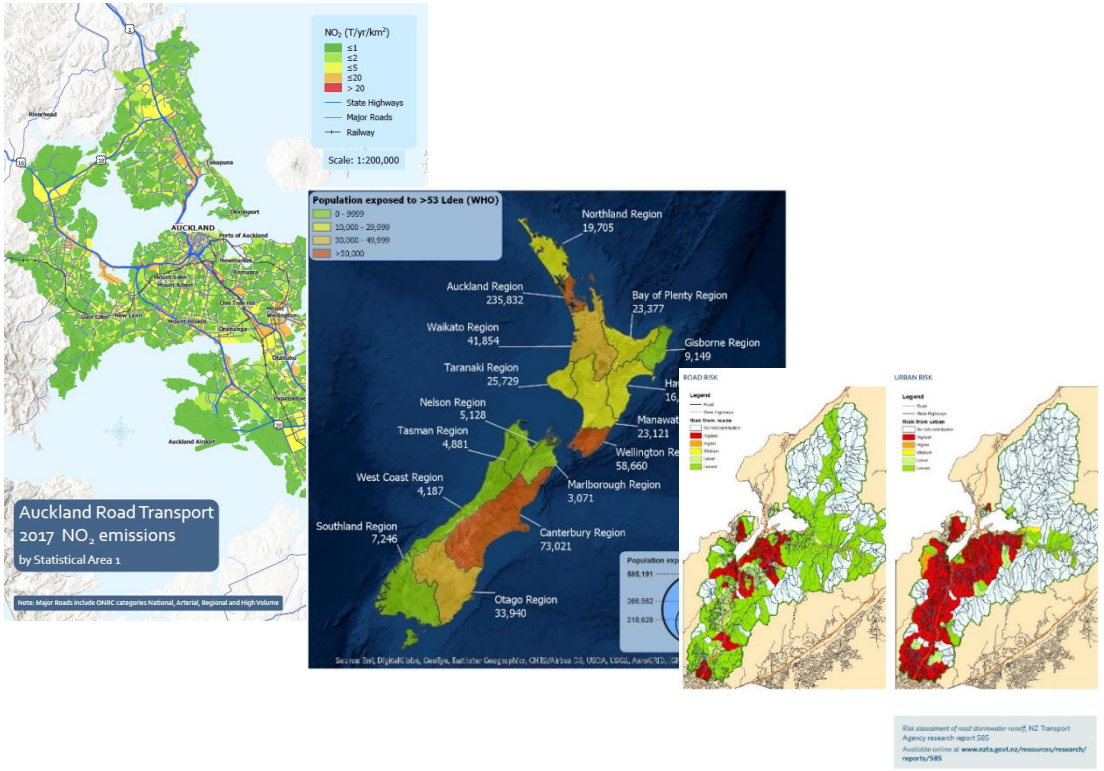
Mapping the Environmental Impact of Land Transport Stormwater Run-off, Road Traffic Noise and Vehicle Emissions

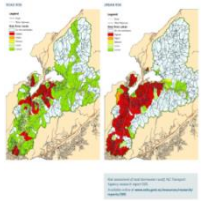
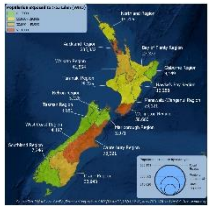


NZ ESRI Users Conference Transport Special Interest Group Workshop 2019
Sky City, Auckland
12th August 2019

Rob Hannaby
NZ Transport Agency
Lead Advisor – Environment
rob.hannaby@nzta.govt.nz

Overview

1. Exploring the challenges
2. Case studies

Stormwater Run-Off and Roads	
Road Traffic Noise	
Vehicle Emissions	

Transport Evidence Base

FIGURE 8: THEME OVERVIEW – TRANSPORT IMPACTS

Topic	Related enduring question
Transport impacts	**Knowledge needs** **Better understanding the size, exposure, valuation, interactions and influences of social, economic, cultural (including transport impacts for Māori as tangata whenua) and environmental impacts as well as the potential effects from mitigations**

Transport Evidence Based Strategy

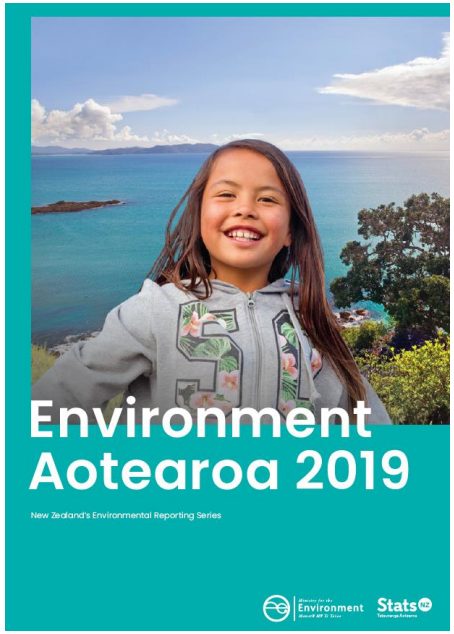
Improving the way we use evidence and make decisions in transport

Ministry of Transport

Domain Strategy, Economics & Evaluation

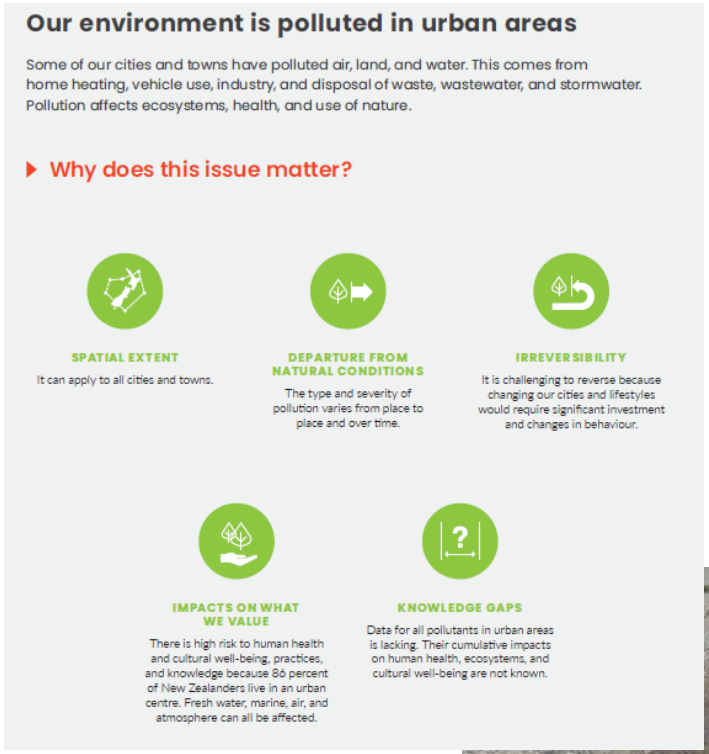
High-priority initiatives			Impact	Breadth of applications	Strategic value	Right resources
		Scale M – H	Assessment result			
Quick wins	**R11.9**	Improve environmental impact evaluation around run-off of vehicle pollutants on road				
	R11.2	Develop environment impact framework for emissions and infrastructure				
Other high-priority initiatives	**R11.1**	Research into transport emissions profiles				
	R10.1	Develop health and safety risk profiles and exposures that leads to transport-related harm				

Stormwater Run-off and Roads



courses (*Our fresh water 2017*). Stormwater can contain elevated concentrations of heavy metals (Lewis et al, 2015), coming from vehicles (copper from brake pads and zinc from tyres), metal roofing, and industrial yards (Kennedy & Sutherland, 2008). Wastewater and stormwater can also contain many other pollutants including personal care products, medicines, and plastics that were washed into waterways.

The extent to which stormwater and wastewater pollute fresh water is determined by how much land is covered by solid surfaces like roofing, asphalt, and concrete. These impervious surfaces reduce the amount of rain that soaks into soils and aquifers, and increase the amount entering the stormwater system.



Our environment is polluted in urban areas

Some of our cities and towns have polluted air, land, and water. This comes from home heating, vehicle use, industry, and disposal of waste, wastewater, and stormwater. Pollution affects ecosystems, health, and use of nature.

▸ Why does this issue matter?

SPATIAL EXTENT
It can apply to all cities and towns.

DEPARTURE FROM NATURAL CONDITIONS
The type and severity of pollution varies from place to place and over time.

IRREVERSIBILITY
It is challenging to reverse because changing our cities and lifestyles would require significant investment and changes in behaviour.

IMPACTS ON WHAT WE VALUE
There is high risk to human health and cultural well-being, practices, and knowledge because 86 percent of New Zealanders live in an urban centre. Fresh water, marine, air, and atmosphere can all be affected.

KNOWLEDGE GAPS
Data for all pollutants in urban areas is lacking. Their cumulative impacts on human health, ecosystems, and cultural well-being are not known.

Road Traffic Noise

nzherald.co.nz

Search for content...

National Opinion Business Tech World Sport Entertainment Lifestyle Trav

Lifestyle Health & Wellbeing Food & Drink Fashion & Beauty Relationships Parenting De

Traffic noise increases risk of heart attack, researchers find

12:44 PM Monday Jul 11, 2016

Spotlight

SHARE:

People in areas exposed to traffic noise are at a higher risk of heart disease. Photo / iStock

Exposure to traffic noise increases the risk of suffering from a heart attack, researchers have found.

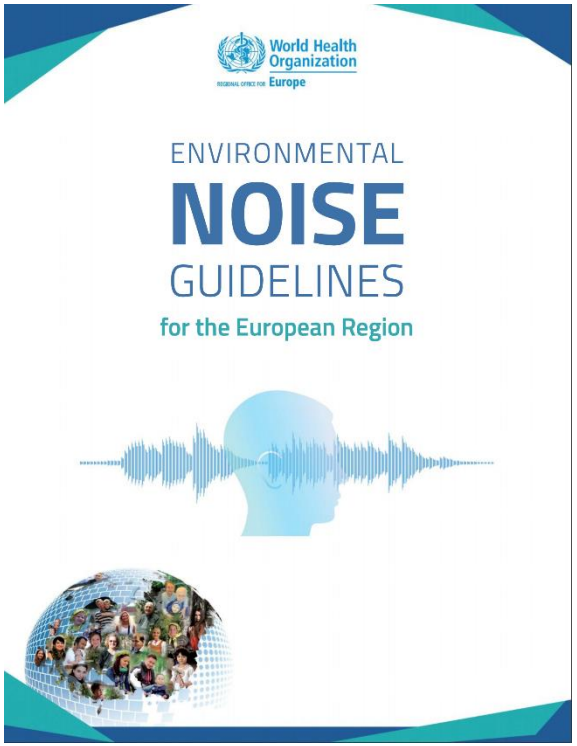
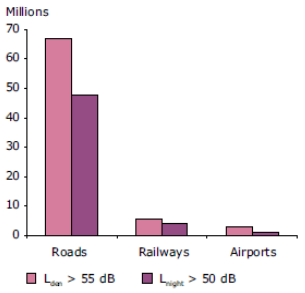


Figure 7.1 People affected by transport noise in agglomerations > 250 000 inhabitants (EU-27)

Almost 67 millions people (i.e. 55 % of the population living in agglomerations with more than 250 000 inhabitants) are exposed to daily road noise levels exceeding 55 dB L_{den} (the lower benchmark for the combined noise indicator). Daily exposure to railway noise and airport noise in these agglomerations is lower but still significant, with respectively 5.6 and 3.2 million people exposed to levels above 55 dB L_{den}. With almost 48 million people exposed to levels exceeding 50 dB L_{night} (the lower benchmark for nighttime noise) road noise is also by far the largest source of exposure to night-time transport noise.



Source: The European Topic Centre Land Use and Spatial Information, 2008.

Vehicle Emissions

RNZ Home News Radio Podcasts & Series Topics Pacific

New Zealand World Politics Pacific Te Ao Māori Sport Business Country Comment & A

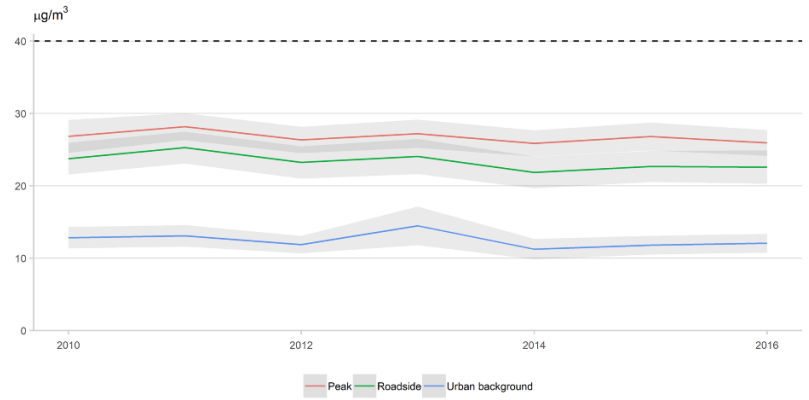
NEW ZEALAND / ENVIRONMENT

Queen St contains highest levels of black carbon in NZ

5:25 pm on 7 November 2018 Share this

Downtown Auckland appears to be serving as a basin for air pollution, including high levels of potentially deadly black carbon.

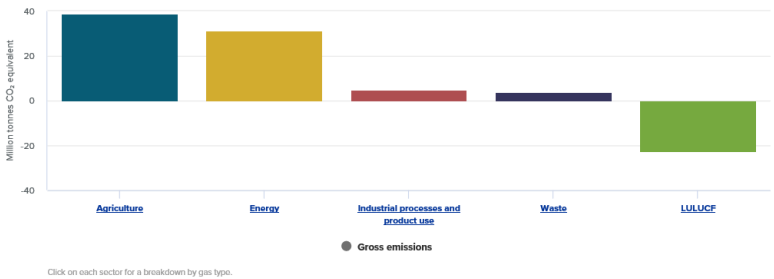
Annual average nitrogen dioxide concentrations at NZ Transport Agency monitoring sites 2010–16



Note: Dotted line shows WHO long-term guideline; shading shows 95% confidence intervals. No exceedances are displayed due to averaging.
Only sites that met data completeness criteria are displayed.

Data source: NZ Transport Agency; National Institute for Water and Atmospheric Research

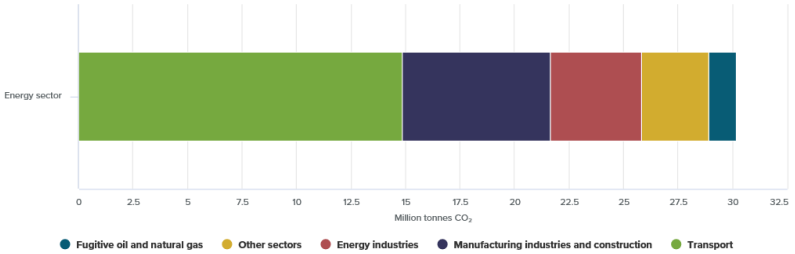
New Zealand's gross emissions by sector and gas type, 2016



Click on each sector for a breakdown by gas type.

Data source: Ministry for the Environment

Gross CO_2 emissions from the energy sector, 2016



Data source: Ministry for the Environment

Updated Health and Air Pollution in New Zealand Study

Table 6.1: Total air pollution health impacts for New Zealand in 2006 by source and effect

Health Effect	Cases by Source						Social Costs ($million)
	Domestic Fires	Motor Vehicles	Industry	Open Burning	Natural	Total	
Premature Mortality (adults)	659	255	113	139	1,136	2,307	8,211
Premature Mortality (babies)		1	0	1	5	9	31
Cardiac Admissions (all)	101	51	21	29	217	449	3
Respiratory Admissions (all)	209	91	34	47	356	731	3
Restricted Activity Days (all)	817,600	352,300	139,900	187,700	1,440,000	2,926,500	181
Total Social Costs ($million)							8,429

Note the social costs can be pro-rated across the table by source.

NZ TRANSPORT AGENCY WAKA KOTAHI

New Zealand Government

Challenge and Response

The Challenge

- Transport can create a range of public health, ecological, social and cultural impacts.
- Most impacts are experienced at the local scale but often require a management response at the regional or national level.
- Efficient and effective management requires comprehensive measurement of such impacts in space and time.
- Whilst there are numerous measurement frameworks, there remains the enduring problem of collecting, reporting and analysing such data in a way that enables multiple stakeholders, often working in apparently unrelated disciplines, to understand the relevance of the data to them and any 'call to action'.

The Response

- Innovative use of Geographical Information Systems (GIS).

Stormwater Run-off and Roads

NZ TRANSPORT AGENCY

What are you looking for?

Home › Resources › Research reports › Reports ›

Resources

← Back to Resources

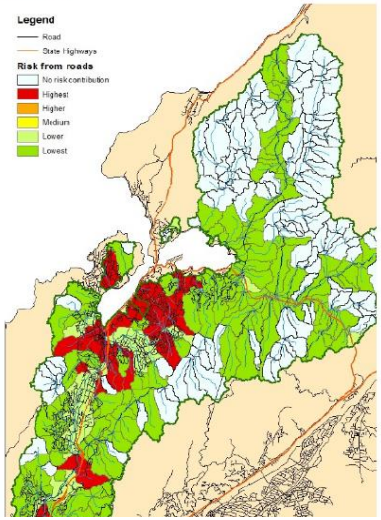
Research Report 585 Risk assessment of road stormwater run-off

Published: March 2016 | Category: Research & reports , Research programme | Audience: General

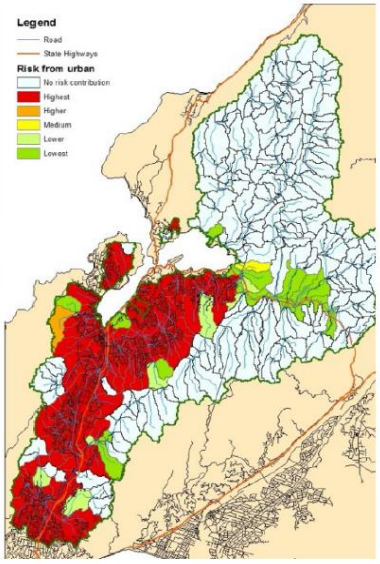
This report describes a GIS-based road stormwater screening (RSS) model developed to upgrade and widen application of the NZ Transport Agency's 2007 vehicle kilometres travelled screening tool.

The RSS model provides a robust, consistent method for assessing relative risks to receiving waterbodies using estimates of copper and zinc from road traffic and non-road (urban) sources.

ROAD RISK



URBAN RISK



Risk assessment of road stormwater runoff

5.9 Conclusions from case study

Conclusions from applying the RSS model in the case study area are as follows:

5.9.1.1 Rivers and streams risk assessment

The majority of sub-catchments containing roads are classified in the 'lowest risk' category. In contrast, most sub-catchments containing any urban land use are classified as 'highest risk' reflecting the fact that loads of copper and zinc are high in relation to stream dilution potential. Loads from non-road impervious surfaces make up the majority of the total metal loads in these sub-catchments.

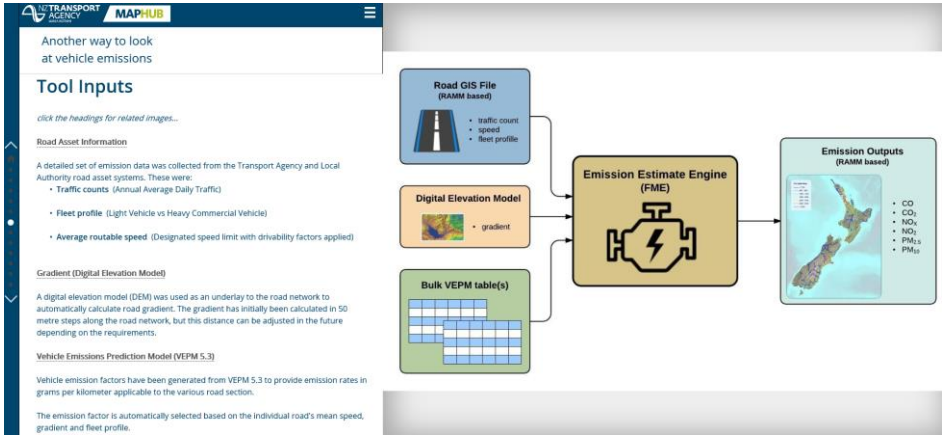
Risk assessment of road stormwater runoff, NZ Transport Agency research report 585

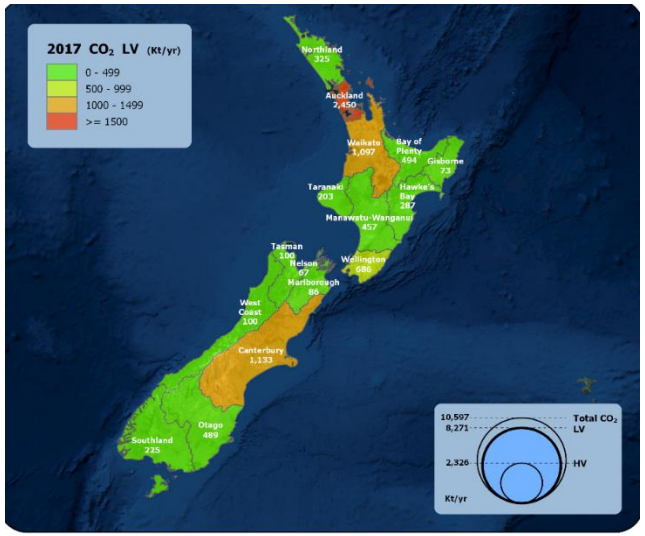
Available online at **www.nzta.govt.nz/resources/research/reports/585**

Stormwater Run-off

Overview	• ESRI ArcGIS and MS Excel Road Stormwater Screening (RSS) Model • Considers relative risk of run-off from Road Traffic and Non-road Urban Contaminants • Run-off for river reach sub-catchments based River Catchment Classification system • Output Parameters - Road traffic run-off 'markers' - copper and zinc
Stakeholders and Partners	• NZ Transport Agency • MWH / Stantec • NIWA • Greater Wellington Regional Council
Current Status	• Basic relative risk model developed • Case study of run-off risk for Te Awarua-o-Porirua Harbour and Catchment complete
Next Steps	• Improve efficiency of sourcing and process model input data, including development of national geodatabase. • Further validation work – additional case studies • Improve functionality and user interface • Map national risk
Further Information	• https://www.nzta.govt.nz/resources/research/reports/585/

Vehicle Emissions



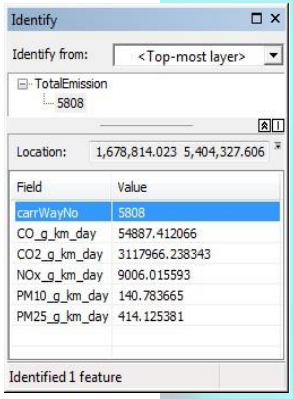


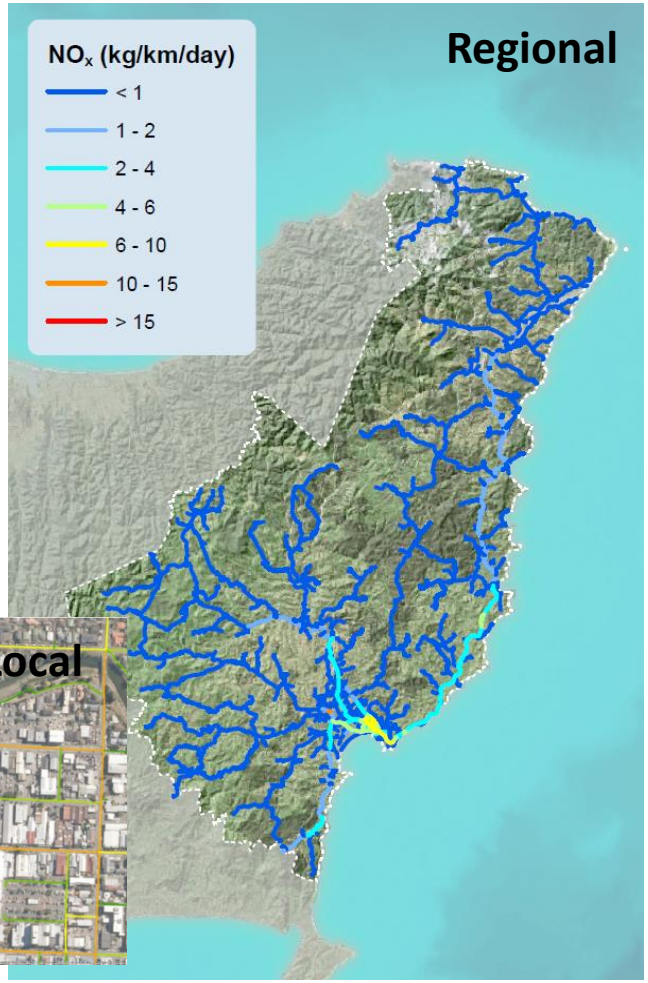
National

Vehicle Emissions

Overview	• ESRI ArcGIS Feature Manipulation Engine (FME) software model • Emissions factors based on NZ Vehicle Emission Prediction Model • Years Modelled – 2016, 2017, 2018 • Output Parameters - Greenhouse Gases (CO2) and Harmful Air Pollutants (CO, NOx, PM, etc) • LV and HV split; petrol, diesel and electric/hybrid split
Stakeholders and Partners	• NZ Transport Agency • Jacobs • Transport Environment Knowledge Hub
Current Status	• Vehicle emissions mapped across NZ State highways and local road networks from 2016 and being updated yearly.
Next Steps	• Map concentrations and exposure to harmful air pollutants • Further validation work – to include comparison against regional and national greenhouse gas and harmful air pollutant inventories and monitoring data • Development of a 'future state' model for scenario testing of interventions
Further Information	• https://www.nzta.govt.nz/roads-and-rail/highways-information-portal/technical-disciplines/air-quality-climate/planning-and-assessment/vehicle-emissions-mapping-tool/

Vehicle Emissions





Road Traffic Noise

26th ARRB Conference – Research driving efficiency, Sydney, New South Wales 2014

STATE HIGHWAY NOISE MAPPING – AUCKLAND MOTORWAYS CASE STUDY

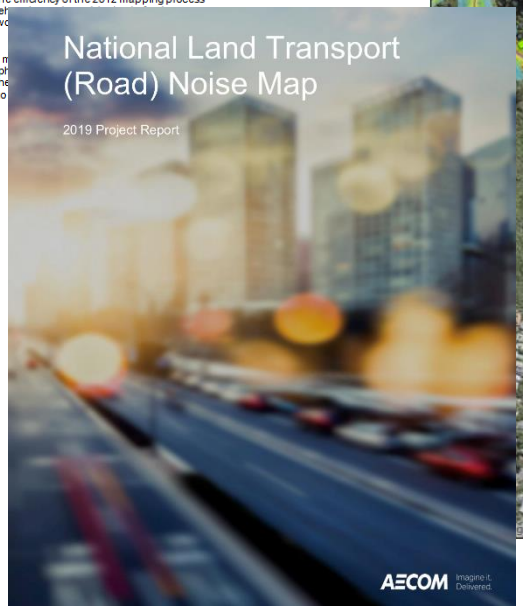
Rob Hannaby, NZ Transport Agency, New Zealand
Stephen Chiles, NZ Transport Agency, New Zealand
Chris Worts, NZ Transport Agency, New Zealand
James Whitlock, Marshall Day Acoustics, New Zealand
Andy Haigh, Beca, New Zealand

ABSTRACT

The NZ Transport Agency initiated a strategic noise mapping exercise in 2009. The aim was to generate noise maps covering the 220 km motorway network in Auckland, which could then be used to inform and identify priority areas for noise mitigation.

The 2009 exercise was repeated and refined in 2012 to address a number of short-comings, in particular, the limited geographical coverage of the maps due to incomplete input data, as well as output inconsistencies associated with the mapping methodology. Careful project scoping, supplier selection and project management enabled the efficiency of the 2012 mapping process to be enhanced and streamlined. Ultimately a compre
have been generated for the Auckland motorway netwo
2011.

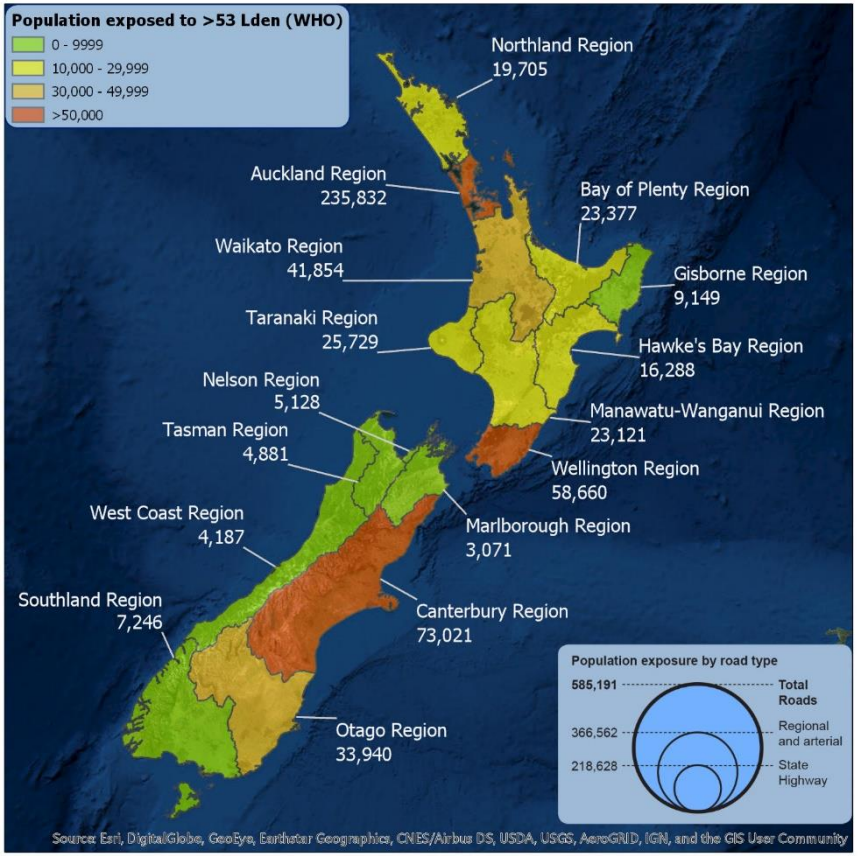
This paper explores the lessons learnt from the noise m
benefits of optimising the use of specialists in geograph
acoustics, transport policy and asset management. The
information provided by the maps is now being used to
to road-traffic noise issues in Auckland.



NZ TRANSPORT AGENCY WAKA KOTAHI

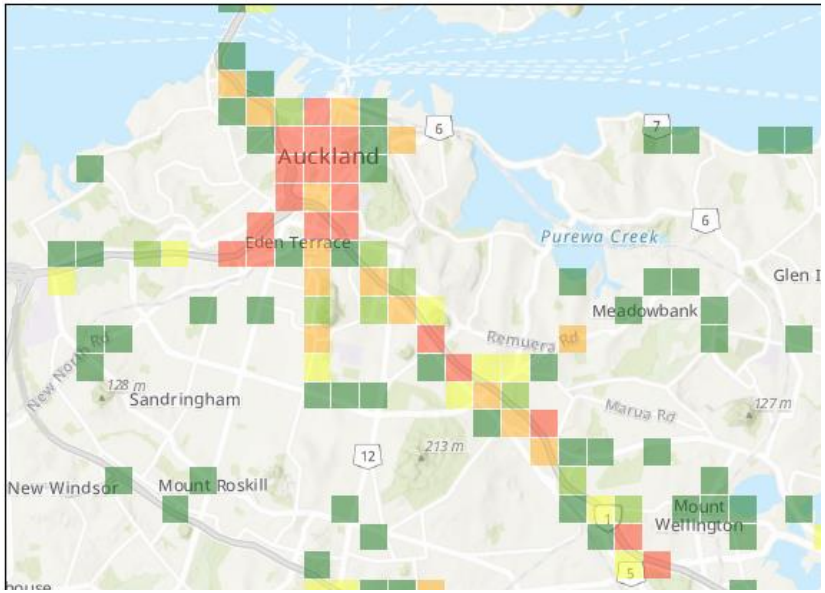
New Zealand Government

Road Traffic Noise



National

Local



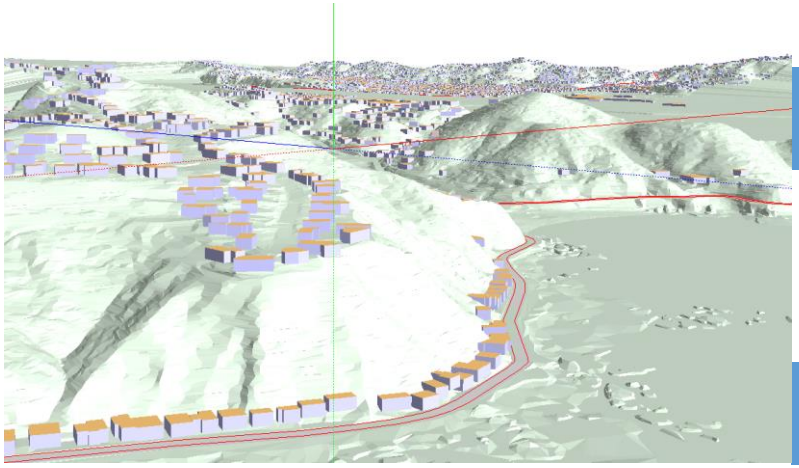
Corridor/Grid

Road traffic noise modelling

National noise mapping 2018/19

First national noise map for New Zealand

Includes state highways, regional and arterial roads



15,000+ km^2	TERRAIN
14,000+ km	ROADS
1,600,000+	BUILDINGS
3,000+	BRIDGES
88+ km	NOISE BARRIERS

Road Traffic Noise

Overview	• ESRI ArcGIS and Soundplan Model • State highways, regional and arterial roads • Year modelled – 2017 (traffic) and 2013 (population) • Output Parameter – $L_{Aeq(24hr)}$ (and others)
Stakeholders and Partners	• NZ Transport Agency • AECOM • Chiles Ltd
Current Status	• Completed 2019 • Used to inform noise mitigation business case development
Next Steps	• Annual updates • Update population exposure estimates with 2018 census • Refinements to input data sets (topography, building footprints and heights, noise barriers, building use, etc)
Further Information	• https://www.transport.govt.nz/assets/Import/Uploads/Research/Documents/3558c194f0/D2-National-land-transport-map-Boland-AECOM.pdf

Summary

- Smart use of GIS platform(s) informed by robust science to enable cross-sector collaboration in order to minimise the impact of transport-related environmental harms.

- Designed to:
  - support strategic and tactical interventions
  - monitor and report spatial and temporal trends at national, regional and local levels
  - inform scenario testing and economic appraisal

Thank You

QUESTIONS?

Rob Hannaby
NZ Transport Agency
Lead Advisor – Environment
rob.hannaby@nzta.govt.nz