants are reduced accordingly. The air quality roadmap should set out policies and measures in order to comply with those limit values and, where appropriate, target values by the attainment deadline. Post 2030, action plans will be required for areas exceeding the limit values.

2.2 National Legislation

The S.I. No. 739/2022 Ambient Air Quality Standards Regulations 2022 implements the European Union Directive 2008/EC/50 on Ambient Air Quality, CAFÉ and designated the Environmental Protection Agency (EPA) as the competent authority responsible for assessing ambient air quality in the territory of the State. AQLVs were published for seven pollutants, with alert thresholds for an additional five pollutants.

The Ambient Air Quality Standards Regulations also cites requirements for short-term action plans, where there is a risk that the level of pollutant will exceed one or more of the alert thresholds or target value or AQLV. Short term action plans will vary depending on the individual case but should provide for effective measures to control, and, where necessary, reduce or suspend activities which contribute to the risk of the respective limit values, or target values or alert thresholds being exceeded. Those action plans may include measures in relation to motor vehicle traffic and construction works.

EU member states will have two years to transpose the revised the Ambient Air Quality Directive 2024/2881/EU AQLV into their national laws, this will be done by an update to the Ambient Air Quality Standards Regulations. As a precautionary approach, for all TII projects, all results of the AQA should be compared against the 2030 standards outlined in Table 2.1.

2.3 Project Ireland 2040 National Planning Framework

Project Ireland 2040 National Planning Framework (NPF) is the Government's high-level strategic plan for shaping the future growth and development of Ireland to 2040. Air Quality is covered under Objective 64 which states:

> *'Improve air quality and help prevent people being exposed to unacceptable levels of pollution in our urban and rural areas through integrated land use and spatial planning that supports public transport, walking and cycling as more favourable modes of transport to the private car, the promotion of energy efficient buildings and homes, heating systems with zero local emissions, green infrastructure planning and innovative design solutions.'*

The guidance acknowledges that one of the largest sources of emissions to air is from transportation. It is essential that TII schemes support the objectives of Project Ireland 2040 NPF including Objective 64 described above.

2.4 National Investment Framework for Transport in Ireland

The Department of Transport (DoT) published the National Investment Framework for Transport in Ireland (NIFTI) in December 2021 following approval by Government. NIFTI is the DoT's framework for prioritising future investment in the land transport network. The primary goal of NIFTI is to ensure that investment in Ireland's land transport network supports the delivery of Project Ireland 2040 National Strategic Outcomes.

NIFTI establishes a set of Investment Priorities, in addition to Modal and Intervention Hierarchies, which serve to guide land transport investment. During the development of Project Outline Document (POD) and Feasibility Report, Sponsoring Agencies must demonstrate that a proposed investment aligns with these Priorities and Hierarchies to be considered for funding.

The NIFTI Investment Priorities are (in no particular order) Decarbonisation, Protection and Renewal, Mobility of People and Goods in Urban Areas, and Enhanced Regional and Rural Connectivity.

Under the NIFTI Modal Hierarchy, sustainable modes, starting with active travel (walking, wheeling and cycling) and then public transport, should be considered first before less sustainable modes such as the private car.

The NIFTI document refers to the National Air Pollution Control Programme (NAPCP) and Ireland's requirement, under the EU National Emissions Ceiling Directive (NECD), to produce one every four years. The first NAPCP was prepared and submitted in 2019 and updated in 2021 and 2024. The reports demonstrate the pathway Ireland will follow to achieve compliance with the NECD 2020 and 2030 targets and presents an overview of current and projected 2030 emission levels for five pollutants. The most recent NAPCP published in 2024, includes policies and measures that were finalised after the previous NAPCP was submitted and have now been included in the latest national air pollutant emission inventory and projection data. The NAPCP recognises that transport is a significant contributor to air pollution in Ireland, particularly nitrogen oxide emissions. NIFTI considers potential investment in transport infrastructure but will be informed by specific sectoral priorities and wider policy objectives including the NAPCP and Clean Air Strategy.

TII schemes should support the objectives of the NIFTI.

2.5 Clean Air Strategy

The Clean Air Strategy provides the high-level strategic policy framework necessary to identify and promote the integrated measures across Government policy that are required to reduce air pollution and promote cleaner ambient air, while also delivering on wider national objectives. The strategy is committed to achieving the WHO air quality guidelines interim target 3 by 2026 and interim target 4 by 2030 and achievement of final WHO values by 2040. It should be noted that the strategy was published in 2023 and therefore prior to the revised EU Air Quality Directive publication, however, as previously noted, IT4 aligns with the revised EU Air Quality Directive limit values for 2030.

2.6 Climate Action Plan

The Climate Action Plan sets the roadmap for taking decisive action to halve Ireland's emissions by 2030 and reach net zero no later than 2050 and is updated annually. Air Quality is discussed in the Climate Action Plan in the context of decarbonisation of public sector transport. The most recent version of the Climate Action Plan should be considered, as appropriate, within the AQA being undertaken.

2.7 National Development Plan 2021 - 2030

The revised National Development Plan (NDP) published in October 2021 (Government of Ireland, 2021), sets out a ten-year capital expenditure framework that will support Ireland's transition to a low-carbon society over the period to 2030. The NDP review includes an assessment, to determine the impact that each of the exchequer-funded measures contained in the NDP is likely to have on seven climate and environmental outcomes including air quality.

2.8 National Sustainable Mobility Policy

In April 2022, the Government of Ireland published their National Sustainable Mobility Policy which sets out a strategic framework to 2030 for active travel and public transport to help Ireland meet its climate obligations. It is accompanied by an action plan to 2025 which contains actions to improve and expand sustainable mobility options across the country by providing safe, green, accessible and efficient alternatives to car journeys. It also includes demand management and behavioural change measures to manage daily travel demand more efficiently and to reduce the journeys taken by private car.

2.9 TII Sustainability Implementation Plan

As a United Nations (UN) Member State, Ireland has adopted the 2030 Agenda for Sustainable Development (UN, 2022). TII is tasked with improving Ireland's quality of life and national economic competitiveness by developing, maintaining and operating the national road and light rail network in a safe, cost effective and sustainable way. In 2024 TII published an updated Sustainability Implementation Plan (TII, 2024) which sets the direction for TII, aligns objectives, brings together different workstreams, and harnesses the opportunity each Division/Section has to contribute to sustainability. The plan is guided by the following six key principles:

- Provide effective, efficient and equitable mobility;
- Enable safe and resilient networks and services;
- Collaborate for a holistic approach;
- Deliver end-to-end improvements;

- Transition to net zero; and
- Create total value for society.

Air quality practitioners should be aware of this plan and project managers should ensure proposed schemes align with the six key principles set out above.

2.10 Environmental Impact Assessment

Requirements for Environmental Impact Assessment (EIA) derive from the European Commission Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment. Amendments to this initial directive from 1997, 2003, and 2009 were subsequently codified by EIA Directive 2011/92/EU which in turn has been amended by EIA Directive 2014/52/EU.

Under EIA 'air quality' is identified as one of the environmental factors for which the:

> "…*environmental impact assessment shall identify, describe, and assess in an appropriate manner, in the light of each individual case, the direct and indirect significant effects of a project*." (Article 3(1) Amending EIA Directive 2014/52/EU).

Proposed road and rail infrastructure developments are defined under the Roads Act 1993 (as amended), and under the Transport (Railway Infrastructure) Act 2001 (as amended). An EIA is a mandatory requirement in respect of certain projects e.g. a motorway, a bridge over 100m in an urban area and 1 km for a rural road.

An EIA will always be required as part of a Railway Order, which is applied for in the case of light rail or metro infrastructure. Where EIA is not a mandatory requirement, i.e. for other Specified Linear Infrastructure projects (National Roads, motorway service areas and toll schemes and rural cycleways (offline & greenways)), they are subject to 'Screening for the requirement for EIA' to determine if the project is, or is not likely to have significant effects on the environment. Where likely significant effects are identified the project is subject to a 'Sub-threshold Development EIA' (Department of Housing, Local Government and Heritage, 2022).

Where EIA is a mandatory requirement, or is 'screened in for EIA', the project may seek to undertake optional EIA 'scoping': a process of determining the content and extent of the matters which should be covered in the environmental information to be submitted in an EIA Report. Separately, a scoping opinion may be requested from the planning authority or An Bord Pleanála, as appropriate.

2.10.1 Air Quality Assessments for Projects not requiring EIA

Some projects may not be of a class or scale as to require EIA e.g. road improvement or cycleway project. Nevertheless, even where EIA is not required, individual standalone assessments may still be required to address particular environmental aspects e.g. AQA.

For these projects, the standalone AQA should continue to follow the broad approach and structure outlined in these guidelines. As such, the AQA report should include distinct sections covering baseline, magnitude of impact and significance of effect. The report should be illustrated with figure maps to show any receptors, sensitive designated habitats, air quality constraints and principal features.

2.10.2 Air Quality Assessments as Part of the EIA Process

AQA may be carried out either formally or informally as follows:

- Formally, as part of the preparation of an Environmental Impact Assessment Report (EIAR) for projects above a certain threshold, or sub-threshold projects if deemed necessary during the EIA screening process, where the potential impact of the project on the environment are determined by the consenting authority likely to be significant.
- Formally, as part of Appropriate Assessment where there are potentially significant effects at European sites.
- Informally, as a contribution to the assessment of project proposals and consent applications (e.g. Part 8 developments). Air Quality assessment will be carried out on sub-threshold projects where the Project Manager deems it prudent or is required by local policy.

3. Application of the Guidelines to Specified Infrastructure Projects

TII's Project Management Guidelines (PMG) provide a framework for a phased approach to the management of the development and delivery of National Road and Public Transport Capital Projects.

This Overarching Technical Document **PE-ENV-01106** sets out the approach of AQA to all TII projects, whilst the Standards Document **PE-ENV-01107** sets out the required standards for proposed National Roads, motorway service areas, and toll schemes. They are applicable to Projects which are funded through TII and/or where TII is the Approving Authority.

The NTA is the Approving Authority for Public Transport Projects, in such cases the Project Approval Guidelines for Projects Funded by the NTA shall apply. Where TII is the Sponsoring Agency, then agreement shall be reached at Project outset with the relevant Approving Authority as to the applicability of these guidelines.

TII and the NTA recognise Projects of different value thresholds and identify different Phases within the delivery of Projects. The different Project Thresholds and Phases are outlined in this Section together and the AQA outputs required for TII Projects.

3.1 Project Thresholds

This chapter provides an overview of the TII Project Phases, PMG and PAG process and deliverables, and the application of air quality assessment and the associated outputs required for each as part of this OTD.

This OTD shall be applied to projects subject to the statutory approvals and procedure as outlined in Section 2.10.2. These projects shall be subject to a robust but proportionate appraisal of air quality effects at an appropriate level of detail, taking into account the size and complexity of the project and the applicable statutory approval process. The information should include whether REM or detailed dispersion modeling will be used for the AQA, the pollutants to be monitored and the duration as well as extent of the monitoring to be undertaken.

This OTD shall be applied in a manner appropriate to the likely significant air quality effects and the applicable statutory approval process. This shall be determined by the Project Manager and, during the relevant later phases, by the air quality practitioner.

3.2 Project Phases

These Guidelines specifically apply to Project Phases 1 to 4 of the TII Project Management Guidelines (PMG) **PE-PMG-02041** (TII). These Phases address concept and feasibility, option selection, design, environmental evaluation, and statutory processes.

These Guidelines do not apply to TII Project Phase 0 which is carried out by the Project Manager. However, the Project Manager may request support from an Air Quality Specialist if the project objectives include air quality. The project objectives are captured in the Project Outline Document (POD).

These Guidelines do not provide detailed guidance for air quality practitioners to TII Project Phases 5 to 7, which relate to procurement, construction and implementation, and closeout and review. However, Phases 5 to 7 may require support from air quality practitioners to help procure, implement and review air quality mitigation and monitoring measures where these are required.

Additionally, there may be occasions where the assessments undertaken during Phases 2 and 3 require updating during latter Phases, for example if there was a significant time lag between Phases or due to changes brought about during the statutory procedures. If the assessment requires updating, then the methodology outlined in this OTD should be followed.

While TII and the NTA use slightly different terminology, they both have a multi-phase sequential approach to the delivery of Projects (refer to Table 3.1 below for reference). Some of these Phases may be amalgamated for lower threshold Projects.

Table 3.1 TII and NTA Project Phases

TII PMG Project Phases			**NTA Project Phases**		
Planning and Design	Phase 0	Scope and Strategic Assessment	**Planning and Design**	**Phase 1**	Scope and Purpose
	Phase 1	Concept & Feasibility			
	Phase 2	Option Selection		**Phase 2**	Concept Development and Option Selection
	Phase 3	Design and Environmental Evaluation		**Phase 3**	Preliminary Design
	Phase 4	Statutory Processes		**Phase 4**	Statutory Processes
Construction / Implementation	Phase 5	Enabling and Procurement	**Construction / Implementation**	**Phase 5**	Detailed Design and Procurement
	Phase 6	Construction and Implementation		**Phase 6**	Construction and Implementation
	Phase 7	Closeout and Review		**Phase 7**	Closeout and Review

3.3 Application of the Guidelines to Project Thresholds and Phases

Figure 3.1 and TII's **Project Management Guidelines** (PMG), **Project Manager's Manual for National Road Projects** and **Project Manager's Manual for Greenway Projects** provide a framework for a phased approach for the management, development and delivery of National Road and Greenways. The NTA's Project Approval Guidelines provide a framework for a phased approach for the management, development and delivery of Public Transport Projects.

Where TII is the Sponsoring Agency, then agreement shall be reached at Project outset with the relevant Approving Authority as to the applicability of these guidelines.

TII's associated **Project Appraisal Guidelines** (PAG) provide specific guidance on the appraisal of certain aspects of projects on National Roads.

Multi-Criteria Assessments[2] (MCA) are generally used in the ranking of options at Phase 1 (concept and feasibility) and 2 (options assessment). The AQA process for each phase is discussed in further detail in Section 4 of the Guidelines.

[2] Under the PAG (and the TAF), projects with an estimated costs of over €30m will require a Transport and Accessibility Appraisal (TAA). Both the MCA (for projects under €30m) and TAA (for project over €30m) utilise the same seven-point scale and similar assessment criteria. As the TAA is an MCA process, for ease of reference in this Standard the term MCA is used when referring to the Phase 2 Stage 2 option assessment. See PAG Unit 7 for further detail of MCA/TAA requirements.

Phase 1: Concept and Feasibility

- Determine existing air quality in the study area in relation to NO_2, PM_{10} and $PM_{2.5}$ from available information. If sensitive designated habitats are identified in the study area, background NO_x and ammonia concentrations should be inclulded.
- Identify constraints, risks and opportunities in relation to air quality.
- Map key constraints such as residential areas and senstive designated habiats.
- Upon the request of the Project manager,provide input to the development of SMART objectives and feasibility of the strategic options in terms of air quality based on the identified constraints, risks and oppertunities.

Phase 2: Option Selection (Stage 1: Prelinary Options Assessment)

- Determine existing air quality in the study area in relation to NO_2, PM_{10} and $PM_{2.5}$ from available information. If sensitive designated habitats are identified in the study area, background NO_x and ammonia concentrations should be inclulded.
- Identify significant non-road sources.
- Identify on a map all sensitive receptor locations (human health and sensitive designated habitats) with buffers set at 50m (from carriageway edge) and 200m (from the carriageway centreline) of each option that have the potential to be significantly affected during the operational phase of the proposed scheme.
- Discuss any opportunities for mitigation.
- Review relevant previous air quality studies for schemes within the study area.
- Review of planning permissions granted within the study area of relevance from an air quality perspective.

Phase 2: Options Selection (Stage 2: Project Appraisal Matrix)

- Update existing air quality understanding in the study area in relation to NO_2, PM_{10} and $PM_{2.5}$ if further information is available since Stage 1 assessment was undertaken. If sensitive designated habitats are identified background NO_x and ammonia concentrations should be inclulded.
- Calculate the Index of Overall Change in Exposure for NO_X and PM_{10}.
- Calculate local scale pollutant (NO_2, PM_{10} and $PM_{2.5}$) concentrations at representative worse-case human sensitive receptors within the air quality study area.
- Determine the impacts on sensitive designated habitats.
- Discuss any opportunities for mitigation.

Phase 2: Options Selection (Stage 3: Preferred Option)

- Review assessments undertaken at Stage 1 and 2 and update if necessary.
- Lead in the preparation of the air quality section of the Options Report.

Phase 3: Design and Environmental Evaluation

- Undertake walkover of preferred route corridor.
- Update existing air quality understanding in the study area in relation to NO_2, PM_{10} and $PM_{2.5}$ if further information is available since Phase 2 assessment was undertaken. If sensitive designated habitats are identified, background NO_x and ammonia concentrations should be inclulded.
- Install a monitoring campaign, if necessary.
- Participate in the EIA Screening and scoping processes.
- Re-calculate Index of Overall Change in Exposure if traffic flows or alignments have changed since Stage 2.
- Undertake a local air quality assessment to calculate NO_2, PM_{10} and $PM_{2.5}$ concentrations at representative worse-case human sensitive receptors within the air quality study area.
- Undertake an assessment of NO_x and NH_3 concentrations at senistive designated habitats and calculate NO_x deposition and acid deposition.
- Undertake a construction phase assessment.
- Calculate total emissions of NO_x and CO_2e for the existing route and preferred route for the baseline, opening and design years.
- Complete air quality section of EIAR.
- Assist in the preparation of the air quality section of the Options Report.

Figure 3.1 AQA framework up to Phase 4 Statutory Process

4. Air Quality Assessment Process

4.1 Introduction

These Guidelines describe the methodology to undertake an AQA. The methodology presented allows practitioners to undertake a proportionate level of assessment, taking into consideration existing air quality and the potential for the proposed option(s) to result in significant air quality effects.

These Guidelines should be applied to National Roads, motorway service areas and toll schemes light rail, metro, rural cycleways (offline & greenways), where the proposed scheme results in a significant change in traffic flow/composition or alignment of a road during the operational or construction phase. For each of these proposed schemes, the pollutants of most concern in relation to emissions from road traffic are NO_2, PM_{10} and $PM_{2.5}$. In addition, the effects of NH_3 and NO_x should be considered with respect to the potential effects on sensitive designated habitats.

These Guidelines should also be applied to National Roads, motorway service areas and toll schemes, light rail, metro, rural cycleways (offline & greenways), where sensitive receptors are located within 250m of the boundary of the site or route used by construction vehicles on the public highway as potential dust effects are of concern. The assessment of potential construction phase effects is outlined in Section 4.9.

4.2 Baseline Air Quality

Box 2: Purpose of Baseline Air Quality Data

Air quality monitoring data forms an important part of each phase of scheme assessment:

- To describe the existing air quality conditions in a study area.
- To provide information on background concentrations (i.e. non road sources) to capture pollutants not explicitly modelled.
- To verify the air quality model (i.e. confirm air quality predictions reproduce baseline conditions).
- To provide baseline concentrations representative of receptors exposure.
- To determine the effectiveness of mitigation measures.

As discussed, the pollutants of most concern in relation to emissions from road traffic are NO_2, PM_{10}, and $PM_{2.5}$ with respect to human health, and NO_x and NH_3 with respect to sensitive designated habitats. The gathering of baseline air quality data should focus on these pollutants only.

Baseline air quality data can be gathered from desktop reviews and/or a monitoring survey set up specifically for the proposed scheme (scheme specific monitoring). The approach to be taken for desktop reviews and scheme specific monitoring is described in the following sub-sections. Further detailed air quality monitoring information is presented in SD **PE-ENV-01107**.

Due to the Project programme constraints, scheme specific monitoring is sometimes undertaken prior to receiving final traffic data. This means that a final air quality study area may not be known when monitoring is undertaken. Therefore, the air quality practitioner should use earlier iterations of traffic data (e.g. Phase 2 Options Selection) and professional judgement to determine a likely air quality study area for proposed schemes. This likely air quality study area can then be used to identify the area for which air quality monitoring data should be obtained.

4.2.1 Desktop Reviews

A desktop review should be undertaken using local air quality monitoring data collected as part of national or local government programmes, or as part of AQA related to other development schemes. The air quality practitioner should review the data to ensure it is suitable for use.

The Environmental Protection Agency (EPA) publishes annual reports on *Air Quality in Ireland* that provide statistical summaries of monitoring data. The EPA also provides access to real-time monitoring data. These reports and data can be accessed via the EPA website at Air | Environmental Protection Agency (epa.ie) - https://www.epa.ie/environment-and-you/air/. The EPA also publishes EU verified hourly pollutant files on their SAFER Environmental Research Data Archive and research papers regarding monitoring of pollutants such as Research 193: Ambient Atmospheric Ammonia in Ireland 2013 -2014 (EPA, 2017). Information can also be obtained from the Air Pollution Information System (APIS) regarding critical loads, background nitrogen and acid deposition and NH_3.

In all cases, regard should be given to the quality assurance and quality control (QA/QC) procedures that have been applied to the operation of the monitoring sites. Where the monitoring stations have been operated and or reported on by the EPA, then it may be assumed that adequate procedures have been applied. Where data is derived from monitoring studies conducted by other parties, then details of the QA/QC procedures should be obtained to ensure appropriate procedures have been followed as outlined in Defra's LAQM.TG(22) (Defra, 2025 (or most recent update)) and described within the assessment report. If no QA/QC details are provided, then the data should not be used in the assessment.

The fundamental aims of a QA/QC programme are (Ricardo-AEA, 2012):

- The data obtained from measurement systems should be representative of ambient concentrations;
- Measurements must be accurate, precise and traceable;
- Data must be comparable and reproducible; and
- Results must be consistent over time.

In order for seasonal or annual averaged air quality pollutant measurements to be meaningful, an appropriate level of data capture is required (refer to Section 4.2.3).

4.2.2 Scheme Specific Monitoring

Scheme specific air quality monitoring should only be undertaken on a proposed scheme where a quantitative local AQA is being undertaken. Furthermore, the need to undertake scheme specific air quality monitoring depends upon the availability of existing air quality data and the complexity of the proposed scheme. For example, a greenway scheme would not, in general, require monitoring as these schemes are not complex and likely to result in no or small changes in traffic flow/composition and therefore air quality effects are likely to be not significant.

As described in Section 4.2, the pollutants of most concern in relation to emissions from road traffic are NO_2, PM_{10}, and $PM_{2.5}$. Therefore, scheme specific monitoring should focus on these pollutants only.

As described in Section 4.2, NO_X and NH_3 are also pollutants of concern with regards to sensitive designated habitats. Monitoring of NO_x is not a requirement for AQA due to the limitations with using low cost monitoring techniques and the disproportionate expense associated with real time reference monitors. Monitoring should focus on NO_2 as it is one of the precursors for N deposition.

Monitoring of NH_3 is also not a requirement for AQA due to the background concentrations in Ireland generally already exceeding the critical load for sensitive vegetation of 3 μg/m^3 and 1 μg/m^3 for very sensitive habitats e.g. lichen, which indicates that the contribution from road sources is small compared to other sources e.g. agriculture. Annualisation can be completed on some monitored pollutants, such as NO_2, where short term monitoring campaigns (see section 4.2.3) have been conducted. The annual mean concentrations from the annualisation can then be used for model verification purposes. However, for NH_3 there is the considerable variability in concentrations not only between sites but also month to month and year to year at a monitoring location. Therefore, using this approach to annualise short term monitoring of NH_3 for model verification purposes would be unlikely to reduce the uncertainty in the results.

Therefore, it is not necessary to verify NH_3 results. The discussion of the realistic worst case should be used to inform the significance of the proposed scheme in terms of potential NH_3 effects. Additionally, the discussion should also consider the outcome of the optimistic and pessimistic scenarios (Table 4.5) due to the greater uncertainty of the ammonia concentrations compared to NO_2 and PM_{10}. This should be done where there is a risk of likely significant effects from ammonia and/or nitrogen deposition at sensitive designated habitats.

4.2.3 Short-Term Monitoring

Unless data is obtained from fixed monitoring stations or for nationally significant projects, it is unlikely that the period of monitoring will extend over a full calendar year due to programme constraints. Where data from short-term monitoring campaigns is used, the results may be adjusted to an equivalent annual mean concentration by comparison with fixed automatic monitoring stations. Where continuous monitoring methods e.g. gravimetric or chemiluminescent methods, are used the duration of the monitoring campaign should be for at least 6 months; however, for practical reasons, the monitoring period may be shorter, but, wherever possible, should extend for at least 3 months and should not be less than 1 month. Specifically in relation to nitrogen dioxide monitoring using passive diffusion tubes, a minimum of six months duration is required. If the monitoring campaign is less than 6 months, a justification should be provided.

If data capture for the calendar year is less than 75% but greater than 25%[3], annualisation will need to be completed. This process will enable the air quality monitoring results to be compared with relevant air quality standards. Further details of how to undertake the annualisation process can be found in SD **PE-ENV-01107**.

4.2.4 Monitoring for NO_2

Concentrations of NO_2 may be measured using passive diffusion tubes[4]. These provide a simple, cost-effective means of monitoring at a number of locations providing greater spatial distribution of information than would be possible with an automatic analyser. Diffusion tubes with a wind protection cap are also available, where the cap is intended to reduce the potential positive bias resulting from the effect of wind turbulence (Bureau Veritas (BV), 2021).

Where diffusion tubes are used, it is essential that the data is adjusted for laboratory ‘bias’. This is dependent on the laboratory that prepared the tubes, and the method of preparation that was used. Suitable bias adjustment factors may be derived locally (by collocating tubes with an automatic analyser) or national biased adjustment factors may be obtained from the following website https://laqm.defra.gov.uk/air-quality/air-quality-assessment/national-bias/, for some of the laboratories that may be used.

[3] Defra LAQM.TG(22) Box 7.14 states that 3 months or 25% of data for the calendar year is the minimum to undertake annualisation.
[4] Details on siting and deployment of diffusion tubes discussed under “NO_2 by Diffusion Tubes” Section of Technical Guidance LAQM.TG(22) (DEFRA 2025).

The assessment report should explicitly state what bias adjustment factors have been applied.

4.2.5 Monitoring for PM_{10} and $PM_{2.5}$

Generally, PM_{10} and $PM_{2.5}$ monitoring will not be required unless there is a risk of exceedances in the opening year, i.e. within 10% of the relevant AQLVs (2030 standard refer to Table 2.1) and alternative data is not available to confirm this. For example, in terms of PM_{10}, this means that if annual mean concentrations are > 18 µg/m^3 (2030 standard) then monitoring should be undertaken, unless alternative representative sources of PM_{10} data are available. This type of location is most likely to be in urban environments.

There is a wide range of methods that may be used to determine concentrations of PM_{10} and $PM_{2.5}$, including manual gravimetric samplers and continuous analysers. $PM_{2.5}$ monitoring is not specifically recommended, as monitoring for PM_{10} can be utilised to infer $PM_{2.5}$ concentrations.

Monitoring concentrations of PM in ambient air is not straightforward, due to the variable nature and composition of the particles. There can be significant problems with the loss of semi-volatile components such as ammonium nitrate and the absorption and retention of water vapour. The method that is selected for the collection and determination of PM mass has an influence on the PM concentration that is subsequently reported.

QA/QC procedures are particularly important for PM monitoring and especially where gravimetric samplers and subsequent laboratory weighing is used. Guidance on QA/QC procedures for PM monitoring is given in Annex 1 to LAQM.TG(22) (Department for the Environment, Food & Rural Affairs (DEFRA), 2022).

4.3 Study Area

Box 3: Study Area

The study area, within which the AQA is undertaken, needs to be defined. It should include all areas where a significant change in pollutant concentration at sensitive receptors may occur.

The study area is determined based on the proximity of sensitive receptors to roads where a significant change in traffic flow, composition and/or road alignments associated with the proposed scheme is predicted to occur.

4.3.1 Traffic Study Area

Prior to determining the air quality study area, following the stepped approach outlined below, the Traffic Study Area (TSA) should be determined. For the local air quality assessment, the TSA is the area of traffic identified as reliable for inclusion in an environmental assessment i.e. the data had undergone a level of analysis/sense checking to assess traffic model 'noise', location of zone connecters and the level of calibration/validation in the model. The competent practitioners from traffic and air quality teams should define the TSA and ensure it covers areas that are likely to be sensitive to changes in air quality e.g. where there are monitored exceedances of the air quality thresholds.

It should be noted that the TSA for the local air quality assessment may differ from the traffic dataset applied to the regional assessment. Further information regarding the study area for the regional assessment is provided in Section 4.8.

4.3.2 Stepped Approach

The study area is determined for the two assessments which are required; Index of Overall Change in Exposure and local AQA.

The Index of Overall Change in Exposure is undertaken to compare the overall impact on people for each of the options and/or preferred option (sum of residential properties multiplied by change in emission rate for each link).

While the local AQA is undertaken to determine the absolute pollutant concentrations and change in concentration at sensitive receptors. The outcome of the local AQA informs the significance of the proposed scheme for air quality. The study areas are determined for each assessment as described below.

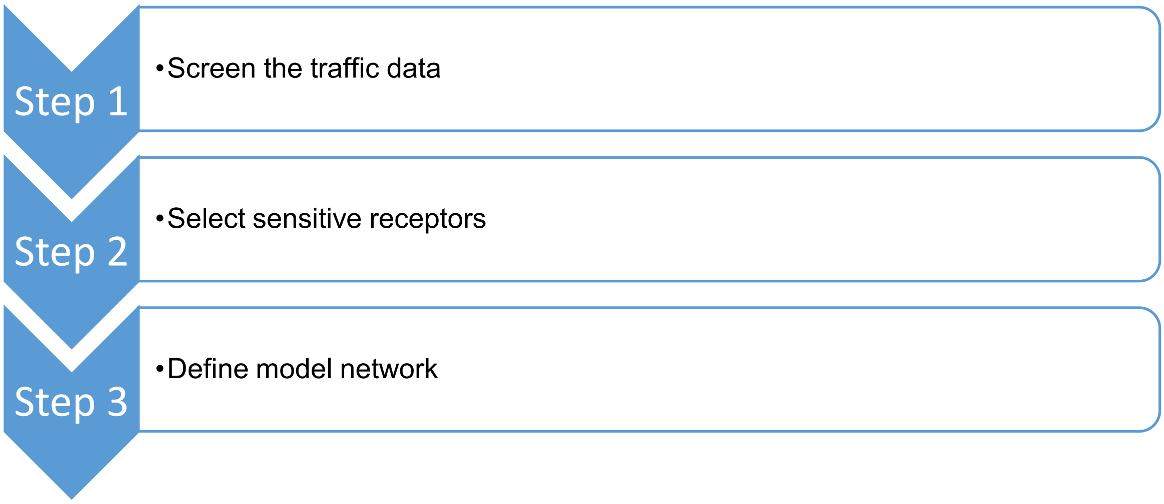

Figure 4.1 Steps to define the air quality study area

4.3.3 Step 1: Screen the Traffic Data

The traffic data should be screened to establish if traffic changes are expected due to a proposed scheme and if these changes may affect air quality. The screening is done using the following criteria to determine the affected road network (ARN). This screening is undertaken to help identify those locations where the greatest changes in traffic and air quality are likely to occur. The criteria are based on the changes between the Do-Something (DS) traffic compared to the Do-Minimum (DM) traffic in the year of opening:

- Road alignment will change by 5 meters (m) or more; or
- Annual average daily traffic (AADT) flows will change by 1,000 or more; or
- Heavy duty vehicle (HDV) (vehicles greater than 3.5 tonnes, including buses and coaches) flows will change by 200 AADT or more; or
- Daily average speed change by 10 kph or more; or
- Peak hour speed will change by 20 kph or more.

The above criteria should be applied to the TSA only. A statement should be included in the AQA detailing how the study area was defined and that the TSA is appropriate for the AQA.

To ensure a balanced comparison between any options, the same study area should be used for the existing route and each option. This may mean that a composite ARN needs to be compiled which draws together all the individual options ARN.

The above screening criteria are appropriate as the criteria will identify those areas where the biggest changes in air quality may be expected and accurately estimating even lower traffic flow changes (e.g. less than 1,000 AADT) across a study area can be very challenging. For example, roads with existing low traffic volumes often exhibit higher variability and less consistent traffic patterns.

Additionally, the traffic model for the proposed scheme may not be as well calibrated or validated across all roads in study area. Therefore, it is recommended to assess changes greater than 1,000 AADT only.

In addition, although the AQLV will decrease in future years, this will be offset by cleaner engine technologies resulting in less emissions per vehicle. Therefore, the recommendation remains that an AADT change of 1,000 is appropriate.

This is unless there is a high degree of confidence in the underlying traffic data and traffic modelling within the transport modelling team and additionally there is a risk of likely significant effects being missed if roads with a change in AADT of less than 1000 was not done.

4.3.4 Step 2 – Select Sensitive Receptors

A list of receptors sensitive to air quality are described in Sections 4.6.1 and 4.7 including both human receptors and sensitive designated habitats.

For the Index of Overall Change in Exposure assessment all sensitive human receptors, located within 50 m of the carriageway edge ARN should be included in the assessment.

Steps 1 and 2 then defines the study area for the Index of Overall Change in Exposure.

For the local AQA, worse-case sensitive receptors should be selected up to 200 m from the carriageway centreline. Both human and sensitive designated habitats should be selected as applicable and in consultation with biodiversity and human health practitioners. This larger study area is proposed for the local assessment (compared to 50 m for the Index of Overall Change as described above), to allow for changes in pollutant contributions from multiple roads to be captured in the assessment.

4.3.5 Step 3 – Define Model Network

For the local AQA, all roads within 200 m of the selected receptors, for which traffic data is available, should be included in the study area.

Steps 1, 2 and 3 then define the study area for the local AQA.

It is recommended that, following a review of the results of the local AQA, the competent air quality practitioner should consider if any likely significant effects could have been missed from the assessment with particular focus on the edges of the study area. If so, then the air quality practitioner should undertake a detailed level assessment in these areas if traffic data is available to check if there are any significant effects. If traffic data is not available a risk-based review should be undertaken using professional judgement to determine whether likely significant effects may occur (e.g. areas of poor air quality with likely perceptible beneficial or adverse changes).

4.4 Index of Overall Change in Exposure

Box 4: Index of Overall Change in Exposure

The index of Overall Change in Exposure is undertaken to compare the overall impact on people for each of the options and/or preferred options. The impact of each option and/or preferred option is calculated by comparing the DS scenario/s with the DM scenario/s.

The Index is based on identifying the number of sensitive receptor locations within 50 m of the carriageway edge for all road links with a significant change in traffic for each of the options (refer to Section 4.3.3, for the criteria of significant change). Justification for the 50 m distance criteria is drawn from the two reports published by the UK Air Quality Expert Group (AQEG, 2004, 2005).

Figures 4.2 and 4.3 have been taken from these reports and demonstrate that both NO_2 and PM_{10} concentrations decline rapidly with increasing distance from the carriageway, such that levels beyond 50 m distance are unlikely to be distinguishable from the background in most situations[5].

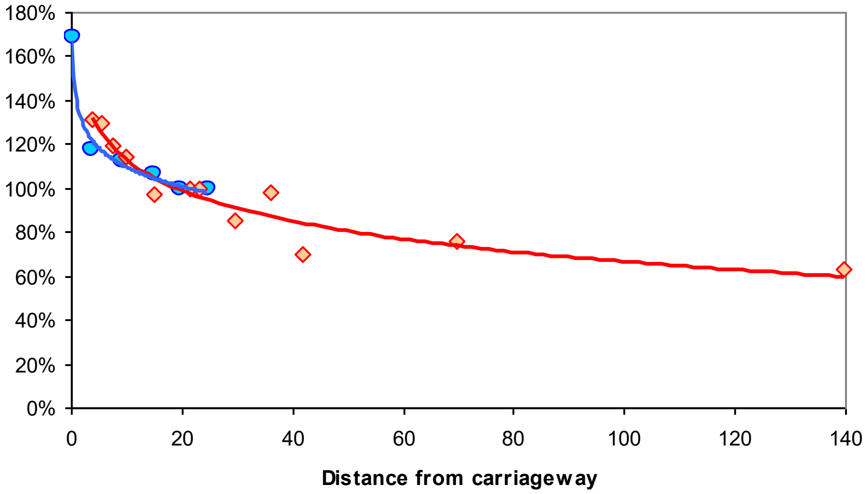

Figure 4.2 NO_2 concentrations measured on a transect away from a busy central London road (red) and a motorway (blue), normalised to 100% at about 20m distance from the edge of the carriageway*. The data points have been fitted using a logarithmic relationship.

Source: AQEG (2004) Nitrogen Dioxide in the United Kingdom

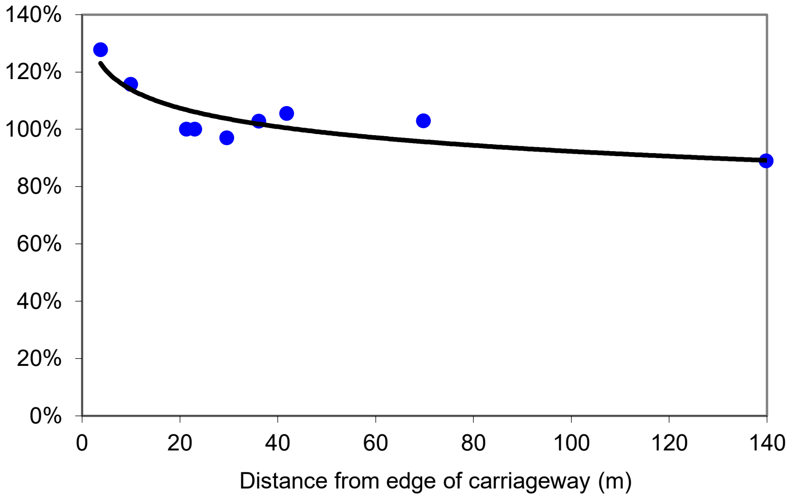

Figure 4.3 PM_{10} gravimetric concentrations measured on transects away from the M25 motorway, normalised to 100% at about 20 m from the edge of the carriageway*. The data points have been fitted using a logarithmic relationship.

Source: AQEG (2005) Particulate Matter in the United Kingdom

[5] Exceptions may occur in areas with very low background concentrations and extremely high traffic flows or in areas where dispersion is influenced by the presence of a street canyon

The various steps required to calculate the Index of Overall Change in Exposure are summarised in Figure 4.4. A worked example is provided in the SD **PE-ENV-01107**.

Collate traffic information for each link.
Including traffic flows (AADT), % of HDV, speeds (per vehicle type i.e. LDV and HDV), and link lengths. This information is required for the opening year of the proposed scheme, with (DS) and without (DM) the proposed scheme in place.

↓

Define the study area.
As described above in Sections 4.3.1 to 4.3.5.

↓

Calculate total emissions for each link
Using the TII REM, calculate the total emissions for each link, based on link length, vehicle flow, %HDV and speed.

↓

Calculate the difference between DM and DS emissions from each link
Where a new section of road is proposed, an emission of zero should be assumed for the DM situation. Where a road is closed/removed as part of the proposed scheme, an emission of zero should be assumed for the DS. A negative value will represent a decrease in emissions with the proposed scheme, a positive value will represent an increase.

↓

Count the number of sensitive locations within 50 m of the carriageway edge of each of the links
Where a property falls within 50 m of two or more links, it should be counted as part of the total number of properties for both links (i.e. the property should be 'double counted').

↓

Calculate the change in emission rate (kg/km/yr) for each link being considered in the study area.
This can be calculated by dividing the calculated change in emissions (kg/yr) by the link length (km).

↓

Multiply the change in emission rate from each link by the number of properties within 50 m.
Retain the sign, -ve for a decrease in emissions and +ve for an increase.

↓

Add together the total numbers for each link.
To determine an overall exposure index for each option.

↓

Compare the exposure index for each of the Options.
A negative score indicates that there would be an overall reduction in exposure to pollution, i.e. a benefit, a positive score indicates an increase in exposure to pollution, i.e. adverse impact. The option with the lowest exposure index would be the preferred option from an air quality perspective.

Figure 4.4 Summary of steps to calculate the Index of Overall Change in Exposure

4.5 Local Air Quality Assessment Overview

Box 5: Local Air Quality Assessment

> The local AQA is undertaken to determine the absolute pollutant concentrations and change in concentration at sensitive receptors. The outcome of the local AQA informs the significance of the proposed scheme for air quality.

The local AQA assessment is undertaken using a tool such as TII REM or detailed dispersion modelling software such as ADMS-Roads (CERC, 2022).

The TII REM has been developed using R programming language in a user-friendly R shiny application. TII REM is a modular tool consisting of four main elements: traffic data, a fleet mix database, an emission rate database and an ambient air quality model (Figure 4.5). TII should be contacted by the project team to request access to the TII REM[6]. A user manual with instructions on how to use TII REM is embedded in the TII REM tool to assist the air quality practitioner in the use of the tool.

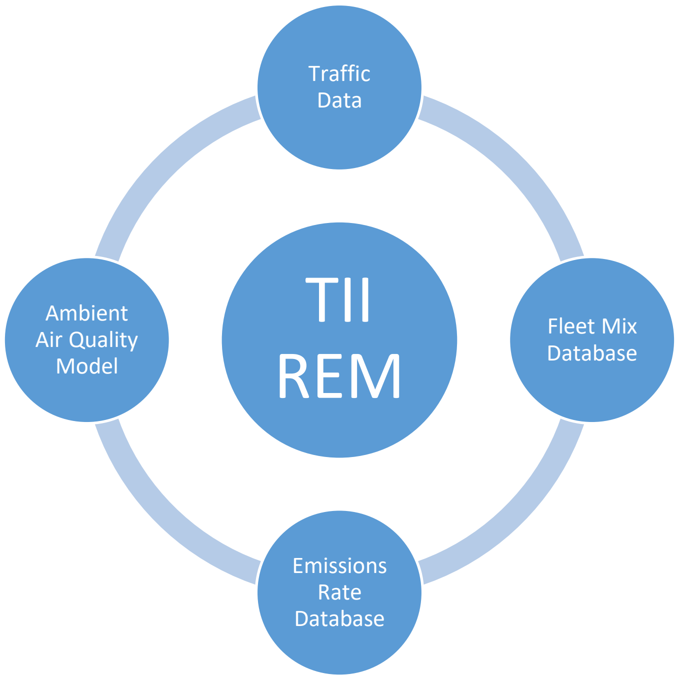

Figure 4.5 TII REM Structure

The decision on the most appropriate modelling software to use is based on existing air quality and the complexity of the proposed scheme. See Table 4.1 for further details on model selection.

[6] Please note that in order to get access to the REM, prospective users should email climatetools@tii.ie to be set up as an authorised user on the TII Web Application Portal.

Table 4.1 Criteria to determine modelling software to use for the local air quality assessment

Model Type to Use	Criteria
Detailed dispersion modelling e.g. ADMS	• If existing NO_2, PM_{10} and/or $PM_{2.5}$ concentrations exceeds 90% of the 2030 standard (refer to Table 2.1) in the baseline year; or • Where sensitive receptors exist within 50 m of a complex road layout (existing or proposed) e.g. grade separated junctions or hills with gradients > 2.5%
TII REM	• If existing NO_2, PM_{10} and/or $PM_{2.5}$ concentrations is less than 90% of the 2030 standard (refer to Table 2.1) in the baseline year; and • For simple schemes such as small junction improvements and signalling changes.

In the event that an alternate modelling approach is proposed this should be discussed with TII prior to undertaking the assessment (e.g. use of TII REM for schemes with complex road layouts).

4.6 Human Health

The following section describes the process to undertake an AQA to predict pollutant concentrations at receptors sensitive to human health. The pollutants of most concern in relation to emissions from road traffic are NO_2, PM_{10} and $PM_{2.5}$ for human health. Therefore, the AQA should focus on these pollutants only.

4.6.1 Receptor Locations

Table 4.2 presents all receptors which are sensitive to potential human health effects and should be included in the local AQA if present within the study area. Table 4.2 also provides information on the air quality standard that would be expected to be relevant for each receptor. If additional receptor types are selected, then a justification should be provided in the AQA for which standards apply.

Discussions with the Population and Human Health practitioners should be undertaken to confirm if there are any additional receptors which should be included in the air quality assessment to support their assessment.

Table 4.2 Human Receptors

Receptor	Pollutant	Standard Type
Residential Properties	NO_2, PM	Annual, 24-hour, 1-hour
Hospitals	NO_2, PM	Annual, 24-hour, 1-hour
Schools	NO_2, PM	Annual, 24-hour, 1-hour
Care Homes	NO_2, PM	Annual, 24-hour, 1-hour
Gardens of residential properties	NO_2, PM	24-hour, 1 hour
Hotels and B&Bs	NO_2, PM	Annual, 24-hour, 1 hour
Place of Worship*	NO_2	1 hour
Sports Centres*	NO_2	1 hour
Shopping Areas*	NO_2	1 hour
Playing Fields*	NO_2	1 hour

Receptor	**Pollutant**	**Standard Type**
Cyclists[7]*	NO_2	1 hour
Outdoor locations including:		
• Car Parks*	NO_2	1 hour
• Bus Stations*, including park and rides	NO_2	1 hour
• Railway Stations*	NO_2	1 hour

**where members of the public are not likely to spend 24 hours, the pollutant of concern at these locations is NO_2 only for the 1 hour standard.*

Air quality practitioners should model specific worse-case receptors and include all receptors where they may contribute to the overall evaluation of significance for a proposed scheme. If a scheme is considered to be overall significant then mitigation will be required (see Section 4.11.2), that enables the overall significant adverse effect to be removed.

In addition, receptor points will need to be included in the modelling exercise to represent monitoring sites that are to be used in model verification.

4.6.2 Background Information

The following presents the background information which is applicable to all AQA.

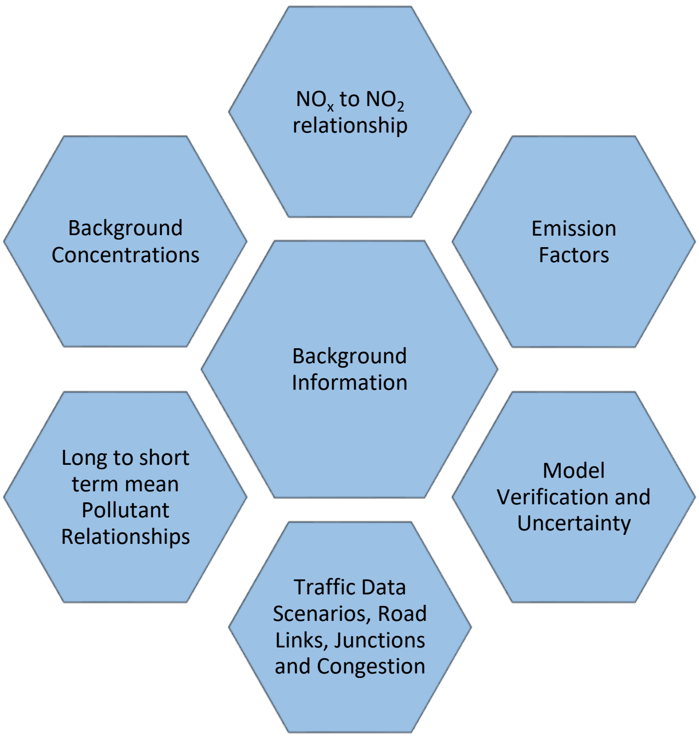

Figure 4.6 Background Information

[7] Pollutant concentrations at a point on a cycle route should be predicted and compared with the 1-hour NO_2 standard. This will, however, likely result in an overestimation of concentrations and exposure. The use of a 1-hour thresholds should be adopted as a precautionary approach. In the event of any 1-hour exceedance the likely realistic level of exposure should then be considered within the overall evaluation of significance.

The NO_x to NO_2 Relationship

Nitrogen oxides, NO_x ($NO + NO_2$), are predominantly emitted from road vehicle exhausts in the form of nitric oxide (NO) which is then transformed to NO_2 via a series of complex chemical processes in the atmosphere. The dominant pathway for NO_2 formation is via the reaction of NO with ozone (O_3).

The UK's Department for Environment, Food and Rural Affairs (DEFRA) have published an approach for predicting NO_2 from NO_x concentrations at roadsides, which takes account of the difference between fresh emissions of NO_x and background NO_x, the concentration of O_3, and the different proportions of primary NO_2 emissions in different years. The approach was incorporated into a simple spreadsheet calculator which allows the calculation of NO_2 from NO_x and vice versa. Air quality practitioners are advised to use the latest version of the tool. The tool and User Guide are available here https://laqm.defra.gov.uk/air-quality/air-quality-assessment/nox-to-no2-calculator/.

The calculator was designed for local authorities in the UK and provides default input data for the regional background concentrations of O_3, NO_x and NO_2 via a "local authority selection tab". For detailed modelling assessments in Ireland, it can be assumed that regional concentrations are characterised by a local authority in Northern Ireland, 'Armagh, Banbridge and Craigavon' is recommended, as the average NO_x, NO_2 and O_3 concentrations in Ireland are reasonably well represented by this area. This approach has the advantage that concentrations in future years will be automatically calculated within TII REM, which would be needed to assess the opening year of the scheme.

For assessment where the TII REM is being used the NO_x to NO_2 conversion is undertaken by the model when the user imports a receptor file to calculate NO_2 concentrations that can be compared to air quality standards.

Relationship between the Annual Mean and Short Term Standards for NO_2, PM_{10} and $PM_{2.5}$

The outputs from the air quality models (ADMS and REM) are annual mean concentrations for NO_2, PM_{10} and $PM_{2.5}$. Therefore, a study was undertaken to determine an appropriate annual mean concentration below which the daily and hourly standards (where appropriate) for each pollutant are unlikely to be exceeded.

The study involved comparing the annual mean concentrations of each pollutant against the number of exceedances of the 2030 AQLVs for all sites within the UK Automatic Urban Rural Network (AURN) between 2014 and 2024. Data from the UK AURN was used as Irish EPA sites did not record enough exceedances to allow a relationship to be established. The number of permitted exceedances was then added to a plot and used to infer an appropriate annual mean concentration below which the short term standards are unlikely to be exceeded.

For NO_2, a linear relationship between the annual mean and hourly/daily standards was established, compared to a non-linear relationship between annual mean and daily standards for PM_{10} and $PM_{2.5}$.

Relationship between the Annual Mean and 1-Hour and 24-hour Mean Nitrogen Dioxide Standard

The air quality standards for NO_2 are expressed in terms of both the annual mean and the number of hours above 200 $\mu g/m^3$ (1 hour) and 50 $\mu g/m^3$ (24 hour) (2030 standard). The following relationships can be used to consider whether short term air quality standards for NO_2 are expected to be met.

- For the 1-hour NO_2 2030 AQLV, an annual mean NO_2 concentration of 30 $\mu g/m^3$ is an appropriate annual value, below which the hourly NO_2 limit value is unlikely to be exceeded.

- For the daily NO_2 2030 AQLV, an annual mean NO_2 concentration of 25 μg/m^3 is an appropriate annual value, below which the daily NO_2 limit value is unlikely to be exceeded.

Relationship between the Annual Mean and 24-Hour Mean PM_{10} Standard

The air quality standards for PM_{10} are expressed as the annual mean and an allowable number of days above 45 μg/m^3 (2030 standard). For PM_{10}, an annual mean concentration of 22.8 μg/m^3 is an appropriate annual value, below which the 24 hour PM_{10} limit value is unlikely to be exceeded.

The following relationship can also be used to determine the number of exceedances of the 24 hour limit value based on the annual mean:

$$y = 0.1197x^2 - 2.7055x + 17.509$$

where:

y is the number of daily PM_{10} exceedances

x is the annual mean PM_{10} concentration

This equation should not be used where the annual mean PM_{10} concentration is below 11.3 μg/m^3. Where the annual mean PM_{10} concentration is less than 11.3 μg/m^3, it can be concluded that exceedances of the daily PM_{10} AQLV are unlikely to occur.

Relationship between the Annual Mean and 24-Hour Mean $PM_{2.5}$ Standard

The air quality standards for $PM_{2.5}$ are expressed as the annual mean and an allowable number of days above 25 μg/m^3 (2030 standard). For $PM_{2.5}$, an annual mean concentration of 10.4 μg/m^3 is an appropriate annual value, below which the 24 hour $PM_{2.5}$ limit value is unlikely to be exceeded.

The following relationship can also be used to determine the number of exceedances of the 24 hour limit value based on the annual mean:

$$y = 0.2847x^2 - 3.8108x + 31.678$$

where:

y is the number of daily $PM_{2.5}$ exceedances

x is the annual mean $PM_{2.5}$ concentration

This equation should not be used where the annual mean $PM_{2.5}$ concentration is below 5.2 μg/m^3. Where the annual mean $PM_{2.5}$ concentration is less than 5.2 μg/m^3, it can be concluded that exceedances of the daily $PM_{2.5}$ AQLV are unlikely to occur.

Emission Factors

Emission factors incorporated into the TII REM were derived from the EU industry standard vehicle emissions calculator published in the EMEP/EEA air pollutant emission inventory guidebook and consistent with those developed for the UK National Atmospheric Emissions Inventory (NAEI). This allows users to calculate emission rates in terms of grams per vehicle-kilometre for all years up to 2050.

The TII REM uses county-based Irish fleet composition for different road types, for different European emission standards from pre-Euro to Euro 6/VI with scaling factors to reflect improvements in fuel quality, retrofitting, and technology conversions. The TII REM also includes emission factors for PM_{10} emissions associated with brake and tyre wear.

The TII REM includes factors to calculate emissions of NO_X and particulate matter ($PM_{2.5}$ and PM_{10}) associated with exhaust, and also non-exhaust emissions (NEE) comprising $PM_{2.5}$ and PM_{10} from brake and tyre wear, and road abrasion.

The toolkit allows users to calculate vehicle emissions for multiple road links based on vehicle fleet composition, traffic speeds and road type.

The emission rates for detailed modelling should also be taken from the TII REM. Air quality practitioners can export these ready for use in detailed modelling packages from a download feature in the TII REM tool.

Background Pollutant Concentrations

Dispersion models only directly account for those sources that are explicitly included within the air quality model (for example, the local road network). It is therefore usually necessary to account for emissions arising from other sources by including the local background contribution. This local background may represent a significant or dominant proportion of the total pollutant concentration, it is important that careful consideration is given to background levels and how they may change in future years.

In order to estimate future background pollutant concentration, the following approach should be followed:

Step 1: Determine which category is appropriate for the study area

The study area should be assigned to one of the following categories, which align with those outlined by the EPA:

- The ‘Large Urban’ area will be representative of the Zone A;
- The ‘Urban’ area will be representative of Zone B and Zone C; and,
- The ‘Rural’ area will be representative of Zone D.

An appropriate background site within the same Zone as the study area should be chosen.

Step 2: Project Future Background Concentrations for the Required Pollutants

Future background concentrations should be projected based on the values shown in the matrices, found in Appendix C. The user should apply the zone category (Step 1, above) and transport decarbonisation pathway (optimistic, realistic worse-case, or pessimistic). For the main air quality assessment, the realistic worse-case scenario should be used to inform the significance of the proposed scheme. The optimistic and pessimistic scenarios can also be presented in the air quality appendix should the air quality practitioner deem it useful as a sensitivity assessment.

As NAEI data is only available up to 2040, projection factors have been produced to calculate background concentrations up to 2040. Where background concentrations beyond 2040 are required, the user should project the background concentrations to 2040 and assume this is representative of the future year.

Worked Example:

Baseline annual mean background monitored $PM_{2.5}$ concentration of 10 µg/m^3 recorded in 2026 in Zone A, and a future assessment year of 2035.

$$10\ \mu g/m^3 \times 0.903 = 9.0\ \mu g/m^3$$

Extract from Appendix C, Table 15.

	2023	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**
2022	0.978	0.957	0.935	0.924	0.912	0.901	0.889	0.878	0.869	0.860	0.852	0.843	0.834
2023		0.978	0.956	0.944	0.932	0.921	0.909	0.897	0.888	0.879	0.871	0.862	0.853
2024			0.977	0.965	0.953	0.941	0.929	0.917	0.908	0.899	0.890	0.881	0.872
2025				0.988	0.975	0.963	0.951	0.939	0.929	0.920	0.911	0.901	0.892
2026					0.988	0.975	0.963	0.950	0.941	0.931	0.922	0.913	**0.903**

Figure 4.7 Worked Example: Background Concentrations

Traffic Data Scenarios

AQA should consider cumulative effects to ensure the predicted concentrations include emissions from existing traffic as well as committed schemes. It is recognised that the AQA will usually be inherently cumulative as traffic growth associated with other developments will need to have been incorporated within the traffic data utilised within the AQA.

The air quality practitioner should confirm with the project transportation consultants that the traffic data provided for the environmental assessments includes committed schemes (i.e. schemes which have planning approval and funding approval) as part of the DM and DS scenarios. Further information with regards to what constitutes a committed scheme is outlined in Section 2.6.3 of the TII Project Appraisal Guideline Unit 4.0 PE-PAG-02013.

In some limited circumstances it may be necessary to undertake additional modelling scenarios to ensure cumulative effects are considered in further detail, for example if a number of TII schemes are being delivered in the same geographical area and the construction and/or the commencement of operations are anticipated to take place concurrently.

The traffic growth assumptions utilised in the AQA should be set out in the AQA report. It is recommended that the 'high' growth traffic scenario is used to ensure a reasonably foreseeable worse-case scenario is assessed in terms of environmental impacts. This is in accordance with the EPA EIA Guidance (EPA, 2022). The details of the traffic data should be discussed with the traffic and noise consultants to ensure the same scenario(s) are used in both the air quality and noise assessments.

The air quality practitioner should also ensure committed receptors (e.g. a new housing development) that are anticipated to be in place by either the construction or operational phases are included in the assessment, as sensitive receptors, as appropriate. This information should be available from the EIA and/or planning team.

Road Links

The road network should be divided into separate links, describing sections of road where traffic conditions are homogenous (in terms of traffic composition, speed, and flow).

Care should be taken to assign an appropriate number of road links particularly where there are sensitive receptors in close proximity to the road.

The assessment should include all roads expected to make a significant contribution to air quality. In practice, it should not be necessary to include any road more than 200 metres away from a sensitive receptor.

Junctions and Congested Traffic

Consideration should be given to sections of road where emissions may be higher, for example, due to congested traffic or road junctions. It is recommended that the simple approach outlined in LAQM.TG(22) is applied where local information with regard to congestion and associated speeds is not available. The assumptions need to be manually applied to the traffic data before it is inputted to the TII REM for use directly or in order to use REM to generate emission rates for use in a detailed dispersion model. Table 4.3 outlines the assumptions that can be made.

Table 4.3 Junctions and Congested Traffic Assumptions

Junction Types	Assumptions
Busy Junctions	Assume that traffic approaching the junction slows to an average of 20 kph. This should allow for a junction, which suffers from a lot of congestion and stopping traffic. In general, these speeds are relevant for approach distances of approximately 25 m.
Other Junctions	For other junctions (non-motorway) and roundabouts where some slowing of traffic occurs, assume that the speed is 10 kph slower than the average free flowing speed.
Motorways	For motorway or trunk slip roads, assume average speeds of 40–45 kph close to the junction.

Alternate approaches may be utilised if sufficient information is available, with clear justification provided and a full explanation of any approach taken.

Model Verification

Models selected for use in the assessment of proposed schemes should be fit for purpose and should have some form of published validation assessment and/or technical methodology report available. However, the validation reports prepared by model developers are unlikely to be specific to the assessment area being considered and a comparison between modelled concentrations and local monitoring data should be carried out. This process is referred to as model verification and should be carried out for all dispersion modelling studies.

Discrepancies between modelled and measured concentrations may arise for a number of reasons, depending on the model being used, for example:

- Uncertainties in traffic data (flows, speeds, vehicle mix);
- Emission factors assumed for each vehicle type;
- Assumptions regarding background concentrations;
- Meteorological data;
- Model input parameters e.g. roughness length, minimum Monin-Obukhov length etc. and
- Model parameters that are fixed, e.g. initial dispersion, but which may in practice vary according to local conditions.

In all cases, every attempt should be made to minimise any discrepancies. This may involve further scrutiny of the model input assumptions, or the parameterisation of the model itself. Where discrepancies remain, the model should be adjusted to account for any systematic errors. The AQA report should provide full details of the model verification process and explicitly define any adjustment factors that have been used. Guidance on model verification is provided in DEFRA's LAQM.TG(22) and as also shown in Figure 4.8. A worked example of model verification being applied to a proposed scheme is provided in the SD PE-ENV-01107.

Step 1:

Produce a table of information on monitored and modelled data including:

Modelled and monitored road contribution NO_x

Modelled and monitored road contribution NO_2

Background NO_2

Modelled and monitored Total NO_2

% difference between modelled and monitored total NO_2

Step 2:

At each site, calculate the ratio of monitored road NO_x contribution to modelled road NO_x contribution.

This information is useful to help identify sites which may be performing differently than others. These sites can then be investigated and inputs to the model may be varied to improve the performance of these sites. Alternatively, these ratios can be used to separate locations or zones where dispersion is behaving differently e.g. a street canyon from more open or typical urban sites. The ratio is often much higher at sites which could be considered street canyons as they have limited dispersion and separate adjustments may be required.

Step 3:

Prepare a graph of modelled versus monitored road NO_x contribution. Include a trend line. Derive the equation of the trend line which should be in the format of

Y=mx (intercept at 0)

Y= is monitored road contribution NO_x

x = is modelled road contribution NO_x

m is the regression correction factor to apply to the modelled road contribution NO_x

Step 4:

Apply the adjustment factor(s) for road contribution NO_x at all sites and derive total NO_2 concentrations.

Figure 4.8 Summary of steps to model verification

Model Uncertainty

Statistical procedures are available to evaluate model performance and assess the uncertainties. The statistical parameters listed in Table 4.4 should be calculated prior to and after adjustment and provided in the AQA report.

Table 4.4 Model Uncertainty Statistics

Statistics	Formula	Ideal Value	Comments
The correlation coefficient.	$r=\left[\frac{\sum_{i=1}^{N}(Obs_i - Avg.Obs)(Pred_i - Avg.Pred)}{Stdev.Obs \times Stdev.Pred}\right]$	1.0	It is used to measure the linear relationship between predicted and observed data. A value of zero means no relationship and a value of 1 means absolute relationship. This statistic can be particularly useful when comparing a large number of model and observed data points.

Statistics	Formula	Ideal Value	Comments
Fractional bias (FB).	$FB = \frac{(Avg.Obs - Avg.Pred)}{0.5(Avg.Obs + Avg.Pred)}$	0.0	FB values vary between +2 and -2 and has an ideal value of zero. Negative values suggest a model over-prediction and positive values suggest a model under-prediction.
Root Mean Square Error (RMSE).	$RMSE = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(Obs_i - Pred_i)^2}$	0.0	RMSE is used to define the average error or uncertainty of the model. The units of RMSE are the same as the quantities compared. It is used to identify if the model shows a systematic tendency to over or under predict. If the RMSE is higher than ± 25% of the AQLV (2030 standard, refer to Table 2.1) being assessed, it is recommended that the model inputs and verification are revisited in order to make improvements.

i = the number of observations compared, 1, 2, 3 …. N, N = total number of observations compared, Obs = observed concentration, Pred = predicted concentration, Avg.Obs = average of all observed concentrations, Avg.Pred = average of all predicted concentrations, Stdev.Obs = standard deviation of observed concentrations, Stdev.pred = standard deviation of predicted concentrations

4.6.3 TII REM

The TII REM provides a simple and straightforward means of predicting pollutant concentrations associated with road traffic emissions and therefore is not considered a detailed dispersion model. Table 4.5 outlines the criteria for when the TII REM should be used.

Also note that a user guide is included with the tool.

TII REM Inputs and Outputs

The specific input requirements when using the TII REM are described in Table 4.5. Table 4.5 also describes the outputs that are provided by TII REM.

Table 4.5 TII REM Model Inputs and Outputs

Input	Description
Road type and Traffic data	The TII REM input file is used to define the AADT for each link for light and heavy vehicles, speed and county. The user should also define the road type as urban, rural or motorway, and may also define links as part of the National Road Network (NRN). The link length is defined where total annual emissions are required as an output. There is also the option to use ‘advanced’ inputs, which allows the user to define the traffic database used to perform the calculations (see fleet database below) and omit certain vehicle euro class types from the fleet prior to the calculations being performed.
Fleet Database	The TII REM user must select a fleet projection that defines the future changes in fuel technology and vehicle age. **Car Projections** TII REM has four car fleet projections known as: Business as Usual (BaU), Climate Action Plan (CAP) (Government of Ireland, 2021), Intermediate and 2035 ICE (internal combustion engine) Sales Ban 2035.

<table>
<tr><th>Input</th><th>Description</th></tr>
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The BaU fleet projection assumes that the same current trends in vehicle registrations continues into the future.
The CAP projection assumes that the policies set out in the CAPs up to 2024 are implemented resulting in increased adoption of electrified vehicles.
The intermediate fleet projection has been interpolated between the BaU and 2024 CAP. Note there are no new projections in the 2025 CAP and so the 2024 based CAP projections for cars are unchanged.
The intermediate fleet projection provides a conservative fleet for future predictions in the event that the full changes in the vehicle fleet intended in the 2024 CAP do not occur at the rate expected.
The 2035 ICE Sales Ban scenario is based on CAP and represents the end of all new ICE (including petrol, diesel and hybrid) cars in 2025 in-line with EU policy, leading to 100% BEV sales after this date. This is an additional scenario that has been developed to consider the implications of an ICE sales ban.

HGV/LGV Projections
There are four scenarios each for LGV and HGV fleet projections. These are known as: EU Target (HGV)/ICE Sales Ban 2035 (LGV), CAP, and BaU high-ambition and low-ambition.

The EU Target (HGV)/ICE Sales Ban 2035 (LGV) projection comprises a 2035 ICE new sales ban for LGV and interim targets for emissions from sales of new HGVs.
The CAP projection for LGV and HGVs is based on defined objectives in the CAP (up to 2024, as with cars there are no new LGV/HGV projections in the 2025 CAP) to increase the adoption of alternative technologies to reduce emissions with increased electrification.
The BaU LGV and HGV projections are based on a review of market capacity for different technologies for LGV and HGVs.

AQA Main Assessment
The CAP fleet projection for car, BaU high ambition for LGV’s and the EU Target for HGV’s should be included in the main assessment as this combination represents a realistic worse case. These results should be used to inform the significance of the proposed scheme.
AQA Appendices
Within the appendices, the results of the optimistic and pessimistic scenarios can also be presented should the air quality practitioner or another practitioner deem it useful as a sensitivity assessment. For example, where there is a risk of likely significant effects from ammonia and/or nitrogen deposition at sensitive designated habitats.

Optimistic Scenario – using the ICE 2035 Sales Ban scenario for cars, Climate Action Plan scenario for LGVs, and EU Targets for HGVs.
Pessimistic Scenario – using the Intermediate Scenario for cars, Business as Usual (Low Ambition) scenario for LGVs and EU Targets for HGVs.

</td></tr>
</table>

Input	Description
TII REM Output	The TII REM predicts annual mean emission rates and total annual emissions of NO_X, PM_{10} and $PM_{2.5}$, and concentrations of NO_2, PM_{10} and $PM_{2.5}$ at selected receptor locations. The tool also predicts acidity and N-deposition at selected receptor locations based on calculated NO_2 concentrations and NH_3 emissions provided to the tool where appropriate.

4.6.4 Detailed Dispersion Models

Where existing environmental concentrations exceed 90% of the relevant air quality 2030 standard, or where there are complex or unusual features of the proposed scheme, a detailed dispersion modelling assessment would normally be carried out. It should be noted that it is usually only necessary to carry out detailed dispersion modelling in the immediate area of the complex feature, such as a specific junction, and not for the proposed scheme as a whole, although practitioners may find it simpler to use a single approach for the proposed scheme assessment.

There are a range of dispersion models that can be used for the assessment of proposed schemes and it is not within the scope of this document to advise on the selection of one model or another. However, "new-generation" models that rely on an improved understanding of the boundary layer meteorology are now in common use and are strongly preferred above those models that are based on the simpler Pasquill parameterisations.

A justification for the selection of a particular dispersion model should always be provided, setting out, for example, how the features and capabilities of the model are suited to the proposed scheme in question.

Detailed Dispersion Modelling Inputs

The specific input requirements when using detailed dispersion models are described in Table 4.6.

Table 4.6 Detailed Dispersion Modelling Inputs

Input	Description
Emissions activity data	Includes traffic flows, speeds and vehicle composition for each of the road links. Traffic data used for dispersion modelling are frequently derived from transport models which may only forecast peak hour flows and speeds, which then need to be adjusted to provide the required input data for the dispersion model. It is important that the approach used for such adjustments is described or adequately referenced. The input data required for the model is AADT flows to assess proposed scheme at Phase 2. For Phase 3, AADT will be required for REM and period data (AM, inter peak, PM and off peak) for ADMS when undertaking a Phase 3 assessment for the preferred option.
Complex topography	Different terrain heights and the relative elevation of road-link emission sources and receptors in different situations e.g. road cuttings, bridges and flyovers should be considered. Specifically with regards to situations where the height of the road is significantly elevated e.g. bridges, it would not usually be necessary to include this elevation within the model as this would be considered worse case. Instead, monitoring data can be gathered in this type of area which can then be used in model verification to adjust model outputs to reflect the different dispersion characteristics in the area. However, if the outcome of the assessment determines that there are potential significant air quality effects, then bridge heights can be added to model. This ensures a proportionate approach.

Input	Description
	Some models allow complex topographical features (such as hills and valleys) to be included using digital terrain files. However, it is not normally necessary to consider such effects where the gradient in slope is less than 10%. Additional considerations are: • is the modelling domain sufficiently extensive to justify the inclusion of terrain effects? Where single route corridors are under evaluation, significant effects are unlikely to extend more than 200 m from the line of the carriageway. In addition, the resolution of the terrain file e.g. 100 m, may not be sufficient to reflect terrain changes over such small distances, • what level of detail does the model use for terrain modelling? Some models interpolate terrain files to a lower resolution to reduce model run times, and • guidance from Cambridge Environmental Research Consultants (CERC) and Dispersion Modellers User Group (DMUG) on the tools available to replicate these environments should be followed if ADMS-Roads is used.
Street canyons	Street canyons occur when buildings on both sides of the road can lead to the formation of vortices and recirculation of air flow that can trap pollutants and restrict dispersion (DEFRA, 2021). Street canyons are generally defined as narrow streets where the height of buildings on both sides of the road is greater than the road width, however, there are occasions where broader streets may also be considered as street canyons. If using ADMS-Roads for example, there are two modules for modelling street canyons; the basic street canyon module based on the Danish Operational Street Pollution Model (OSPM) developed by Hertel and Berkowicz (1989) and the advanced street canyon module developed by Hood et al. (CERC, 2018). Further guidance on the selection and use of the different modules is provided in the CERC User Guide (CERC, 2022).
Meteorological data	In most cases, the user should select the nearest meteorological site to the study area, but account should be taken of any local effects that may make the data unsuitable, for example, coastal effects or complex topography. The year of meteorological data should correspond with the year of baseline traffic, baseline background pollutant concentrations, baseline emissions data and monitoring data that is to be used for the subsequent model verification. When obtaining meteorological data it is important to confirm with the supplier that the proper QA/QC has been undertaken. Users should confirm whether the data provided are hourly, sequential, as measured or whether missing hours have been filled. It is important that full details of the meteorological data used are reported e.g. the location of the meteorological recording site and its relation to the study area.
Other Inputs	Within the detailed dispersion model, the surface roughness length and minimum Monin-Obukhov length for the monitoring station and study area should be selected. The minimum Monin-Obukhov length is used to limit stable stratification in an urban area i.e. the height at which turbulence is generated more by buoyancy than by wind shear (refer to CERC Guidance for further information (CERC, 2022)).

Input	Description
Assessment of individual traffic lanes	In certain circumstances it may prove beneficial to assess separate lanes of traffic (moving in different directions). This can be particularly useful where, for example, the characteristics of traffic on one side of the carriageway are different to those on the other, or where there are wide roads with physically separated lanes (such as dual-carriageways or motorways).
Cold starts	Cold starts emissions are the additional tailpipe emissions that occur when a car is cold at the start of a journey. The drive cycle data used to inform emissions modelling includes a proportion of cold starts, although this is considered to occur for only a very short period of a journey. Under circumstances where road links may be associated with a significant proportion of vehicles running with cold engines, it will be necessary to account for the excess emissions associated with these "cold start" movements. Such considerations are only likely to apply in specific circumstances such as car parks and in most circumstances are unlikely to affect assessments for the proposed schemes. Professional judgement should be used to determine if this is required for a specific scheme within ADMS or any other tool e.g. CREAM tool. The REM tool does not include a cold start function.

4.6.5 Modelling Uncertainties and Sensitivity Testing

The AQA should provide a robust assessment of the potential impacts of proposed schemes. The AQA should address the uncertainties associated with the data inputs and show what steps have been taken to minimise these uncertainties. Any residual assumptions and limitations or uncertainties should be clearly outlined in the AQA.

As discussed in Section 4.6.2, model verification should be undertaken to adjust modelled concentrations and reduce discrepancies when compared with the monitoring concentrations. The procedure to do so is outlined in Figure 4.8. Verification statistics should be used to inform confidence in the baseline and model input factors, such as meteorology surface roughness. The same model inputs should be used in future scenarios unless there is a specific reason not to do so.

Predicting pollutant concentrations in a future year will always be subject to greater uncertainty. It is necessary to rely on a series of projections of background pollutant concentrations (refer to Appendix C) and vehicle emissions. These are based on emission factors which consider projections of the fleet mix in each year.

Air quality practitioners may wish to carry out sensitivity tests using a range of parameters at a limited number of receptor locations. The purpose of which would be to evidence confidence in the assessment outcome where the effects are sufficiently close to the air quality standards, that changes in outputs could lead to a potentially different outcome (i.e. significant vs not significant). In all cases the model input parameters used should be clearly set out in the AQA. Sensitivity testing for the future scenario, if conducted, should focus on the main sources of uncertainty with regard to air quality; i.e. pollutant background contribution. Additional sensitivity testing may focus on the modelled traffic flow data with tests for core or low growth, where high growth has been used for the main assessment in the AQA.

4.6.6 Collaborative Working

Collaboration with the population and human health practitioner, climate practitioner and noise practitioners should be undertaken.

Collaboration should focus on the selection of human health receptors to ensure consistency with the noise team and to identify opportunities for the property count information for the index of overall change to be derived from noise mapping information.

The selection of sensitive human health receptors should be shared with the population and human health practitioner to determine whether additional receptors should be included to support the population and human health assessment.

In addition, baseline information, particularly concerning exceedances of the 2030 standards, and the results of the AQA should be provided to the population and human health practitioner.

4.7 Sensitive Designated Habitats

Internationally, nationally and locally designated sites of ecological importance (known as designated habitats) need to be included in the AQA. Designated habitats include:

- Ramsar Sites
- Special Protected Areas (SPA) and proposed sites (pSPA)
- Special Areas of Conservation (SAC) and proposed sites (pSAC)
- Nature Heritage Areas (NHA) and proposed Natural Heritage Areas (pNHA)
- Ancient woodland
- Veteran trees
- Nature Reserves
- National Parks
- Refuge for Fauna and Flora
- Wildfowl Sanctuaries
- Biogenetic Reserves
- UNESCO Biosphere Reserves

Only sites that are sensitive to nitrogen (i.e. sensitive designated habitats) should be included in the assessment, it is not necessary to include sites, for example, that have been designated as a geological feature or a water course.

4.7.1 Collaborative Working

Collaborative working between the competent practitioner for biodiversity and air quality is essential when undertaking AQA for sensitive designated habitats at all phases. The project's biodiversity practitioner should advise on the following:

- Scoping sensitive designated habitats to be included in the assessment. The biodiversity practitioner should confirm which sites are sensitive to nitrogen and acid deposition and therefore, should be included in the assessment;
- The location of modelled transects within each sensitive designated habitat;
- The most appropriate habitat to model within each of the sensitive designated habitats; and
- The results of the AQA at sensitive designated habitats confirming if the impacts are significant or not.

It is also essential that references to the air quality impacts discussed in the biodiversity chapter and Natura Impact Statement (NIS) are reviewed by the project's competent practitioner for air quality.

4.7.2 Methodology

The following sets out the assessment methodology to consider the potential impacts from NO_x, nitrogen (N) deposition, acid deposition and NH_3 at sensitive designated habitats.

As discussed in Table 4.1, where pollutant (NO_2, PM_{10} and $PM_{2.5}$) concentrations are sufficiently below the 2030 standards (taken to be <90% of the standard), then a screening approach using the TII REM is appropriate. Where pollutant concentrations are above 90% of the 2030 standards and where there are complex or unusual features, then detailed modelling should be used in the AQA (refer to Table 4.6).

The assessment of NO_x and N deposition will be based on the methodology set out in DMRB LA 105 (Highways England, 2019). The assessment will be undertaken as a stepped approach. The steps used to calculate concentrations of NO_x and NH_3 (Section 5.3.3.5) are presented in Figure 4.9. The steps used to calculate N deposition and acid deposition are presented in Figure 4.10. A worked example of the steps involved in the calculation of NO_x, NH_3, N deposition and acid deposition is provided in the Air Quality SD **PE-ENV-01107**.

Identify sensitive designated habitats

Identify all sensitive designated habitats (as described above) within 200 m of the affected road network (ARN) carriageway centreline and all European designated sites within 2 km. At each sensitive designated habitat (within 200m of the ARN), receptor points at 10 m intervals should be modelled, starting from the nearest point of the sensitive designated habitat to the road, up to a maximum distance of 200 m regardless of whether the habitat extends beyond 200 m.

↓

Calculation of road NO_x

For each point along the transect, the road NO_x concentration shall be calculated for the base year, projected base year, DM and DS scenarios in the opening year and design year (Phase 3 only), following the methodology outlined in Section 4.6. Projected base year represents the opening year of the project assessed with base year traffic and vehicle emission rates for the opening year to inform the assessment of future year projections of NO_x and NO_2.

↓

Calculation of total NO_x

Adjusted Road NO_x should then be added to background NO_x to calculate total NO_x. Total NO_x should then be compared to the critical level of 30 μg/m³.

↓

Calculation of road NH_3

For each point along the transect, the road NH_3 concentration shall be calculated for the base year, projected base year, DM and DS scenarios in the opening year and design year (Phase 3 only).

NH_3 emission factors from road traffic should be used, applying the most up to date knowledge and the appropriate methodology available at the time.

↓

Calculation of total NH_3

Road NH_3 should then be added to background NH_3 to calculate total NH_3.

Total NH_3 concentrations should then be compared to the critical levels of 1 μg/m³ for lichens and bryophytes and 3μg/m³ for everything else (IAQM, 2020).

Figure 4.9 Summary of steps to calculate road contribution and total NO_x and NH_3

Calculation of road NO_2

To determine total N deposition rates at each receptor point, road NO_x shall be converted to road NO_2, for the base year, projected base year and DM and DS in the opening year and design year (Phase 3 only), following the methodology described in Section 4.6.

↓

Conversion of road NO_2 to dry nutrient nitrogen (N) deposition rate

The contribution of road NO_2 to dry nutrient N deposition (kg N/ha/yr) shall be calculated using the following conversion factors from the Air Quality Advisory Group Guidance document AQAG06 and IAQM (2020):

Grassland and similar habitats: 1µg/m^3 of NO_2 = 0.14 kg N/ha/yr

Forest and similar habitats: 1µg/m^3 of NO_2 = 0.29 kg N/ha/yr

↓

Conversion of road NH_3 to dry nutrient nitrogen (N) deposition rate

The contribution of road NH_3 to dry nutrient N deposition (kg N/ha/yr) shall be calculated using the following conversion factors from the air quality advisory group Guidance document AQTAG06 and IAQM:

Grassland and similar habitats: 1 µg/m^3 of NH_3 = 5.2 kg N/ha/yr

Forest and similar habitats: 1 µg/m^3 of NH_3 = 7.8 kg N/ha/yr

↓

Conversion of road dry nutrient nitrogen (N) deposition rate to acid deposition

Acid deposition is calculated using the following conversion factor:

All habitats: 1 kg N/ha/yr = 0.071429 keq N/ha/yr

(1 keq N/ha/yr is equal to 14 kg N/ha/yr)

↓

Calculation of total N deposition

The sum of the road N deposition rate (from NO_2 and NH_3, calculated in steps 2 & 3 respectively) for the base year, DM and DS in the opening year and design year (Phase 3 only) shall be added to the background N deposition for each point along the transect to calculate the total N deposition. Background N deposition rate shall be obtained from the Air Pollution Information System (APIS) website (Centre for Ecology and Hydrology).

The total N deposition shall then be compared to the critical load for the site.

↓

Calculation of total acid deposition

Acid deposition for the base year, DM and DS in the opening year and design year (Phase 3 only) shall be added to the background acid deposition for each point along the transect to calculate the total acid deposition.

Total Acid deposition shall then be compared to the critical load for the site.

Figure 4.10 Summary of steps to calculate N deposition and acid deposition

The competent practitioner for air quality and biodiversity will review the latest information regarding critical loads, background nitrogen and acid deposition and NH_3 at the time of the assessment. The air quality practitioner should refer to the Air Pollution Information System (APIS) to obtain this information. If required, further information regarding background concentrations and critical loads can be gathered from the EPA's research papers 'Research 323: Critical Loads and Soil-Vegetation Modelling' (EPA, 2020) and 'Research 390: Nitrogen-Sulfur Critical Loads: Assessment of the Impacts of Air Pollution on Habitats' (EPA, 2021b).

4.7.3 In Combination Assessment

Natura 2000 is a network of sites selected to ensure the long-term survival of Europe's most valuable and threatened species and habitats. Sites included are the SAC, SPA and Ramsar sites. At these sites it is necessary to consider not only the effects of the proposed scheme in isolation, but also 'in combination' effects i.e. the effects of the proposed scheme when considered cumulatively with all forecast traffic growth on the road network.

In combination assessment does not normally require the modelling of any additional scenarios. It does require the project competent practitioner for biodiversity not to consider the impact of the proposed scheme in isolation, but to compare the DS scenario with the projected base year scenario (which assumes no growth in traffic flow from the base year to the opening year) to take full account of the effects of traffic growth without the obscuring effect of improved vehicle emission factors.

4.8 Regional Assessment

Box 6: Regional Assessment

The regional assessment is undertaken to determine the potential air quality effects of the proposed scheme at a regional level. Pollutants of concern on a regional scale are nitrogen oxides (NO_x) and carbon dioxide (CO_2e).

The assessment of the national/international level impacts of the preferred route should focus on the change in emissions of nitrogen oxides (NO_x) and carbon dioxide (CO_2e) in the current (baseline), opening and design years (15 years after opening year).

The study area for the regional assessment should be discussed with the project transportation consultants to ensure roads with changes in traffic flows/composition attributed to the scheme are included. If there is a fully calibrated scheme traffic model then the outputs from the whole model may be included in the regional assessment.

The TII REM can be used to estimate total NO_x and CO_2e emissions from the road network. The wider-scale impacts should be described principally by comparing the incremental change in emissions between the DM and DS options.

4.9 Construction Air Quality Assessment

Box 7: Construction Air Quality Assessment

Potential air quality effects during the construction phase can occur due to dust emissions and from construction traffic movements.

A semi-quantitative approach is recommended to determine the likelihood of a significant impact from dust soiling, PM_{10} and $PM_{2.5}$ on human health and on vegetation. The approach should be combined with an assessment of the proposed mitigation measures.

The pollutants of most concern in relation to emissions from construction road traffic are nitrogen dioxide (NO_2) and particulate matter (PM_{10} and $PM_{2.5}$) and NO_X and NH_3 on sensitive designated habitats.

4.9.1 Approach and Processes

A 5-step procedure should be followed to screen potential effects, based on the proximity of receptors and baseline conditions in accordance with the Institute of Air Quality Management (IAQM) procedures published in their latest construction dust Guidance. In the IAQM guidance trackout (i.e. mud on roads) are included as a specific dust generating activity, as well as demolition, construction and earthworks. The risk of likely significant effects will be higher in urban areas, where existing PM_{10} concentrations are likely to be higher and due to the number of receptors which may experience potential dust effects.

Figure 4.11 sets out the steps to be taken in the assessment. The latest version of the IAQM guidance is 'Guidance on the assessment of dust from demolition and construction (V2.2)' (IAQM, 2024).

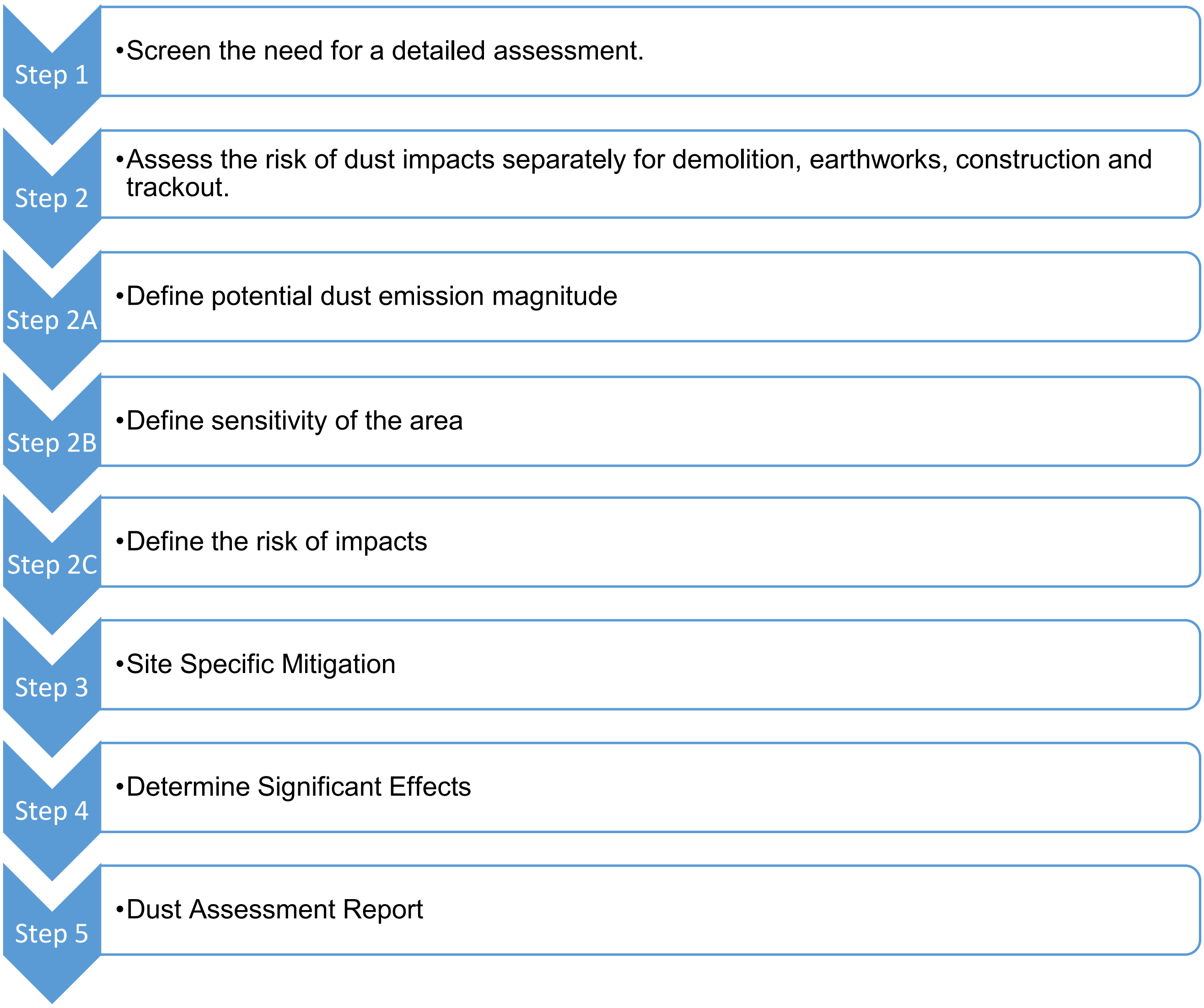

Figure 4.11 Steps to perform a Construction Phase Dust Assessment

Step 1: Screen the Need for a Detailed Assessment

An assessment will be required where there are sensitive human receptors located within 250 m and/or a sensitive ecological receptors located within 50 m of the boundary of the site or route used by construction vehicles on the public highway. Table 4.7 provides a list of receptors which are sensitive to potential dust soiling effects and to human health effects of PM_{10}. Over these distances significant effects on human receptors (nuisance and human health) as well as vegetation may occur.

This screening criteria is set out in Box 1 of the IAQM guidance is ‘Guidance on the assessment of dust from demolition and construction’ (V2.2) (IAQM, 2024).

Table 4.7 Receptors sensitive to dust and PM_{10}

Receptors	Receptor Type
Residential Properties	Amenity
Hospitals	Amenity
Schools	Amenity
Care Homes	Amenity
Playing Fields	Amenity
Parks	Amenity
Footpaths	Amenity
Cultural Heritage Collections- Museums and Galleries	Amenity
Vehicle Showrooms	Amenity
Food manufacturers	Amenity
Hi-tech manufacturing	Amenity
Horticultural operations	Amenity
Car Parks	Amenity
Farmland	Amenity
Roads	Amenity
Places of work	Amenity
Ramsar	Sensitive Designated Habitat
SPA	Sensitive Designated Habitat
SAC	Sensitive Designated Habitat
NHA	Sensitive Designated Habitat
pNHA	Sensitive Designated Habitat
Nature Reserves	Sensitive Designated Habitat

If no detailed assessment is required, then the report can note that no significant effects are likely.

Step 2: Assess the Risk of Dust Impacts.

The risk of potential dust impacts occurring is determined separately for each of the four activities (demolition; earthworks; construction; and trackout) and takes account of:

- The scale and nature of the works, which determines the potential dust emission magnitude (Step 2A); and
- The sensitivity of the area (Step 2B).

These factors are combined within a matrix in Step 2C to give the risk of dust impacts.

For Step 2A, the criteria outlined in the IAQM guidance is predominately focused on the construction of buildings rather than on linear infrastructure projects such as roads and greenways.

For these schemes the IAQM criteria to determine demolition, earthworks and track-out should be followed to determine if the potential dust emission magnitude is classified as small, medium or large. However, for demolition work, the total building size criteria, as defined in the IAQM guidance, should take account of structures as well as buildings. However, for the construction works the IAQM criteria to define the potential dust magnitude is not directly applicable for linear infrastructure schemes. Instead, a cautious approach should be adopted, and the magnitude should be defined as large unless the air quality practitioner can justify that a medium or small classification is more appropriate. The following can be taken into consideration for this justification; scheme type (i.e. greenway), method of construction, construction material, use of concrete batching and duration of build.

Step 3: Site Specific Mitigation

Site-specific mitigation is determined for each of the four activities (demolition; earthworks; construction; and trackout) and is based on the risk of dust impacts occurring, as defined in Step 2.

Step 4: Determine Significant Effects

This step examines the residual effects and determines whether or not these are significant. Further details with regards to Step 4 are provided in Section 4.10.4.

Step 5: Dust Assessment Report

Prepare a dust assessment report, which may be contained as a section of the Air Quality Chapter of the EIAR or Appendix to the chapter.

4.9.2 Other Considerations

The following should be considered when undertaking a construction dust assessment.

Borrow pits and Large Plant Installations

Borrow pits are a specific dust-generating activity that should be given a ‘high dust emission magnitude’ as part of the Earthworks category, rather than being given a specific additional assessment. Similarly, Concrete Batching Plant, Asphalt Plant, Crushing and Screening Plant shall also be given a high dust magnitude for the construction or earthworks categories as appropriate.

Aspergillus Spores

Where relevant, the dust assessment should consider fungus, specifically *Aspergillus spp.*, as an elevated risk factor option for proposed schemes. The risk assigned to proposed schemes where *Aspergillus spp.* may be present, should be assigned a high dust emission magnitude e.g. demolition category, to trigger the need for greater mitigation where immunosuppressed receptors are identified.

Aspergillus spp. may be present in soil, compost and rotting leaves, plants, trees and crops, and dust, and so spores may be released during earthworks or demolition of older buildings. It does not normally affect healthy individuals but may have adverse repository effects for individuals with immunosuppressed or low immunity. Therefore, the specific consideration, as recommended by National Health Agencies or others specialised in the field, should be made for works near locations where immunosuppressed individuals may be present; i.e. hospitals, medical centres, etc. Examples of recommendations are included in the National guidelines for the prevention of nosocomial aspergillosis (Health Protection Surveillance Centre, 2018).

For proposed schemes where *Aspergillus spp.* may be present, then the level of risk and appropriate mitigation measures should be discussed with the project ecologists and human health practitioners. If necessary, microbiologists could be used to determine whether *Aspergillus spp.* is present.

Non-Road Mobile Machinery (NRMM) and Small Plant

Experience of assessing the exhaust emissions from on-site plant machinery (e.g. excavators) and generators (also known as non-road mobile machinery or NRMM) suggests that they are unlikely to make a significant impact on local air quality, and in the vast majority of cases they will not need to be quantitatively assessed. For site plant machinery, consideration should be given to the number of plant/vehicles and their operating hours and locations to assess whether a significant effect is likely to occur (IAQM, 2024). Additionally, consideration should be given to whether battery or electric plant equipment is viable.

4.9.3 Construction Traffic

The following outlines a risk-based approach to determining the need for a construction phase traffic AQA for a proposed scheme. A stepped approach is recommended as illustrated below.

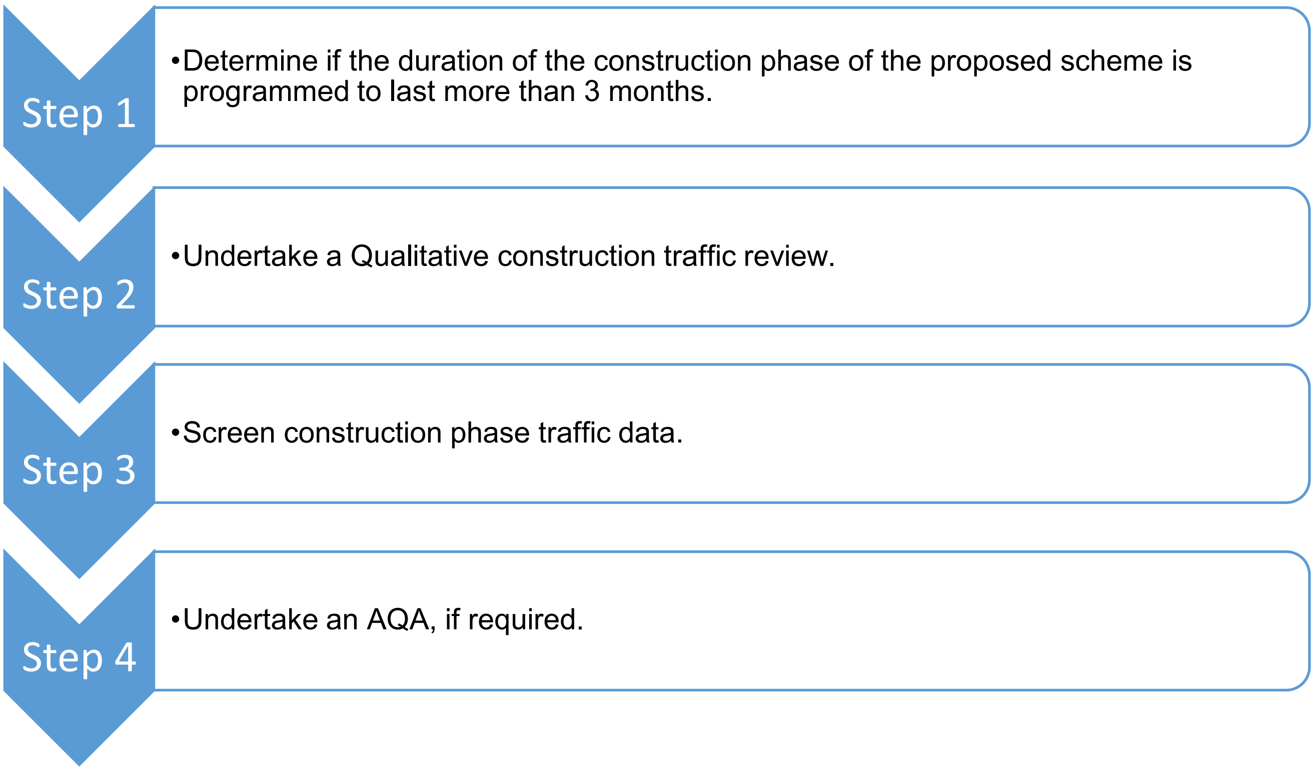

Figure 4.12 Steps to perform a Construction Phase Assessment

4.9.3.2 Step 1 - Duration

Assessment of construction phase traffic impacts will be required where construction activities are programmed to last for a duration of 3 months or more. If the construction phase is programmed to last less than 3 months, then the construction activities are unlikely to constitute a significant air quality effect and can be scoped out of the assessment. Three months is proposed as over this period a change in concentration can affect the hourly and daily concentrations and may result in the number of exceedances breaching the air quality standards.

4.9.3.3 Step 2 – Phase 2 Stage 3 Qualitative Construction Traffic Review

The air quality practitioner should liaise with the project manager and traffic practitioner to update the assumptions and risk assessment for the TII Phase 2, Stage 3 Preferred Option Selection construction traffic review. The update should consider any new information (e.g. emerging information on traffic management) that was not previously available and check that assumptions and baseline air quality conditions are as previously understood.

For those schemes that it was concluded likely significant air quality effects were not expected, the purpose of the review is to confirm that is still the case or not. Conversely the review is also an opportunity to check that those scheme that were considered to have a risk of likely significant air quality effects are still considered to pose a risk or not.

If the update concludes that likely significant effects are not anticipated, taking into account any new information, a qualitative statement should be included in the EIAR to set out why no likely significant effects are anticipated. The qualitative statement should set out the rationale for this conclusion.

Should the update conclude that there is a risk of likely significant air quality effects, the air quality practitioner should progress to step 3.

4.9.3.4 Step 3 – Screen the Traffic

Where step 2 has identified the potential for likely significant air quality effects, construction phase traffic data should be screened against the following criteria. The screening criteria are based on the changes between the DS traffic (i.e. with construction) compared to the DM traffic:

- Road alignment will change by 5 m or more; or
- Annual average daily traffic (AADT) flows will change by 1,000 or more; or
- Heavy duty vehicle (HDV) (vehicles greater than 3.5 tonnes, including buses and coaches) flows will change by 200 AADT or more; or
- Daily average speed change by 10 kph or more; or
- Peak hour speed will change by 20 kph or more.

This approach is consistent with the operational phase assessment.

If the criteria are not met, then a quantitative assessment of construction traffic can be scoped out and the effects are considered to be not significant. If the criteria are met a local AQA is required.

For some projects, peak month construction data may only be available. For these projects, peak month data should be used as a proxy for annual traffic data, which would be considered a cautious approach.

4.9.3.5 Step 4 – Assessment

The construction phase traffic assessment should follow the assessment methodology described for the operational phase assessment. A detailed level assessment, using ADMS, should be undertaken where existing NO_2, PM_{10} and/or $PM_{2.5}$ concentrations exceed 90% of the 2030 standard. For all other areas an assessment using the TII REM should be undertaken (Table 4.1).

The evaluation of significance for the construction phase assessment of traffic emissions should be undertaken following the steps outlined in Section 4.10.

4.10 Evaluation of Significance

Box 8: Evaluation of Significance

The evaluation of significance in terms of air quality for effects during the construction and operational phases should be undertaken.

Determining the significance of air quality effects during the construction phase is based on IAQM latest guidance. For the operational phase effects, the significance is based on the Institute of Air Quality Management (IAQM, 2017) Guidance which ensures consistency with the terminology contained within Table 3.3 of the EPA's 'Guidelines on the information to be contained in the EIAR' (EPA, 2022).

Determination of significance in relation to air quality effects on sensitive designated habitats should be undertaken in consultation with the project biodiversity practitioner.

The evaluation of significance for the operational phase should be undertaken for the opening year only, as the design year is likely to show lower total pollutant concentrations and change in concentration.

4.10.1 Human Health

To describe the air quality effects of the proposed scheme at sensitive human health receptors, the following should be considered in the AQA as defined in the EPA's Guidelines on the information to be contained in the EIAR' (EPA, 2022) including:

- Quality of Effects;
- Describing the Extent and Context of Effects;
- Describing the Probability of Effects;
- Describing the Duration and Frequency of Effects; and
- Describing the significance of Effects.

4.10.1.1 Quality of Effects

The results of the AQA should be interpreted to determine the magnitude of change in pollutant concentration at each of the modelled receptors. It should be noted that AQLV for NO_2 and particulates (PM_{10} and $PM_{2.5}$) have been set at concentrations that provide protection to all members of society, including more vulnerable groups such as the very young, elderly or unwell. As such the sensitivity of receptors was considered when setting the AQLV and therefore no additional subdivision of human health receptors on the basis of building or location type is necessary.

The magnitude of change should be used to describe the quality of the effect as positive, negative or neutral using the criteria in the table below.

Table 4.8 Quality of Effect Criteria

Quality of Effect	Description
Positive effect	Where there is a decrease in annual mean concentration at a receptor which does not constitute a neutral effect.
Neutral effect	Where there is a change in concentration at a receptor of: • 5% or less where the opening year, without the proposed scheme annual mean concentration is 75% or less of the standard; or • 1% or less where the opening year, without the proposed scheme annual mean concentration is 94% or less of the standard.
Negative effect	Where there is an increase in annual mean concentration at a receptor which does not constitute a neutral effect.

4.10.1.2 Extent and Context of Effects

The extent of an effect is considered within the overall evaluation step (step 2), as described below in 4.10.1.5, in the determination of whether an effect is considered to be significant, as described above.

The context of an effect for air quality will focus on the duration of an effect as described in 4.10.1.4.

4.10.1.3 Probability of Effects

The AQA should consider a reasonably foreseeable worse-case and utilise the most up to date information and tools available to minimise the uncertainty in the AQA. Where a significant air quality effect is predicted this is considered a 'likely effect'. Where an effect is evaluated to be not significant, such as following the implementation of mitigation, it is considered to be 'unlikely' that an effect could be significant.

4.10.1.4 Duration and Frequency of Effects

The focus of an evaluation of the significance of an air quality effect, for ambient air quality, is on the potential effect of changes in air quality on the pollutant 2030 standards and is to be assessed for the opening year of the scheme. These standards are defined as concentration limits or exceedances averaged over annual timescales.

Only durations of time that an impact on annual averages are considered to be potentially significant in most incidences. Durations include:

- Momentary (seconds to minutes) are not considered significant as they are unlikely to affect air quality standards;
- Brief (less than a day) is the shortest period of time considered within AQA for road traffic for consideration of short-term standards;
- Temporary (less than a year);
- Short term effects (1 to 7 years);
- Long term effects (15 to 60 years); and
- Permanent effects (over sixty years) should be considered for example for operational phase.

For a construction phase the effects align with the duration of works and any associated changes in traffic. These effects are considered reversable once works cease. For the operational phase of the proposed scheme the AQA focuses on the worse-case year of operation, which is the opening year.

Thereafter, as air quality improves, effects are considered to reduce over time. Air quality is anticipated to improve over the next 15 years (long-term) with improvements in vehicle technology and increased penetration of electric vehicles into the vehicle fleet. Further improvements beyond to 60 years, albeit at reduced rates of improvement, will further reduce air quality effects (permanent effects) with reduced numbers of combustion vehicles and further increases in electric vehicles.

4.10.1.5 Significance of the Effects

The significance of the air quality effect at receptors should be determined. A two stepped approach is recommended as illustrated in Figure 4.13.

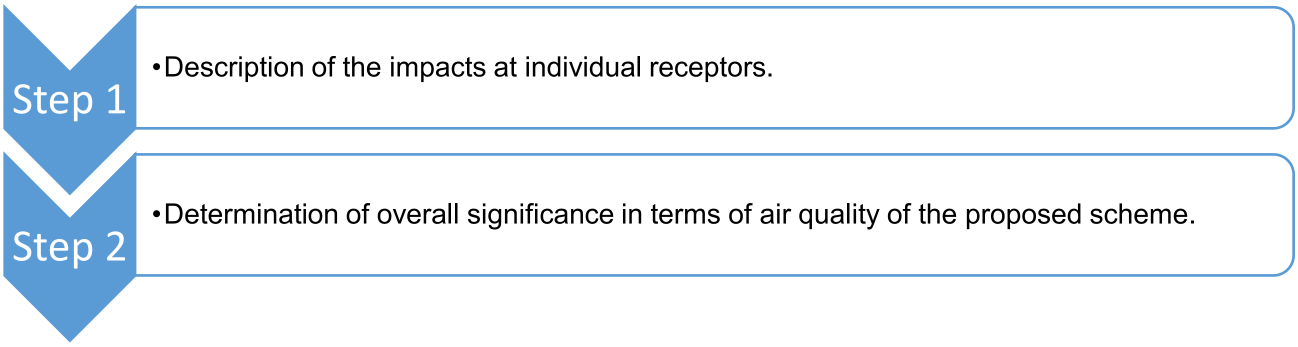

Figure 4.13 Determining the significance of the effect

At Step 1, the impact descriptors in Table 4.9 should be used to describe the impact at each receptor location, which takes into consideration the percentage change in concentration relative to the air quality 2030 standards of the pollutant. The impacts are described as neutral, slight, moderate or substantial. This terminology helps the air quality practitioner to focus on those locations where changes in air quality are expected to be the greatest.

Table 4.9 Impact Descriptors

Long term average concentration at receptor in assessment year	% Change in concentration relative to Air Quality 2030 Standard (AQLV)			
	1	2-5	6-10	>10
75% or less of AQLV	Neutral	Neutral	Slight	Moderate
76 – 94% of AQLV	Neutral	Slight	Moderate	Moderate
95 – 102% of AQLV	Slight	Moderate	Moderate	Substantial
103 – 109% of AQLV	Moderate	Moderate	Substantial	Substantial
110% or more of AQLV	Moderate	Substantial	Substantial	Substantial

The AQLV are discussed in Section 2.1 and Table 2.1.

Step 2 is to determine the overall significance of the impacts, and this should align with the terminology in the EPA guidelines (EPA, 2022). Whilst the outcome of Step 1 may determine that there are ‘slight’, ‘moderate’ or ‘substantial’ impacts at one or more receptors the overall effect may not necessarily be judged as being significant in some circumstances. It is the factors set out in Table 4.10 focused on predicted exceedances that should be used to determine an overall judgement of whether the proposed scheme is ‘significant’ or ‘not significant’ in terms of air quality.

Impacts which are described as neutral or slight i.e. of local importance only, are considered to be 'not significant'. Impacts described as moderate or substantial should be considered in the overall evaluation of significance of a proposed scheme. For these impacts, the factors in Table 4.10 should be applied to determine if the effects are significant or not significant. The additional terms set out in the EPA Guidance e.g. very significant or profound, are not considered to be required within an AQA, as an effect which is significant requires the identification of suitable mitigation measures.

Table 4.10 Factors to consider when determining the overall significance of the proposed scheme

Factors
The number of people affected by increases and/or decreases in concentrations and a judgement on the overall balance.
The number of people predicted to be exposed to levels above 2030 standards.
Whether or not the exceedance of the 2030 standard is predicted to arise in the study area where none existed before, or the size of an exceedance area is predicted to be substantially increased.
Whether or not the study area exceeds a 2030 standard and this exceedance is predicted to be removed, or the size of the exceedance area is predicted to be reduced.
Uncertainty, including the extent to which worse-case assumptions have been made.
The extent to which the 2030 standard is predicted to be exceeded e.g. an annual mean NO_2 of 21 μg/m^3 should attract less weight in the determination of significance than an annual mean of 31 μg/m^3.

4.10.2 Sensitive Designated Habitats

The results of the assessment for NO_x, NH_3, N deposition and acid deposition should be discussed with the competent practitioner for biodiversity who will determine if the results are significant.

Table 4.11 describes the process to determine if the results of the assessment are significant or not.

Table 4.11 Significance of effects at Sensitive Designated Habitats

Description of results	Significance
Total N deposition and acid deposition are more than 1% of the critical load.	Discuss further with project biodiversity practitioners (see below).
The total N deposition and acid deposition are less than 1% of the critical load.	Not significant.

To determine if the air quality impacts at a sensitive designated habitat are significant, the project biodiversity practitioner should consider:

- Factors such as the nature of site management;
- Other factors such as regular flooding in maintaining a suitable habitat;
- The degree of sensitivity to fauna to relatively subtle changes in botanical composition;
- Whether nitrogen or phosphorus is the key limiting nutrient; and
- The extent of the sensitive designated site that is negatively affected should be taken into consideration.

Where significant effects are determined, site survey information is required to determine if the sensitive habitat of relevance is actually present in the affected area and to inform potential mitigation measures that may be required.

4.10.3 Project Appraisal Guidelines Unit 7.0

PAG Unit 7.0 provides guidance and methods used to conduct MCA assessments for TII projects. MCA assessments are required as part of the project appraisal process at Phase 1 (Concept & Feasibility) and Phase 2 (Options Selection).

4.10.3.1 Phase 1 Concept and Feasibility MCA

The focus of this MCA at Phase 1 is to assess the strategic options on the basis of their ability to achieve project objectives.

Air quality inputs to the assessment of strategic options at Phase 1 shall be proportionate to the scale and complexity of the project and on request of the Project Manager. Where no specific SMART project objectives have been identified for air quality, the air quality practitioner shall not input directly into the MCA; however, any risks or opportunities relating to air quality shall be highlighted to the Project Manager and as required, with these carried forward to Phase 2.

Where specific SMART project objective(s) have been identified for air quality (e.g. improve or maintain air quality), the practitioner shall assess the performance of the strategic options against these objective(s) under the environmental criteria within the MCA. The MCA for the Phase 1 strategic option assessment uses a three-point colour scoring system as described in PAG Unit 7.0 – Multi Criteria Analysis. The air quality practitioner can advise the Project Manager on the application of this scale in relation to air quality related objectives. Guidance is provided in Table 4.12 below.

Table 4.12 Phase 1 Concept and Feasibility Three-Point Scale

Score	Examples of issues to be considered in air quality assessment (where relevant to a Project Objective)
Green: Strategic Option meets the requirements of the Project Objective	• Option is located in an area of existing poor air quality i.e. annual mean of one or more pollutant (NO_2, PM_{10} and $PM_{2.5}$) concentrations are within 10% of the 2030 standard (refer to Table 2.1) in the baseline year and; • Option is likely to result in an overall improvement in air quality at human health receptors and/or; • Option is likely to result in an overall improvement in air quality at sensitive designated habitats.
Yellow: Strategic Option partially meets the requirements of the Project Objective	• Option is located in an area of existing good air quality i.e. annual mean of one or more pollutant (NO_2, PM_{10} and $PM_{2.5}$) concentrations are < 10% of the 2030 standard (refer to Table 2.1) in the baseline year and; • Option is likely to result in a deterioration/improvement in air quality at human health receptors and/or; • Option is likely to result in a deterioration/improvement in air quality at sensitive designated habitats.
Red: Strategic Option does not meet the requirements of the Project Objective	• Option is located in an area of existing poor air quality i.e. annual mean of one or more pollutant (NO_2, PM_{10} and $PM_{2.5}$) concentrations are within 10% of the 2030 standard (refer to Table 2.1) in the baseline year and; • Option is likely to result in an overall deterioration in air quality at human health receptors and/or; • Option is likely to result in an overall deterioration in air quality at sensitive designated habitats.

4.10.3.2 Phase 2 Options Selection MCA

The PAG Unit 7.0 document sets out a seven-point scale upon which each option should be assigned an appropriate score (1 to 7) at TII Phase 2 Options Selection, Stages 1 and 2. Table 4.13 below sets out in air quality terms how each of the scores (1 to 7) should be assigned.

It should be noted that the scores should be assigned based on the overall potential air quality effects on human health receptors and sensitive designated habitats during the operational phase only. Practitioners should consider the overall effects of an option to determine whether the balance of improvements and deterioration result in a positive, neutral or negative outcome. The overall evaluation is important, and options may include a mixture of positive, neutral or negative outcomes. The biodiversity practitioner should be consulted with when determining an appropriate score for air quality impacts at sensitive designated habitats.

At Stage 1, a qualitative assessment will be undertaken as outlined in Figure 3.1. Table 4.13 should be followed to assign a score to each option using the definitions provided in the 'Stage 1: Local Air Quality (qualitative)' column. The Stage 1 MCA should be completed for each option with the assigned score and qualitative comments added.

At Stage 2, a quantitative assessment will be undertaken, with outputs from both the local AQA and index of overall change used to inform the score assigned to each option (Table 4.13). The outcome of the local AQA should be used as the primary indicator to assign a score to an option, with the outcome from the index of overall change used to support the decision. The Stage 2 MCA should be completed for each option with the assigned score and comments added.

For both Stage 1 and 2, a score of 1 or 7 would signify that the potential air quality effects from an option would be significant. A score of 7 would indicate a positive significant outcome, while a score of 1 would indicate a negative significant outcome. If a score of 1 is assigned to an option, then it would be considered a show-stopper and further work to consider whether the potential significant effects could be mitigated should be undertaken. If the potentially significant effects cannot be mitigated appropriately then the option should not be taken forward to the next stage. Whether each option meets the scheme objectives should also be considered. Please see Table 4.9 for further guidance on the terms described within Table 4.13 (e.g. slight and moderate).

Table 4.13 Phase 2 Options Selection Seven-Point Scale

Seven Point Scale	Stage 1: Local Air Quality (qualitative)	Stage 2: Local Air Quality (quantitative)	Stage 2: Index of Overall Change in Exposure (quantitative)
7 – Major or highly positive	Based on professional judgement the option would result in potentially significant positive improvements overall in an area of identified poor air quality.	Overall significant positive air quality effects are predicted at either human health receptors or sensitive designated habitats.	Negative index value

Seven Point Scale	Stage 1: Local Air Quality (qualitative)	Stage 2: Local Air Quality (quantitative)	Stage 2: Index of Overall Change in Exposure (quantitative)
6 – Moderately positive	Based on professional judgement it is anticipated that the option would not result in potentially significant air quality improvements overall in an area of identified poor air quality. However, the option has the potential to result in large/moderate decreases in pollutant concentrations at human health receptors or sensitive designated habitats.	Overall significant positive air quality effects are not predicted at either human health receptors or sensitive designated habitats. However, the option has a higher potential for significant positive effects e.g. moderate impacts at individual receptors.	Negative index value
5 – Minor or slightly positive	Based on professional judgement it is anticipated that the option would not result in potentially significant air quality improvements overall in an area of identified poor air quality. However, option has the potential to result in small decreases in pollutant concentrations at human health receptors or sensitive designated habitats.	Overall significant air quality effects are not predicted at either human health receptors or sensitive designated habitats. Only positive effects that are at worst slight at individual locations are predicted.	Negative index value
4 – Not significant or neutral	Based on professional judgement it is anticipated that the option would not result in potentially significant air quality changes overall in an area of identified poor air quality.	Overall significant air quality effects are not predicted at either human health receptors or sensitive designated habitats. Only effects that are neutral at individual locations are predicted.	Low positive or negative index value (less than 100 for NO_X and PM_{10})
3 – Minor or slightly negative	Based on professional judgement it is anticipated that the option would not result in a potentially significant deterioration overall in air quality in an area of identified as poor air quality.	Overall significant air quality effects are not predicted at either human health receptors or sensitive designated habitats. Only negative effects that are at worst slight at individual locations are predicted.	Positive index value

Seven Point Scale	Stage 1: Local Air Quality (qualitative)	Stage 2: Local Air Quality (quantitative)	Stage 2: Index of Overall Change in Exposure (quantitative)
	However, the option has the potential for small increases in pollutant concentrations at human health receptors or sensitive designated habitats.		
2 – Moderately negative	Based on professional judgement it is anticipated that the option would not result in a potentially significant deterioration overall in air quality in an area of identified as poor air quality. However, the option has the potential for large/moderate increases in pollutant concentrations at human health receptors or sensitive designated habitats.	Overall significant air quality effects are not predicted at either human health receptors or sensitive designated habitats. However, the option has a higher risk of significant effects e.g. moderate impacts at individual receptors.	Positive index value
1 – Major or highly negative	Based on professional judgement the option would result in potentially significant negative changes overall in an area of identified poor air quality. This would be a show-stopper and mitigation would be required for an option to progress.	Overall significant adverse air quality effects are predicted at either human health receptors or sensitive designated habitats. This would be a show-stopper and mitigation would be required for a scheme/option to progress.	Positive index value

4.10.4 Construction Dust

Following the determination of the risk of dust impacts and appropriate mitigation measures identified, Step 3 in Figure 4.11, is to determine whether there are significant effects arising from the construction phase of the proposed scheme.

As described in the IAQM Guidance, for almost all construction activity, the aim should be to prevent significant effects on receptors through the use of effective mitigation. In most circumstances this is possible and therefore the residual effects will normally be ‘not significant’.

There may be a few exceptions to this, for example where there is inadequate access to water for dust suppression to be effective and, even with other mitigation measures in place, there may be a significant effect. Therefore, it is important to consider the specific characteristics of the site and the surrounding area to ensure that the conclusion of no significant effect is robust.

4.11 Mitigation

Box 9: Mitigation

Where a competent practitioner for air quality has determined that the proposed scheme is likely to be significant for air quality during either the construction or operational phase, mitigation measures should be recommended as required by the EIA directive 2014/52/EU.

Monitoring should then be carried out to determine the effectiveness of the measures. The level of mitigation and monitoring should be proportionate to the level of significance.

4.11.1 Construction Phase

For the construction phase, mitigation and monitoring actions will be intrinsically linked to risk level, as defined in the latest IAQM Guidance and as determined for proposed schemes using the IAQM approach (Section 4.9). Appropriate mitigation measures are outlined in IAQM Guidance on the assessment of dust from demolition and construction (IAQM, 2024).

Implementation of mitigation measures and monitoring to ensure the measures are effective should be outlined in the EIAR, with further details provided in a Construction Environmental Management Plan (CEMP) or similar document and implemented during Phases 5 to 7. The level of construction mitigation and monitoring should be agreed with TII.

4.11.2 Operational Phase

For the operational phase, if significant effects are predicted, appropriate mitigation measures and monitoring should be outlined in the EIAR which set out the measures that are required to mitigate the effects of the projects and a monitoring regime to determine the effectiveness of the measures. The level of operational mitigation and monitoring should be agreed with TII.

At sensitive designated habitats, where significant effects are determined, site survey information is required to determine if the sensitive habitat of relevance is actually present in the affected area and to inform on any potential mitigation measures that may be required. Similarly, appropriate mitigation measures and monitoring should be included in the EIAR with these agreed with TII and may include:

- Speed limits adjusted for air quality;
- Changes in road alignment;
- Wider route restraint measures to reduce traffic flows; or
- High vertical barriers.

5. Air Quality Assessment through the Project Phases and Stages

5.1 Introduction

Section 3 of these Guidelines outlines *where* AQA applies in the different Project Phases and Stages of TII Specified Infrastructure Projects. The following section details *how* the AQA process is applied to these Phases and Stages.

The following describes the AQA approach and process for each of the Project Phases, which are broadly outlined as:

- TII Phase 1 Concept & Feasibility (NTA Phase 1)
- TII Phase 2 Options Selection (NTA Phase 2)
- TII Phase 3 Design and Assessment (NTA Phase 3)
- TII Phase 4 Statutory Process (NTA Phase 4)

These Phases are outlined in Figure 3.1.

5.2 TII Phase 1 (Concept & Strategic Assessment)

The purpose of Phase 1 is to develop and assess the Strategic Options in terms of their ability to meet the project objectives and their feasibility taking into account constraints, risks and opportunities. The deliverables required for Phase 1 include a feasibility report and Multi-Criteria Analysis (MCA) assessment.

The Project Appraisal Guidelines for National Roads Unit 7.0 – MCA is an appraisal tool used during Phases 1 and 2 to evaluate and rank project options against a set of criteria on the basis of a scoring procedure. While the Project Appraisal Guidelines Unit 3.0 sets out the requirements for the feasibility report.

The specific objectives of the air quality input to the Phase 1 Concept and Feasibility are to characterise existing ambient air quality in a study area and to identify all constraints, risk and opportunities. Upon request of the Project Manager, the outcome of this will feed into the development of SMART objectives against which each option will be scored.

5.2.1.1 Phase 1 – Approach and Process

The approach and process for the Phase 1 Concept and Feasibility includes the tasks in Table 5.1. The level of detail presented at Phase 1 shall be proportionate taking into consideration the nature, scale and potential complexity of the proposed project and the project information available.

Table 5.1 Approach and process for Phase 1

Approach and process for the Phase 1
A desktop review of the local air quality within the study area (See Section 4.2).
Identify constraints, risks and opportunities in relation to air quality.
Map key constraints, such as residential areas and designated habitats.
If required, provide input to feasibility assessment of options in terms of air quality based on the identified constraints risks and opportunities. If no air quality SMART Objectives, constraints, risks and opportunities should be highlighted to the Project Manager.
Provide air quality inputs to the Feasibility Report and MCA.

5.2.1.2 Phase 1 – AQA Outputs

Box 9: Phase 1 Outputs

The outputs will include:

- Detailed air quality mapping, identifying the constraints within the study area such as the location of human health receptors and sensitive designated habitats;
- Input to Feasibility Report to include a description of existing local air quality conditions in relation to NO_2, PM_{10} and $PM_{2.5}$ for human health receptors and NO_x and NH_3 for sensitive designated habitats within the study area and a discussion of the constraints, risks and opportunities in relation to air quality; and
- If required, completion of the Phase 1 MCA to score each of the options for projects with an air quality objective.

5.3 TII Phase 2 (Options Selection)

The Project Appraisal Guidelines for National Roads Unit 7.0 – MCA is an appraisal tool used during the Phase 2 Options Selection process to evaluate and rank project options against a set of criteria on the basis of a scoring procedure. For all major national road projects an MCA must be undertaken at Stages 1 and 2. A 3-stage process is detailed in the Project Appraisal Guidelines (TII, 2024) (Figure 5.1).

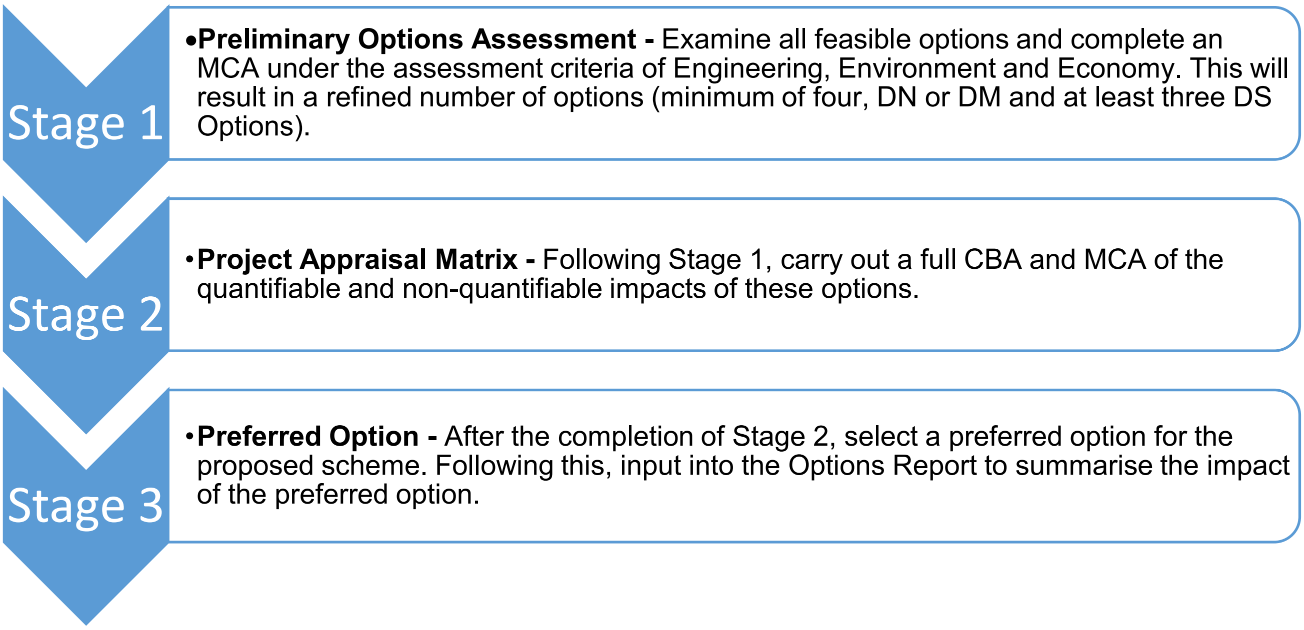

Figure 5.1 Stepped Approach detailed in the Project Appraisal Guidelines

The following sub-sections provide further Guidance on the air quality work required for Phase 2 Options Selection Stages 1 to 3.

5.3.2 Phase 2, Stage 1 - Preliminary Options Assessment

The Stage 1 Preliminary Options Assessment in the Option Selection process is to provide an update with regards to the nature and extent of significant constraints within a defined study area since Phase 1. These constraints should be documented and mapped so that feasible options can be designed to avoid such constraints, where possible. The first part of this data collection should be based on desk-based research studies. All known constraints relevant to air quality should be identified e.g. existing monitored concentrations exceeding the 2030 standards and recorded on suitably scaled maps.

The specific objectives of the air quality input to the Stage 1 Preliminary Options Assessment are to characterise existing ambient air quality in a study area and to identify all sensitive receptor locations within the study area that are likely to be impacted before feasible options are identified.

5.3.2.1 Phase 2, Stage 1 – AQA Approach and Process

The AQA approach and process for the Stage 1 preliminary option assessment includes the tasks in Table 5.2.

Table 5.2 AQA approach and process for Phase 2, Stage 1

AQA approach and process for the Phase 2, Stage 1
Definition of the purpose and scope of the assessment.
A review of the local air quality within the study area (See Section 4.2).
A review of non-road sources of pollution which could lead to elevated background concentrations or higher incidences of exceedance of short-term standards. This should consider potential sources of NO_2, PM_{10} and $PM_{2.5}$. Non-road sources include industrial sources (both point sources and fugitive emissions), ports and areas with a high density of domestic solid-fuel combustion. Sources within 1 km of the study corridor should be identified; this should be extended to 3 km in the case of large industrial sources such as power stations.

AQA approach and process for the Phase 2, Stage 1
Identify on a suitably scaled map, the number of sensitive human receptor locations within 50 m of the carriageway edge and 200 m of the carriageway centreline of each option that has the potential to be significantly affected by the preliminary options. European designated sites within 2 km of the route options and all sensitive designated habitats within 200 m of the of the carriageway centreline for route options should also be identified.
A discussion of any opportunities for mitigation.
A review of previous studies, local AQA or reports, and any other air quality work undertaken by TII, EPA or local authorities and provide a qualitative statement on what any studies indicate.
A review of future developments which have been granted planning permissions within the study area of relevance for air quality e.g. sensitive receptors and developments likely to impact air quality. Provide a qualitative statement on the air quality implications of any committed receptors.

5.3.2.2 Phase 2, Stage 1 – AQA Outputs

Box 10: Phase 2, Stage 1 Outputs

The outputs will include:

- Detailed air quality mapping, identifying the location of receptors for both human health and sensitive designated habitats, within 50 m of the carriageway edge and 200 m of the carriageway centreline of each option that have the potential to be significantly affected by the proposed options;
- Stage 1 report including a description of existing local air quality conditions in relation to NO_2, PM_{10}, $PM_{2.5}$ (as well as NH_3 and NO_x if sensitive designated habits are identified within the study area), identification of non-road sources within the study area, a discussion of any opportunities for mitigation and a review of previous air quality studies and future planning applications which have been granted approval within the study area;
- Completion of the Stage 1 MCA to score each of the options relative to their potential air quality effects; and
- Record that receipt of the outputs has been acknowledged by the overall Project Manager for a scheme.

5.3.3 Phase 2, Stage 2 - Project Appraisal Matrix

Following an examination of the Stage 1 Preliminary Options Assessment of the Option Selection process, option selection continues. The design team develops feasible options in accordance with the Project Appraisal Matrix.

The air quality input for the feasible route options should consider the relative impacts of each of the route options on exposure to air pollution at sensitive locations. The assessment should focus on NO_2, PM_{10} and $PM_{2.5}$ which are the pollutants of greatest concern with respect to road traffic emissions and human health. The assessment should also consider air quality impacts (NO_x and NH_3) for sensitive designated habitats.

For Stage 2 there are four steps that should be completed in the route options selection (Figure 5.2).

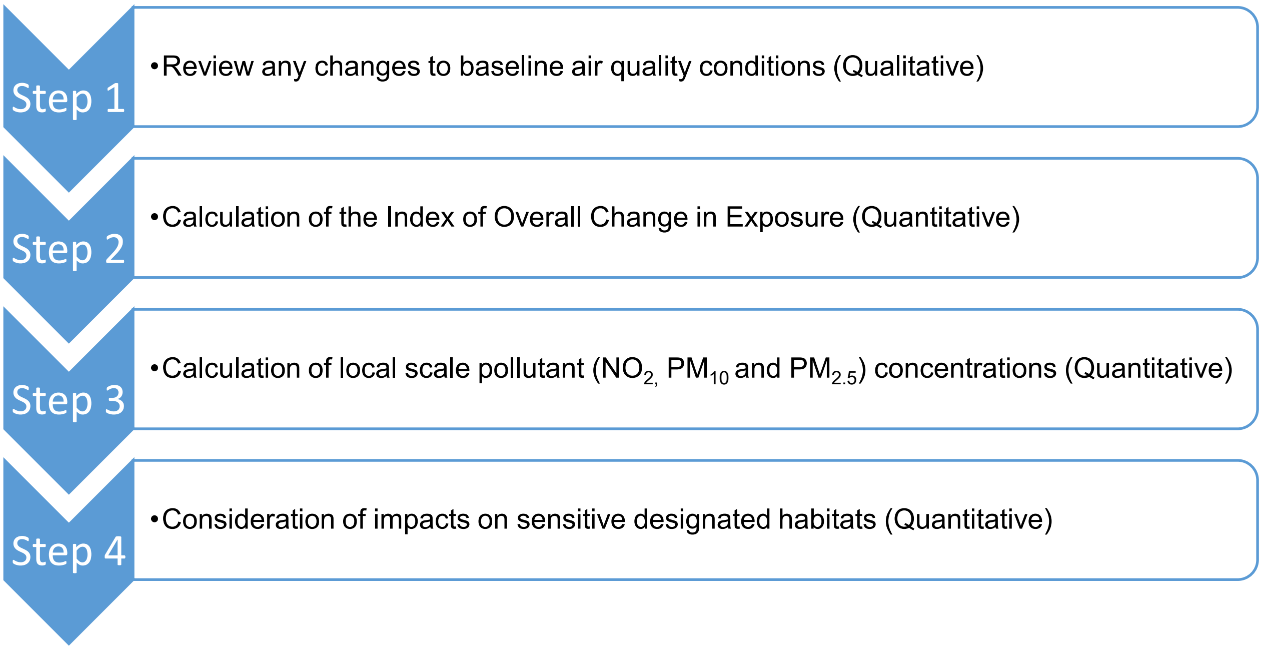

Figure 5.2 Air Quality steps for assessing the route options selection

5.3.3.2 Step 1: Changes to Baseline Air Quality Conditions

The air quality practitioner should review and update where necessary the baseline conditions reported in the Stage 1 assessment. This review should include:

- Any available monitoring data from the EPA or local authorities for NO_2, PM_{10} and $PM_{2.5}$ concentrations. As well as NH_3 and NO_x if designated habitats are identified within the study area;
- Information about existing non-road pollution sources; and
- Location of sensitive human receptors and sensitive designated habitats.

5.3.3.3 Step 2: Calculation of the Index of Overall Change in Exposure

The Calculation of the Index of Overall Change in Exposure allows the overall impact of each route option in terms of NO_x and PM_{10} to be compared. It is based on the number of properties within 50 m of the carriageway edge of all road links that will experience a significant change in traffic. The Index of Overall Change in Exposure methodology is set out in Section 4.4.

5.3.3.4 Step 3: Calculation of Local Scale Pollutant (NO_2, PM_{10} and $PM_{2.5}$) Concentrations

The air quality practitioner should undertake a quantitative assessment to determine NO_2, PM_{10} and $PM_{2.5}$ concentrations in the base year and opening of the proposed route options, with and without the options operational. This should be undertaken for all options, for which traffic data is available. This assessment shall be undertaken at a few worse-case receptors. These locations should represent the maximum likely impact of each of the route options. They should cover locations where air quality is expected to improve as well as those where it is expected to deteriorate. Predictions should be carried out using the TII REM or detailed dispersion modelling, as appropriate, as described in Section 4.5.

The magnitude of change in NO_2, PM_{10} and $PM_{2.5}$ concentrations at each receptor should be calculated to determine the most preferred to least preferred option in terms of air quality. The predicted concentrations should also be compared with the air quality standards.

If concentrations are predicted to exceed or approach (defined as greater than 90%) the 2030 standards in the opening year for any of the options, this should be identified in the Options Selection report.

5.3.3.5 Step 4: Consideration of Impacts on Sensitive Designated Habitats

Any assessment of air quality impacts on designated habitats should be discussed and agreed with the project biodiversity practitioner. The potential impact of the route options on sensitive designated habitats is limited to the local level. Consideration should therefore be given to all sensitive designated habitats that are within 200 m of the carriageway centreline of the affected road network, during operation. The assessment methodology is described in Section 4.7.

The air quality practitioner should refer to APIS to obtain the latest information regarding critical loads, background nitrogen and acid deposition and NH_3 this information. The TII REM or detailed modelling should be used as appropriate, to predict concentrations of NO_x. NH_3 emissions should be predicted using the best available method at the time of undertaking the assessment e.g. Calculator for Road Emissions of Ammonia (CREAM) Tool developed by Air Quality Consultants. NH_3 emissions for each road link (as g/km/s) can then be included in ecology receptor files to allow this source of N to be incorporated into the predictions of deposited N, deposited acid and NH_3 concentrations from the TII REM. N deposition and acid deposition should be calculated and evaluated as described in Section 4.7.

5.3.3.6 Phase 2, Stage 2 – AQA Approach and Process

The AQA approach and process for the Stage 2 selected options assessment includes the tasks set out in Table 5.3.

Table 5.3 AQA approach and process for the Phase 2, Stage 2

AQA approach and process for the Phase 2, Stage 2
Review Stage 1 Report
Definition of the purpose and scope of the assessment which should include a discussion of which parts of the operational AQA have been undertaken (i.e. Index of Overall Change in Exposure, local assessment) and if some parts of the assessment have not been undertaken, justification shall be provided.
An update on any changes to the location of sensitive receptors or local emissions sources since the preparation of the Stage 1 Report was undertaken.
Refine the map to identify the number of sensitive human receptor locations within 50 m of the carriageway edge and 200 m of the carriageway centreline of each option that are or have the potential to be significantly affected by a proposed scheme. European designated sites within 2 km of the proposed scheme routes and all sensitive designated habitats within 200 m of the carriageway centreline for route options should also be identified.
A review of any additional monitoring data that have become available following preparation of the Stage 1 Report.

Prepare a Stage 2 report, including:

- A description of the methodology used;
- Air quality baseline;
- A table showing the Index of Overall Change in Exposure for each of the Options;
- The results of the local AQA for all options, for which traffic data is available, with predicted NO_2, PM_{10} and $PM_{2.5}$ concentrations reported at a few worse-case relevant locations in the opening year;
- Identification of any locations where concentrations are likely to exceed, or are above 90% of the 2030 standards (refer to Table 2.1) in the opening year;
- A table illustrating the calculated NO_x and NH_3 concentrations which should be used to calculate N deposition and acid deposition at sensitive designated habitats for comparison with the relevant standards; and
- A discussion of opportunities for mitigation for each option. If likely significant effects are predicted, appropriate mitigation measures shall be developed for proposed options to be progressed.

5.3.4 Phase 2, Stage 2 – AQA Output

Box 11: Stage Two Outputs

The outputs will include:

- Further refined mapping to illustrate the location of air quality receptors for both human health and sensitive designated habitats;
- Stage 2 report outlining the inputs and outputs of the Index of Overall Change in Exposure and local AQA;
- Completion of the Stage 2 MCA to score each of the options relative to their potential air quality effects;
- Input to the CBA, if required; and
- Record that receipt of the outputs has been acknowledged by the overall Project Manager.

5.3.5 Phase 2, Stage 3 - Preferred Option

The purpose of Stage 3 is to select the preferred option and to outline the likely environmental effects, including the air quality effects.

Further project detail may or may not be available for the preferred option. Where available any additional detail should be reflected in the Stage 3 report.

5.3.5.1 Phase 2, Stage 3 - AQA Approach and Process

The AQA approach and process for the Stage 3 preferred option selection includes the tasks set out in Table 5.4.

Table 5.4 AQA approach and process for the Phase 2, Stage 3

AQA approach and process for the Phase 2, Stage 3
Review of the Stage 2 Report
Definition of the purpose and scope of the assessment
The air quality practitioner should review and update where necessary the baseline conditions reported in the Stage 2 Report. This should include: • any available monitoring data from the EPA or local authorities with regards to NO_2, PM_{10}, $PM_{2.5}$. If sensitive designated habitats are identified within the study area, NH_3 and NO_x concentrations should also be included; • information about existing non-road pollution sources; and • location of human receptors and sensitive designated habitats.
Recalculate the Index of Overall Change in Exposure for the preferred option if there are any changes to the traffic data, alignment of the proposed scheme or number or location of sensitive receptors since Stage 2.
Assist, where necessary, the Design team in preparing the air quality section of the Options Report.
Undertake a review with the project manager and traffic practitioner, to consider the air quality risks associated with the construction of the emerging preferred option with respect to the change in road traffic e.g. additional vehicle trips and traffic management. The intention of the review is to establish the likely level of traffic data that would be required for the air quality practitioner to undertake a proportionate AQA of the construction phase. The focus of the review will be to determine the risk of a likely significant air quality effect. Where a risk of likely significant effect is determined through this review, traffic data suitable for use in air quality screening and assessment would be required (see Section 4.9.3.3). It is recommended that a precautionary approach is taken, and that traffic data is created if there is considered to be a risk of a likely significant air quality effect to avoid later delays to the assessment process.

5.3.6 Phase 2, Stage 3 – AQA Output

Box 13: Phase 2, Stage 3 Outputs

The outputs will include:

- Further refined mapping to illustrate the location of air quality receptors for both human health and sensitive designated habitats if the route alignment has been updated since Stage 2.
- Input to the Stage 3 Report to include the inputs and outputs of the Index of Overall Change in Exposure (if undertaken);
- Input into the options Report to summarise the impact of the preferred option; and
- Record when the receipt of the outputs has been acknowledged by the overall Project Manager.

5.4 TII Phase 3 (Design and Environmental Evaluation)

This phase of project delivery allows for the iterative design and environmental assessment, where required, of the project. The environmental assessment will include AQA as part of the EIAR where EIA is required, otherwise AQA may be undertaken where air quality effects are considered sufficiently relevant to be assessed in its own right. In the latter situation the AQA will either form a standalone report or be compiled within a project specific environmental report.

Significant detail will emerge through this iterative design and assessment phase of the project. This detail will address construction and operation stages as well as the detailed design of all aspects of the project. Phasing of construction may also be a relevant consideration.

As the design and assessments progress the detail of proposed mitigation measures for all environmental factors assessed, will also evolve.

All of this detail must be reflected and assessed in the AQA where it is relevant to the determination of likely significant effects. The process for identifying, assessing, and mitigating significant air quality effects is set out in detail in Section 4 of these Guidelines. However, some further aspects of the process and outputs for this phase are outlined in the following.

5.4.1 TII Phase 3 – Air Quality Assessment Process

Following the identification of the preferred option as outlined in Phase 2, the air quality practitioner should participate in the tasks listed in Table 5.5.

Table 5.5 Phase 3 – Air Quality Assessment Processes

Phase 3 – Air Quality Assessment Processes
Site Walkover: Undertake a walkover survey of the air quality study area to confirm that all significant features e.g. non-road pollution sources, sensitive receptors, have been identified and properly assessed in the Phase 2 options selection process.
Baseline air quality conditions: Review and update where necessary the baseline conditions reported in the Stage 3 assessment. This should include: • any available monitoring data from the EPA or local authorities with regards to NO_2, PM_{10} and $PM_{2.5}$ concentrations. If sensitive designated habitats are identified within the study area, NH_3 and NO_x concentrations should also be included; • information about existing non-road pollution sources; and • location of sensitive human and ecological receptors.
EIA Screening: Participate in the EIA Screening process to ascertain whether there is a likelihood of significant environmental effects for air quality.
EIA Scoping: Scope the AQA for the EIAR and, in particular, establish the extent of any scheme specific monitoring surveys.
Monitoring Survey: It may be necessary to carry out air quality monitoring within the air quality study area, depending upon the availability of existing data and the complexity of the proposed scheme i.e. a Greenway Scheme would not require monitoring. Monitoring should only be undertaken for proposed schemes where a quantitative local AQA will be undertaken. The project programme should take into account the timescales required to complete baseline monitoring surveys; as a minimum, three months monitoring should be undertaken. Further details regarding the monitoring campaign are provided in Section 4.2.2.

5.4.1.1 Environmental Impact Assessment Report (EIAR)

In preparing the EIAR, regard should be given to the EPA's Guidelines on the Information to be Contained in the EIAR's (EPA, 2022) and NRA's EIA of National Road Schemes – A Practical Guide (NRA, 2008).

The air quality input for the EIAR should follow on from the work carried out for the Phase 2 Option Selection phase. The input to the EIAR should include the information listed in Table 5.6.

Table 5.6 Inputs to the EIAR

Input to the EIAR
Definition of the purpose and scope of the AQA.
An update on any changes to the location of sensitive receptors or local emissions sources following preparation of the Phase 2 Options Selection.
Any additional monitoring data that will have become available following preparation of the Phase 2 Option Selection. If monitoring has been carried out, then precise details of the methodology (see Section 4.2), period and annualised concentrations and comparisons with the relevant 2030 standards should be provided.
A table showing the recalculated Index of Overall Change in Exposure for the existing route and the preferred option. This should include information about the number of properties within 50 m of the carriageway edge for each link considered.
A description of the local air quality modelling methodology. This should include: • A description of the model used (including a version number); • a justification for the model selection; • the source of any input data such as background concentrations; • traffic data[8]; • meteorological data; and • the methodology used to verify any detailed dispersion modelling (see Section 4.6.2).
A suitably scaled map showing the locations of the receptors used in the air quality modelling and the preferred option.
Predicted NO_2, PM_{10} and $PM_{2.5}$ concentrations at worse-case receptors within 200 m of the ARN carriageway centreline in the current (baseline), opening and design years with and without the preferred route in place.
A discussion of the modelling results, including comparison with the air quality 2030 standards (refer to Table 2.1) and any local monitoring data.
An assessment of the significance of the predicted concentrations using the criteria set out in Section 4.10, taking account of the modelling uncertainties.
Proposed mitigation measures, where appropriate. If significant air quality effects are predicted following mitigation, then TII should be contacted to discuss.
A table presenting total emissions of NO_x and CO_2e for the existing route and the preferred route in the current (baseline), opening and design years.
Predictions of NO_x and NH_3 concentrations at sensitive designated habitats and calculations of N deposition and acid deposition. A discussion of results prepared with biodiversity practitioners should be presented to determine if the impacts are significant.
Discussion of any impacts during the construction phase, proposed mitigation measures and residual impacts, as required.
Where dealing with European sites, reference to the results included in the NIS prepared for the purpose of Appropriate Assessment. Further information is provided in Section 4.7.

[8] It is important that the traffic data be either reproduced in the Air Quality Chapter of the EIAR, or a specific reference provided as to where they can be found (in the format that was used for the assessment).

5.4.2 TII Phase 3 – Air Quality Outputs

Box 12: Stage Three Outputs

The outputs will include:

- Detailed air quality mapping, identifying the location of sensitive receptors and description of the baseline air quality in the study area;
- An assessment of likely significant air quality effects;
- Compilation of the above information into the formal AQA Chapter of the EIAR
- Where EIA is required, or into the project specific environmental report or standalone AQA report where EIA is not required;
- A separate Non-Technical Summary (NTS) of the AQA, where EIA is required;
- Update the Options Report to summarise the impact of the preferred option; and
- Record that receipt of the outputs has been acknowledged by the overall Project Manager.

5.5 TII Phase 4 (Statutory Processes)

This phase is focused on securing approval for the project from the consenting authority e.g. the Local Authority or An Bord Pleanála. Air Quality-related inputs in Phase 4 are likely to include those listed in Table 5.7.

Depending on the outcome of the statutory process, other specific mitigation measures, and conditions of consent may need to be incorporated into the design and schedule of mitigation commitments. The appropriateness of mitigation measures to reduce impacts to levels not considered to be significant shall be determined through air quality modelling. It is essential that the modelling is proportionate in approach.

Table 5.7 Phase 4 Air Quality Inputs

Phase 4 Air Quality Inputs
Reviewing and drafting responses, where warranted, to air quality issues raised in submissions to the consenting process.
Reviewing and drafting responses to any air quality requests for further information issued by the consenting authority.
Reviewing and updating, if necessary, any aspect of the AQA, and documenting same.
Drafting an Air Quality Brief of Evidence, where a public oral hearing is to be held, in relation to air quality aspects, including the AQA and responses to submissions *etc.*
Taking part in oral hearing preparation meetings.
Finalising the Air Quality Brief of Evidence.
Presenting the Statement of Evidence at the public oral hearing and responding to any questions on air quality aspects direct from the public, other bodies, or the Inspector for the consenting authority.
Review and report on any air quality aspects addressed in the decision of the consenting authority (and Planning Inspector's report).

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Appendix A:

Sample Air Quality Chapter Headings (Phase 3)

The following is a sample of a suitable structure to include in the EIAR air quality chapter.

Introduction

- Scope of the air quality assessment.
- Air quality practitioner (include information regarding the competency and qualifications of the air quality practitioner).

Relevant Legislation and Policy

- Relevant European and national legislation.
- Relevant national planning policies.
- Relevant local planning policies.

Methodology

- Overall approach.
- Study Area (define how the study area for the construction and operational phases have been determined).
- Input data e.g. traffic data and sensitive receptors.
- Describe the methodology for the Index of Overall Change in Exposure, local AQA, regional assessment and include version numbers of tools, and spreadsheets used.
- Assessing the significance of effects.
  - Human health.
  - Sensitive designated habitats.
  - Construction impacts.

Baseline Conditions

- Desk-based air quality monitoring reviews.
- Scheme specific monitoring.
- Background air pollution.

Limitations and Assumptions

Assessment of Air Quality Effects

- Construction Phase.
  - Construction Dust Assessment.
  - Construction traffic assessment.
- Operational Phase
  - Index of Overall Change in Exposure.
  - Local air quality assessment.
    - Human health.
    - Sensitive designated habitats.
  - Regional Assessment.

Significance of the Air Quality Effects

- Construction Phase.
- Operational Phase.

Mitigation Measures

- Construction Phase.
- Operational Phase.

Residual Effects

- Construction Phase.
- Operational Phase.

Cumulative Impacts

Summary and Conclusion

Appendix B:

Competent Air Quality Practitioner

Recital 33 of the Preamble to Directive 2011/92/EU, as amended by Directive 2014/52/EU, states, inter alia, *'Experts involved in the preparation of environmental impact assessment reports should be qualified and competent.' Article 5(3)(a) of the amended EIA Directive states 'the developer shall ensure that the environmental impact assessment report is prepared by competent experts'.* It is therefore reasonable to surmise that Air Quality Professionals who carry out AQA on TII projects (which require EIA) must be expert, qualified and competent. Furthermore, it is the responsibility of the developer e.g. the road authority, to ensure that this is the case. To assist developers in meeting this responsibility, the following recommendations are made.

It is recommended that the Air Quality Technical Lead involved in the preparation of environmental impact assessment reports and/or the carrying out of AQA in respect of TII projects have the following qualifications:

- Chartership of a professional body;
- Honours degree (National Framework of Qualifications (NFQ) Level 8 (or equivalent level)) in a relevant subject e.g. environmental science (or equivalent discipline); and/or, a
- Master's degree (NFQ Level 9 (or equivalent level)) in a relevant subject e.g. environmental science (or equivalent discipline).

Furthermore, it is recommended that the Air Quality Technical Lead has at least 10 years' relevant post-graduate experience. It is important to note that the minimum number of years' relevant post-graduate experience may change (upwards or downwards) depending on the size, nature, complexity, etc., of the project in question. Furthermore, it is essential to carefully lay down further criteria defining what post-graduate experience is considered relevant in the context of the project at hand.

The developer must document the criteria (along with the underlying rationale) it has devised to ensure that its Air Quality Technical Lead are qualified, competent and expert. The developer shall also document how these criteria have been applied in the selection of its Air Quality Technical Lead.

Again, it is essential to note that it is the developer's responsibility to ensure that its Air Quality Technical Lead, who carry out the AQA on TII projects (which require EIA), are qualified, competent and expert.

Appendix C:

Background Concentrations

Table C.1 Background NOx Projection Factors for a Large Urban Area using an Optimistic Scenario

		Projected Future Year																	
		2023	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**2040**
Baseline Year	**2022**	0.957	0.929	0.901	0.879	0.858	0.837	0.817	0.798	0.782	0.768	0.756	0.745	0.740	0.733	0.727	0.722	0.717	0.713
	2023		0.970	0.940	0.917	0.894	0.872	0.850	0.830	0.813	0.798	0.785	0.773	0.768	0.761	0.754	0.749	0.744	0.740
	2024			0.968	0.943	0.918	0.895	0.872	0.849	0.832	0.815	0.801	0.788	0.783	0.775	0.768	0.762	0.757	0.753
	2025				0.973	0.946	0.920	0.895	0.871	0.852	0.834	0.819	0.805	0.798	0.790	0.783	0.777	0.771	0.766
	2026					0.971	0.943	0.915	0.889	0.868	0.848	0.831	0.816	0.809	0.799	0.792	0.785	0.779	0.774
	2027						0.969	0.938	0.909	0.885	0.864	0.845	0.828	0.820	0.809	0.801	0.794	0.787	0.782
	2028							0.966	0.934	0.906	0.882	0.861	0.842	0.832	0.821	0.811	0.803	0.796	0.790
	2029								0.963	0.932	0.904	0.879	0.858	0.846	0.833	0.823	0.814	0.806	0.800
	2030									0.963	0.931	0.902	0.878	0.863	0.848	0.835	0.825	0.817	0.809
	2031										0.961	0.927	0.898	0.879	0.862	0.847	0.835	0.825	0.817
	2032											0.958	0.923	0.900	0.879	0.861	0.847	0.836	0.826
	2033												0.957	0.927	0.901	0.879	0.862	0.848	0.837
	2034													0.962	0.928	0.902	0.881	0.864	0.850
	2035														0.958	0.925	0.898	0.877	0.860
	2036															0.958	0.925	0.898	0.878
	2037																0.958	0.925	0.899
	2038																	0.958	0.926
	2039																		0.959

Table C.2 Background NOx Projection Factors for a Large Urban Area using a Realistic worst-case Scenario

		Projected Future Year																	
		2023	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**2040**
Baseline Year	**2022**	0.957	0.930	0.901	0.879	0.858	0.837	0.817	0.798	0.782	0.768	0.756	0.745	0.740	0.733	0.727	0.722	0.717	0.713
	2023		0.971	0.941	0.917	0.893	0.869	0.845	0.823	0.807	0.793	0.781	0.770	0.766	0.760	0.754	0.749	0.745	0.741
	2024			0.968	0.943	0.917	0.891	0.866	0.842	0.825	0.810	0.797	0.785	0.781	0.774	0.768	0.763	0.758	0.754
	2025				0.972	0.945	0.916	0.889	0.863	0.844	0.828	0.814	0.801	0.796	0.789	0.783	0.777	0.772	0.768
	2026					0.970	0.939	0.908	0.880	0.859	0.841	0.826	0.812	0.806	0.798	0.791	0.786	0.780	0.776
	2027						0.965	0.931	0.900	0.877	0.857	0.839	0.824	0.817	0.808	0.801	0.795	0.789	0.784
	2028							0.961	0.925	0.899	0.875	0.855	0.839	0.830	0.820	0.812	0.805	0.799	0.794
	2029								0.958	0.926	0.899	0.875	0.856	0.845	0.834	0.824	0.816	0.810	0.804
	2030									0.962	0.929	0.900	0.877	0.864	0.850	0.839	0.829	0.822	0.815
	2031										0.960	0.926	0.898	0.881	0.865	0.852	0.841	0.832	0.825
	2032											0.958	0.925	0.903	0.883	0.867	0.855	0.844	0.836
	2033												0.958	0.931	0.906	0.887	0.872	0.859	0.849
	2034													0.965	0.934	0.911	0.892	0.877	0.865
	2035														0.962	0.933	0.911	0.892	0.878
	2036															0.964	0.937	0.915	0.898
	2037																0.967	0.940	0.920
	2038																	0.969	0.945
	2039																		0.972

Table C.3 Background NOx Projection Factors for a Large Urban Area using a Pessimistic Scenario

		Projected Future Year																	
		2023	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**2040**
Baseline Year	**2022**	0.957	0.929	0.901	0.879	0.858	0.837	0.817	0.798	0.782	0.768	0.756	0.745	0.740	0.733	0.727	0.722	0.717	0.713
	2023		0.970	0.940	0.916	0.892	0.868	0.845	0.823	0.807	0.794	0.782	0.772	0.768	0.762	0.757	0.752	0.748	0.744
	2024			0.968	0.942	0.916	0.890	0.865	0.842	0.825	0.810	0.798	0.787	0.783	0.776	0.771	0.766	0.762	0.758
	2025				0.972	0.944	0.915	0.888	0.863	0.845	0.829	0.815	0.803	0.799	0.792	0.786	0.781	0.776	0.772
	2026					0.969	0.938	0.908	0.880	0.860	0.842	0.827	0.814	0.809	0.801	0.795	0.790	0.785	0.780
	2027						0.965	0.931	0.900	0.878	0.858	0.841	0.827	0.820	0.812	0.805	0.799	0.794	0.790
	2028							0.961	0.926	0.900	0.877	0.858	0.842	0.834	0.825	0.817	0.810	0.805	0.800
	2029								0.958	0.927	0.901	0.878	0.860	0.850	0.839	0.830	0.823	0.817	0.811
	2030									0.962	0.930	0.903	0.881	0.869	0.856	0.846	0.838	0.830	0.824
	2031										0.961	0.929	0.903	0.888	0.873	0.861	0.851	0.843	0.836
	2032											0.961	0.930	0.910	0.892	0.878	0.866	0.857	0.849
	2033												0.962	0.938	0.916	0.899	0.885	0.874	0.865
	2034													0.970	0.943	0.923	0.907	0.894	0.884
	2035														0.969	0.944	0.925	0.910	0.898
	2036															0.972	0.950	0.932	0.918
	2037																0.975	0.955	0.939
	2038																	0.978	0.960
	2039																		0.981

Table C.4 Background NOx Projection Factors for an Urban Area using an Optimistic Scenario

		Projected Future Year																	
		2023	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**2040**
Baseline Year	**2022**	0.959	0.933	0.906	0.883	0.861	0.840	0.818	0.798	0.782	0.768	0.754	0.742	0.736	0.728	0.721	0.714	0.708	0.702
	2023		0.972	0.943	0.920	0.896	0.873	0.851	0.829	0.813	0.797	0.783	0.770	0.763	0.755	0.747	0.740	0.734	0.728
	2024			0.970	0.945	0.920	0.896	0.872	0.849	0.831	0.815	0.800	0.786	0.779	0.770	0.762	0.755	0.748	0.742
	2025				0.973	0.947	0.921	0.895	0.871	0.852	0.834	0.818	0.803	0.796	0.787	0.778	0.771	0.764	0.757
	2026					0.972	0.944	0.916	0.890	0.870	0.851	0.833	0.818	0.809	0.800	0.791	0.783	0.775	0.769
	2027						0.970	0.940	0.912	0.889	0.869	0.850	0.833	0.824	0.813	0.804	0.795	0.788	0.780
	2028							0.968	0.936	0.912	0.889	0.868	0.850	0.839	0.828	0.818	0.809	0.800	0.793
	2029								0.965	0.937	0.912	0.889	0.868	0.857	0.844	0.833	0.823	0.814	0.806
	2030									0.968	0.939	0.913	0.890	0.876	0.861	0.849	0.838	0.829	0.820
	2031										0.966	0.936	0.909	0.893	0.876	0.862	0.850	0.840	0.830
	2032											0.964	0.933	0.913	0.894	0.878	0.864	0.852	0.842
	2033												0.963	0.938	0.915	0.896	0.880	0.866	0.855
	2034													0.969	0.941	0.918	0.899	0.883	0.869
	2035														0.965	0.937	0.915	0.895	0.880
	2036															0.966	0.938	0.914	0.896
	2037																0.966	0.937	0.915
	2038																	0.965	0.938
	2039																		0.966

Table C.5 Background NOx Projection Factors for an Urban Area using a Realistic worst-case Scenario

		Projected Future Year																	
		2023	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**2040**
Baseline Year	**2022**	0.959	0.933	0.906	0.883	0.861	0.840	0.819	0.798	0.782	0.768	0.754	0.742	0.736	0.728	0.721	0.714	0.708	0.702
	2023		0.972	0.944	0.920	0.896	0.871	0.847	0.824	0.808	0.793	0.780	0.768	0.762	0.754	0.747	0.741	0.735	0.729
	2024			0.970	0.945	0.919	0.893	0.868	0.844	0.827	0.811	0.797	0.784	0.778	0.770	0.762	0.756	0.749	0.743
	2025				0.973	0.945	0.918	0.891	0.865	0.846	0.830	0.814	0.801	0.794	0.786	0.778	0.771	0.765	0.758
	2026					0.971	0.941	0.911	0.883	0.864	0.846	0.829	0.815	0.808	0.799	0.791	0.783	0.776	0.770
	2027						0.967	0.935	0.905	0.883	0.863	0.846	0.830	0.822	0.812	0.804	0.796	0.789	0.782
	2028							0.964	0.930	0.906	0.884	0.864	0.847	0.838	0.827	0.818	0.810	0.802	0.795
	2029								0.961	0.933	0.908	0.886	0.866	0.856	0.844	0.834	0.825	0.817	0.809
	2030									0.967	0.937	0.911	0.889	0.876	0.863	0.851	0.841	0.832	0.824
	2031										0.965	0.935	0.910	0.894	0.879	0.866	0.855	0.845	0.836
	2032											0.964	0.934	0.915	0.897	0.882	0.870	0.858	0.849
	2033												0.964	0.941	0.919	0.902	0.887	0.874	0.864
	2034													0.971	0.945	0.924	0.907	0.893	0.880
	2035														0.969	0.944	0.924	0.907	0.893
	2036															0.970	0.946	0.927	0.911
	2037																0.972	0.949	0.930
	2038																	0.973	0.952
	2039																		0.976

Table C.6 Background NOx Projection Factors for an Urban Area using a Pessimistic Scenario

		Projected Future Year																	
		2023	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**2040**
Baseline Year	**2022**	0.959	0.933	0.906	0.883	0.861	0.840	0.819	0.798	0.782	0.768	0.754	0.742	0.736	0.728	0.721	0.714	0.708	0.702
	2023		0.972	0.944	0.919	0.895	0.870	0.847	0.824	0.808	0.794	0.781	0.769	0.763	0.756	0.749	0.743	0.737	0.731
	2024			0.970	0.944	0.918	0.893	0.867	0.843	0.827	0.811	0.797	0.785	0.779	0.771	0.764	0.758	0.752	0.746
	2025				0.972	0.945	0.917	0.890	0.865	0.846	0.830	0.815	0.802	0.796	0.788	0.780	0.774	0.767	0.761
	2026					0.970	0.940	0.911	0.884	0.864	0.846	0.830	0.816	0.810	0.801	0.793	0.786	0.780	0.773
	2027						0.967	0.935	0.905	0.884	0.864	0.847	0.832	0.824	0.815	0.807	0.799	0.792	0.786
	2028							0.964	0.931	0.907	0.885	0.866	0.849	0.841	0.831	0.822	0.814	0.806	0.800
	2029								0.962	0.934	0.909	0.888	0.869	0.859	0.848	0.838	0.830	0.822	0.815
	2030									0.967	0.939	0.914	0.892	0.881	0.868	0.857	0.847	0.839	0.831
	2031										0.966	0.938	0.913	0.899	0.885	0.872	0.862	0.852	0.844
	2032											0.966	0.938	0.921	0.904	0.890	0.878	0.868	0.859
	2033												0.967	0.946	0.926	0.910	0.897	0.885	0.875
	2034													0.975	0.952	0.933	0.918	0.905	0.894
	2035														0.973	0.952	0.934	0.920	0.908
	2036															0.976	0.956	0.939	0.926
	2037																0.978	0.960	0.945
	2038																	0.980	0.964
	2039																		0.982

Table C.7 Background NOx Projection Factors for a Rural Area using an Optimistic Scenario

		Projected Future Year																	
		2023	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**2040**
Baseline Year	**2022**	0.961	0.928	0.895	0.866	0.838	0.809	0.781	0.754	0.733	0.713	0.694	0.676	0.668	0.658	0.649	0.640	0.631	0.623
	2023		0.965	0.931	0.900	0.870	0.841	0.811	0.782	0.761	0.740	0.720	0.701	0.692	0.682	0.672	0.663	0.654	0.645
	2024			0.963	0.932	0.900	0.869	0.838	0.808	0.785	0.763	0.742	0.722	0.713	0.702	0.692	0.682	0.673	0.664
	2025				0.966	0.933	0.900	0.868	0.836	0.811	0.788	0.766	0.745	0.735	0.724	0.713	0.703	0.694	0.685
	2026					0.965	0.930	0.895	0.862	0.836	0.811	0.788	0.766	0.755	0.743	0.732	0.722	0.712	0.702
	2027						0.963	0.926	0.890	0.863	0.836	0.812	0.788	0.777	0.764	0.752	0.741	0.731	0.721
	2028							0.961	0.922	0.892	0.864	0.837	0.813	0.800	0.786	0.774	0.762	0.751	0.741
	2029								0.958	0.926	0.895	0.866	0.839	0.825	0.810	0.797	0.784	0.773	0.762
	2030									0.964	0.929	0.898	0.869	0.853	0.836	0.822	0.808	0.796	0.784
	2031										0.962	0.926	0.894	0.876	0.858	0.842	0.828	0.814	0.802
	2032											0.960	0.924	0.903	0.882	0.865	0.848	0.834	0.821
	2033												0.959	0.934	0.910	0.890	0.872	0.856	0.841
	2034													0.970	0.942	0.918	0.898	0.880	0.863
	2035														0.967	0.939	0.916	0.895	0.877
	2036															0.967	0.939	0.915	0.895
	2037																0.967	0.939	0.915
	2038																	0.967	0.939
	2039																		0.967

Table C.8 Background NOx Projection Factors for a Rural Area using a Realistic worst-case Scenario

		Projected Future Year																	
		2023	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**2040**
Baseline Year	**2022**	0.961	0.928	0.895	0.866	0.838	0.809	0.782	0.754	0.733	0.714	0.694	0.676	0.668	0.658	0.649	0.640	0.631	0.623
	2023		0.966	0.931	0.900	0.870	0.839	0.808	0.779	0.757	0.737	0.718	0.699	0.691	0.681	0.672	0.663	0.655	0.646
	2024			0.964	0.932	0.899	0.867	0.835	0.804	0.781	0.760	0.740	0.721	0.712	0.702	0.692	0.683	0.674	0.665
	2025				0.966	0.932	0.898	0.864	0.831	0.807	0.785	0.763	0.743	0.734	0.723	0.713	0.704	0.694	0.686
	2026					0.964	0.927	0.891	0.856	0.831	0.807	0.785	0.764	0.754	0.743	0.732	0.722	0.713	0.703
	2027						0.961	0.922	0.885	0.858	0.832	0.808	0.786	0.775	0.763	0.752	0.742	0.732	0.722
	2028							0.958	0.917	0.888	0.860	0.834	0.810	0.799	0.786	0.774	0.763	0.752	0.742
	2029								0.955	0.922	0.892	0.863	0.838	0.824	0.810	0.798	0.786	0.775	0.764
	2030									0.963	0.928	0.897	0.868	0.853	0.838	0.824	0.811	0.799	0.788
	2031										0.961	0.926	0.894	0.877	0.860	0.845	0.831	0.818	0.806
	2032											0.960	0.925	0.905	0.885	0.868	0.853	0.839	0.826
	2033												0.960	0.936	0.913	0.894	0.877	0.862	0.848
	2034													0.972	0.946	0.923	0.904	0.887	0.872
	2035														0.970	0.944	0.923	0.904	0.887
	2036															0.971	0.946	0.925	0.907
	2037																0.972	0.948	0.928
	2038																	0.973	0.950
	2039																		0.975

Table C.9 Background NOx Projection Factors for a Rural Area using a Pessimistic Scenario

		Projected Future Year																	
		2023	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**2040**
Baseline Year	**2022**	0.961	0.928	0.895	0.866	0.838	0.809	0.782	0.754	0.733	0.714	0.694	0.676	0.668	0.658	0.649	0.640	0.631	0.623
	2023		0.965	0.931	0.900	0.869	0.838	0.808	0.779	0.757	0.737	0.718	0.700	0.692	0.682	0.673	0.665	0.656	0.648
	2024			0.964	0.931	0.899	0.866	0.834	0.804	0.781	0.760	0.740	0.721	0.713	0.703	0.694	0.685	0.676	0.667
	2025				0.966	0.931	0.897	0.863	0.831	0.807	0.785	0.764	0.744	0.735	0.725	0.715	0.706	0.697	0.688
	2026					0.964	0.927	0.891	0.856	0.831	0.808	0.786	0.765	0.755	0.744	0.734	0.724	0.715	0.706
	2027						0.961	0.922	0.885	0.858	0.833	0.809	0.788	0.777	0.766	0.755	0.744	0.735	0.725
	2028							0.958	0.918	0.888	0.861	0.836	0.812	0.801	0.788	0.777	0.766	0.756	0.746
	2029								0.956	0.923	0.893	0.865	0.840	0.827	0.814	0.801	0.790	0.779	0.769
	2030									0.963	0.929	0.899	0.871	0.856	0.842	0.828	0.816	0.804	0.793
	2031										0.962	0.928	0.897	0.881	0.865	0.850	0.837	0.824	0.813
	2032											0.961	0.927	0.909	0.890	0.874	0.860	0.846	0.834
	2033												0.962	0.940	0.919	0.901	0.885	0.871	0.858
	2034													0.975	0.951	0.931	0.913	0.897	0.883
	2035														0.973	0.951	0.931	0.914	0.899
	2036															0.975	0.954	0.935	0.919
	2037																0.977	0.957	0.939
	2038																	0.978	0.960
	2039																		0.980

Table C.10 Background PM_{10} Projection Factors for a Large Urban Area

		Projected Future Year																	
		2023	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**2040**
Baseline Year	**2022**	0.986	0.972	0.959	0.951	0.943	0.936	0.928	0.920	0.915	0.909	0.904	0.898	0.892	0.887	0.882	0.876	0.871	0.866
	2023		0.986	0.972	0.964	0.957	0.949	0.941	0.933	0.928	0.922	0.916	0.911	0.905	0.900	0.894	0.889	0.883	0.878
	2024			0.986	0.978	0.970	0.962	0.954	0.947	0.941	0.935	0.929	0.924	0.918	0.912	0.907	0.901	0.896	0.890
	2025				0.992	0.984	0.976	0.968	0.960	0.954	0.949	0.943	0.937	0.931	0.925	0.920	0.914	0.909	0.903
	2026					0.992	0.984	0.976	0.968	0.962	0.956	0.950	0.944	0.938	0.933	0.927	0.922	0.916	0.910
	2027						0.992	0.984	0.976	0.970	0.964	0.958	0.952	0.946	0.940	0.935	0.929	0.923	0.918
	2028							0.992	0.984	0.978	0.972	0.966	0.960	0.954	0.948	0.942	0.937	0.931	0.925
	2029								0.992	0.986	0.980	0.974	0.968	0.962	0.956	0.950	0.944	0.938	0.933
	2030									0.994	0.988	0.982	0.976	0.970	0.964	0.958	0.952	0.946	0.940
	2031										0.994	0.988	0.982	0.976	0.970	0.964	0.958	0.952	0.946
	2032											0.994	0.988	0.982	0.976	0.970	0.964	0.958	0.952
	2033												0.994	0.988	0.982	0.976	0.970	0.964	0.958
	2034													0.994	0.988	0.982	0.976	0.970	0.964
	2035														0.994	0.988	0.982	0.976	0.970
	2036															0.994	0.988	0.982	0.976
	2037																0.994	0.988	0.982
	2038																	0.994	0.988
	2039																		0.994

Table C.11 Background PM_{10} Projection Factors for an Urban Area

		Projected Future Year																	
		2023	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**2040**
Baseline Year	**2022**	0.984	0.968	0.952	0.944	0.935	0.927	0.918	0.910	0.904	0.897	0.891	0.885	0.879	0.873	0.866	0.860	0.854	0.848
	2023		0.984	0.968	0.959	0.950	0.942	0.933	0.925	0.918	0.912	0.906	0.899	0.893	0.887	0.880	0.874	0.868	0.862
	2024			0.983	0.975	0.966	0.957	0.949	0.940	0.934	0.927	0.921	0.914	0.908	0.901	0.895	0.889	0.882	0.876
	2025				0.991	0.982	0.973	0.965	0.956	0.949	0.943	0.936	0.929	0.923	0.916	0.910	0.904	0.897	0.891
	2026					0.991	0.982	0.973	0.964	0.958	0.951	0.944	0.938	0.931	0.925	0.918	0.912	0.905	0.899
	2027						0.991	0.982	0.973	0.966	0.960	0.953	0.946	0.940	0.933	0.926	0.920	0.913	0.907
	2028							0.991	0.982	0.975	0.968	0.962	0.955	0.948	0.941	0.935	0.928	0.922	0.915
	2029								0.991	0.984	0.977	0.970	0.964	0.957	0.950	0.943	0.937	0.930	0.923
	2030									0.993	0.986	0.979	0.972	0.966	0.959	0.952	0.945	0.939	0.932
	2031										0.993	0.986	0.979	0.972	0.965	0.959	0.952	0.945	0.938
	2032											0.993	0.986	0.979	0.972	0.965	0.959	0.952	0.945
	2033												0.993	0.986	0.979	0.972	0.965	0.958	0.952
	2034													0.993	0.986	0.979	0.972	0.965	0.958
	2035														0.993	0.986	0.979	0.972	0.965
	2036															0.993	0.986	0.979	0.972
	2037																0.993	0.986	0.979
	2038																	0.993	0.986
	2039																		0.993

Table C.12 Background PM_{10} Projection Factors for a Rural Area

		Projected Future Year																	
		2023	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**2040**
Baseline Year	**2022**	0.988	0.977	0.965	0.955	0.945	0.935	0.925	0.915	0.908	0.902	0.896	0.889	0.883	0.878	0.873	0.868	0.863	0.857
	2023		0.988	0.976	0.966	0.956	0.946	0.936	0.926	0.919	0.913	0.906	0.900	0.893	0.888	0.883	0.878	0.873	0.868
	2024			0.988	0.978	0.967	0.957	0.947	0.937	0.930	0.924	0.917	0.911	0.904	0.899	0.894	0.888	0.883	0.878
	2025				0.990	0.979	0.969	0.958	0.948	0.941	0.935	0.928	0.922	0.915	0.910	0.905	0.899	0.894	0.889
	2026					0.989	0.979	0.968	0.958	0.951	0.945	0.938	0.931	0.925	0.919	0.914	0.909	0.903	0.898
	2027						0.989	0.979	0.968	0.961	0.955	0.948	0.941	0.935	0.929	0.924	0.918	0.913	0.908
	2028							0.989	0.979	0.972	0.965	0.958	0.951	0.945	0.939	0.934	0.928	0.923	0.917
	2029								0.989	0.982	0.975	0.969	0.962	0.955	0.949	0.944	0.938	0.933	0.927
	2030									0.993	0.986	0.979	0.972	0.965	0.960	0.954	0.949	0.943	0.937
	2031										0.993	0.986	0.979	0.972	0.966	0.961	0.955	0.950	0.944
	2032											0.993	0.986	0.979	0.973	0.968	0.962	0.956	0.951
	2033												0.993	0.986	0.980	0.974	0.969	0.963	0.957
	2034													0.993	0.987	0.981	0.976	0.970	0.964
	2035														0.994	0.988	0.983	0.977	0.971
	2036															0.994	0.988	0.983	0.977
	2037																0.994	0.988	0.982
	2038																	0.994	0.988
	2039																		0.994

Table C.13 Background $PM_{2.5}$ Projection Factors for a Large Urban Area

		Projected Future Year																	
		2023	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**2040**
Baseline Year	**2022**	0.978	0.957	0.935	0.924	0.912	0.901	0.889	0.878	0.869	0.860	0.852	0.843	0.834	0.826	0.817	0.808	0.800	0.791
	2023		0.978	0.956	0.944	0.932	0.921	0.909	0.897	0.888	0.879	0.871	0.862	0.853	0.844	0.835	0.826	0.817	0.808
	2024			0.977	0.965	0.953	0.941	0.929	0.917	0.908	0.899	0.890	0.881	0.872	0.863	0.854	0.845	0.836	0.827
	2025				0.988	0.975	0.963	0.951	0.939	0.929	0.920	0.911	0.901	0.892	0.883	0.874	0.864	0.855	0.846
	2026					0.988	0.975	0.963	0.950	0.941	0.931	0.922	0.913	0.903	0.894	0.884	0.875	0.866	0.856
	2027						0.987	0.975	0.962	0.953	0.943	0.934	0.924	0.915	0.905	0.896	0.886	0.877	0.867
	2028							0.987	0.974	0.965	0.955	0.946	0.936	0.926	0.917	0.907	0.897	0.888	0.878
	2029								0.987	0.977	0.968	0.958	0.948	0.938	0.928	0.919	0.909	0.899	0.889
	2030									0.990	0.980	0.970	0.960	0.951	0.941	0.931	0.921	0.911	0.901
	2031										0.990	0.980	0.970	0.960	0.950	0.940	0.930	0.920	0.910
	2032											0.990	0.980	0.970	0.960	0.950	0.939	0.929	0.919
	2033												0.990	0.980	0.969	0.959	0.949	0.939	0.929
	2034													0.990	0.979	0.969	0.959	0.949	0.938
	2035														0.990	0.979	0.969	0.958	0.948
	2036															0.990	0.979	0.969	0.958
	2037																0.989	0.979	0.968
	2038																	0.989	0.979
	2039																		0.989

Table C.14 Background $PM_{2.5}$ Projection Factors for an Urban Area

		Projected Future Year																	
		2023	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**2040**
Baseline Year	**2022**	0.975	0.951	0.926	0.914	0.901	0.889	0.877	0.865	0.855	0.846	0.836	0.827	0.818	0.808	0.799	0.789	0.780	0.770
	2023		0.975	0.949	0.937	0.924	0.912	0.899	0.886	0.877	0.867	0.857	0.848	0.838	0.829	0.819	0.809	0.799	0.790
	2024			0.974	0.961	0.948	0.935	0.922	0.909	0.900	0.890	0.880	0.870	0.860	0.850	0.840	0.830	0.820	0.810
	2025				0.987	0.973	0.960	0.947	0.934	0.924	0.913	0.903	0.893	0.883	0.873	0.863	0.852	0.842	0.832
	2026					0.987	0.973	0.960	0.946	0.936	0.926	0.915	0.905	0.895	0.884	0.874	0.864	0.853	0.843
	2027						0.986	0.973	0.959	0.949	0.938	0.928	0.917	0.907	0.896	0.886	0.875	0.865	0.854
	2028							0.986	0.972	0.962	0.951	0.941	0.930	0.920	0.909	0.898	0.888	0.877	0.866
	2029								0.986	0.975	0.965	0.954	0.943	0.932	0.922	0.911	0.900	0.889	0.878
	2030									0.989	0.978	0.967	0.957	0.946	0.935	0.924	0.913	0.902	0.891
	2031										0.989	0.978	0.967	0.956	0.945	0.934	0.923	0.912	0.901
	2032											0.989	0.978	0.967	0.955	0.944	0.933	0.922	0.911
	2033												0.989	0.978	0.966	0.955	0.944	0.932	0.921
	2034													0.989	0.977	0.966	0.954	0.943	0.931
	2035														0.988	0.977	0.965	0.954	0.942
	2036															0.988	0.977	0.965	0.953
	2037																0.988	0.976	0.964
	2038																	0.988	0.976
	2039																		0.988

Table C.15 Background $PM_{2.5}$ Projection Factors for a Rural Area

	Projected Future Year																	
Baseline Year	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**2040**
2022	0.982	0.963	0.945	0.930	0.915	0.900	0.885	0.870	0.861	0.851	0.841	0.832	0.822	0.814	0.806	0.798	0.790	0.782
2023		0.981	0.963	0.947	0.932	0.917	0.902	0.887	0.877	0.867	0.857	0.847	0.837	0.829	0.821	0.813	0.805	0.796
2024			0.981	0.965	0.950	0.934	0.919	0.903	0.893	0.883	0.873	0.863	0.853	0.845	0.837	0.828	0.820	0.812
2025				0.984	0.968	0.953	0.937	0.921	0.911	0.901	0.890	0.880	0.870	0.861	0.853	0.844	0.836	0.827
2026					0.984	0.968	0.952	0.936	0.925	0.915	0.905	0.894	0.884	0.875	0.867	0.858	0.849	0.841
2027						0.984	0.967	0.951	0.940	0.930	0.919	0.909	0.898	0.890	0.881	0.872	0.863	0.854
2028							0.983	0.967	0.956	0.945	0.935	0.924	0.913	0.904	0.895	0.886	0.877	0.868
2029								0.983	0.972	0.961	0.950	0.940	0.929	0.920	0.910	0.901	0.892	0.883
2030									0.989	0.978	0.967	0.956	0.945	0.935	0.926	0.917	0.908	0.898
2031										0.989	0.978	0.966	0.955	0.946	0.936	0.927	0.918	0.908
2032											0.989	0.977	0.966	0.957	0.947	0.938	0.928	0.919
2033												0.989	0.977	0.967	0.958	0.948	0.939	0.929
2034													0.988	0.979	0.969	0.959	0.950	0.940
2035														0.990	0.980	0.971	0.961	0.951
2036															0.990	0.980	0.970	0.960
2037																0.990	0.980	0.970
2038																	0.990	0.980
2039																		0.990

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