AGENDA

Road Dust Working Group

PAPERS

Whangarei Meeting Room (seats 10, VC);
Auckland HSBC Meeting Room 12.14 (VC 2052 seats 10, NZTA staff only, VoIP 928 8717);
Wellington Majestic 5.17 SM Boardroom - 5256 (x12, VC, Voip 04 931 8992);
Blenheim-Marlborough Room (VC 2055, Seats 12, Whiteboard)

Friday 3 November 2017, 10:00am – 12:00pm

AGENDA

Road Dust Working Group Meeting

Friday 3 November 2017, 10.00am – 12.00pm

Agenda:

Item	Topic	Paper	Presenter
1	Welcome, apologies		Tom Simonson / Greg Haldane
2	Review • Terms of Reference for the Road Dust Working Group (recap)	1	Tom Simonson
3	Health Impacts Impossible • Memorandum regarding new research into health effects of road dust	2	Louise Wickham
4	Previous presentation – LVR • Feedback from: Low Volume Roads Workshop	3	Jon Cunliffe
5	NZTA Presentation / Discussion • Unsealed Road Dust Risk	4	Greg Haldane
6	NZTA Investment Discussion • Investment case for dust mitigation		Andrew McKillop and Mark Yaxley
7	Group Summary Discussion		
8	Closing Remarks / Summary		Tom Simonson / Greg Haldane / Jamie Cox

AGENDA

1 Terms of Reference for the Road Dust Working Group

ROAD CONTROLLING AUTHORITIES FORUM (NZ) INC

Special Interest Group on Low Volume Roads

Terms of Reference: Road Dust Working Group

13.4.17 - Version 2

Purpose

The purpose of these Terms of Reference is to specify the objectives, roles and responsibilities of a working group established to; a) prompt, as needed, further analysis toward the impact of dust from unsealed roads on human health and the environment, and b) to support development of a national strategy and policy to support Road Controlling Authorities mitigate the effects.

Title

The Group will be known as the Road Dust Working Group ("Working Group").

Objective

The objectives of the working group are to:

(a) As may be required, investigate possible positive outcomes from mitigating the impact of dust on as it relates to our unsealed road network; and

(b) advocate for and support the development of a national strategy and policy for supporting Road Controlling Authorities to mitigate the effects of road dust on the environment and human health.

Background on Working Group

The Working Group, in part, is the result of the Local Government New Zealand National Conference in July 2016, which adopted a remit proposed by Far North District Council:

> *"That the Crown establish and support a working party in conjunction with Local Government New Zealand, NZTA, MBIE, the Ministry of Health, Iwi and other affected parties to: (a) investigate the impact of dust on human health and the environment as it relates to our unsealed road network; and (b) develop a national strategy and policy for supporting Road Controlling Authorities to mitigate the effects of road dust on the environment and human health."*

Regarding Road Controlling Authorities (RCA) Forum participation, as road controlling managers balance priorities of road management with various overlapping and related issues including public health and land use, the RCA Forum also identifies dust an important and timely issue to have subject matter expertise and background. As such,

the RCA Forum has an established a special interest group on low volume roads and this group has already begun to investigate the impact of road dust on human health and the environment, and to develop a national strategy and policy for supporting its members to mitigate these effects.

It is proposed that this established working group be used to provide the basis for a national working group on this issue. This follows the established model for collaboration within the RCA Forum in response to changing needs or emerging challenges within the sector to ensure sector problems are addressed consistently and appropriately.

Background summary

An effect of traffic on unsealed roads, particularly in summer, is dust. The impact is broad; roughly 48% of all rural roads in New Zealand, or 31,000 kilometres, are unsealed. Increased road dust is recognised as a significant effect from changes in land use and increased heavy vehicle traffic on low volume roads as a result of forest harvesting, dairy conversions, quarrying and more intensive primary industries. For greater understanding on the background and mitigation toward road dust, please refer to Appendix A and B.

In August 2016, the NZ Transport Agency, in response to increasing awareness and complaints about dust on unsealed roads, released Research Report 590 entitled "Impacts of exposure to dust from unsealed roads". The report summarised a two-month road dust monitoring campaign undertaken on a section of Mataraua Road, 10 kilometres southwest of Kaikohe in the Far North District, from February into April 2015.

The monitoring results indicated that potential adverse human health impacts might occur due to the dust discharged from untreated unsealed roads. A comparison of the dust particle concentrations monitored at the untreated and treated sites (using magnesium chloride) showed that the application of a dust suppressant significantly reduced the impact of dust discharged from the road. It also resulted in the development of an impact matrix with associated funding for mitigation.

To date, local councils have had difficulty meeting the requirements outlined in the matrix to obtain mitigation funding.

Product

The Working Group intends to collaborate with industry representatives, central government departments and agencies and all other available stakeholders create a discussion document informing and supporting the development of a national strategy and policy for Road Controlling Authorities to mitigate the effects of road dust on the environment and human health. More specifically, the Working Group will:

- As appropriate, perform a literature review to identify the impacts of dust;
- Assess the relative efficacy and value for money of available alternative means of mitigating road dust;
- Outline a strategic direction using readily available policy and regulatory tools;
- Determine short, medium and long-term objectives;
- Identify and plan for gaps and weaknesses in that may influence outcomes (eg

sector leadership, available funding;

- Develop recommendations on best practice for practitioners for plan investment under existing conditions to reduce adverse impacts and ensure legal compliance;
- Coordination with central and local government organisations, stakeholders and industry representatives to develop necessary background (eg research, strategic business case) toward developing a national strategy to mitigate adverse impacts resulting from dust; and
- Continuing advocacy and support by RCAs, regional councils, stakeholders and industry representatives to central government for a national strategy to mitigate dust using appropriate mitigation and recommended best practice that support a national strategy to address adverse impacts from dust.

Tasks to create product

The Road Dust Working Group will create a discussion document that intends to include:

1. Clear problem identification;
2. A literature review identifying impacts of dust from roads, which will include; safety, health, environmental impact, economic analysis and social costs.
3. An outline of the type of research required to support a national strategy and policy for dust mitigation, including but not limited to an appropriate economic evaluation model and a business case;
4. A conceptual business case outline;
5. A conceptual risk matrix for dust mitigation;
6. National guidelines on best practice for practitioners to plan investment to mitigate the impacts of dust from unsealed roads.
7. Evaluation of a draft, updated policy direction based on the business plan and risk matrix
8. Conceptual engagement plan for NZTA to work with local councils to discuss a policy update; and
9. A draft policy and mitigation plan – written document incorporating the above-noted research and activities, to include existing local government exemplars or case studies.

National Representation

The Road Dust Working Group is intended to be comprised of representatives from Local Government New Zealand, New Zealand Transport Agency, Ministry of Business, Innovation and Employment, the Ministry of Health, Iwi, and road controlling authorities with an interest in the wider impacts of traffic on unsealed roads. It will liaise as necessary with key researchers and experts in the field.

Members and Ancillary Participants

1. LGNZ - Tom Simonson
2. RCAF – Wayne Newman Cresmere Consulting (representing the RCAF Research and Guidelines Group)
3. Wairoa District Council – Jamie Cox (Convenor of RCAF Special Interest Group-LVR)

4. Far North District Council – Wil Pille
5. Far North District Council - Anne Court
6. Kaipara District Council – Garry McGraw
7. Marlborough Roads – Steve Murrin
8. Ministry of Health – Louis Wickham (Emissions Impossible)
9. NZ Transport Agency – Greg Haldane
10. NZ Transport Agency – Murray Gimblett
11. NZ Transport Agency – Rob Hannaby
12. NZ Transport Agency – Chris Gasson
13. Department of Conservation – Richard Davies
14. NZ Forest Owners Association – Glenn Mackie
15. Bay of Plenty Regional Council – Karen Parcell
16. Ministry for the Environment – Dr Travis Ancelet
17. Hancock Forest Management – Chris Bailey
18. Grant Rutledge - Nelson Forests

Meetings

Meetings will be held at intervals based on the needs of the project and the sector. It is expected that one national workshop and up to three meetings would be convened.

Group members will be asked to meet incidental costs of membership. Budget to assist with costs of travel will be provided by the RCA Forum, but it is generally assumed that each member will cover a reasonable level of such costs.

Term

It is expected that the Road Dust Working Group will require a term of six months to a year to deliver a discussion document on planning investment to mitigate the impacts of road dust.

Convenors

Tom Simonson, Local Government New Zealand and Jamie Cox, Wairoa District Council.

Budget

Activities will be funded from the RCA Forum Special Interest Group – Low Volume Roads budget. The convenor and one other member will sign off all invoices for payment from this budget.

Administration

The Group will be supported by the RCA Forum and report to the Research and Guidelines Steering Group. The Research and Guidelines Steering Group will provide administrative support.

Appendix A – Background Information

Airborne dust from unsealed roads is defined as dry, solid particles that can range in diameter from <1 micron to 100 microns (refer Figure 1).[1] The finer the particle, the longer it remains suspended in the air. At 1 micron any settling due to gravity is negligible, whereas particles above 50 microns tend to settle quickly. Similarly, particles greater than 10 microns are unlikely to reach the alveolar region of the lungs, where inhaled gases can be absorbed by the blood, so particulate matter less than 10 microns (PM10) is regarded as the threshold of highest health risk. There is no safe threshold for PM10 - adverse effects on health are observed at all measured levels.[2]

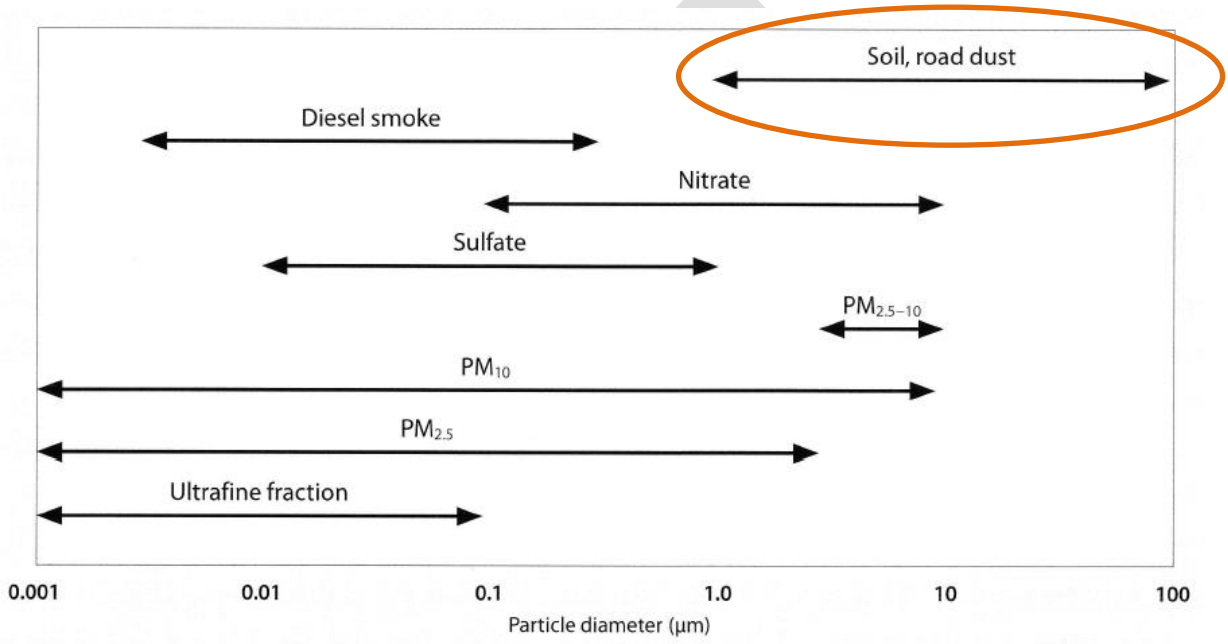

Figure 1 Size range of airborne particles [Source: WHO, 2006]

Dust from unsealed roads creates safety and health hazards for road users and those living or working nearby, as well as economic costs from reduced productivity of land, crops and livestock, and increased road and vehicle maintenance costs.

Dust has long been known as a problem for people living near to unsealed roads due to:

- dust landing on rooves and contaminating collected drinking water
- dust covering gardens and household property
- dust causing health problems for those with breathing disorders

Historically, dust was not regarded as a serious health hazard. It is only since the turn of this century that the full health impacts of suspended particles (dust in the air) have

[1] Micron is the shortened name of micrometre (1 x 10^{-6} metres)

[2] World Health Organisation, (2006). *Air Quality Guidelines Global Update 2005*. Copenhagen. Denmark.

begun to be recognized. They were summarised in a 2003 study, Health Effects of PM10 in New Zealand, as: coughs, asthma symptoms, bronchitis, respiratory illness and mortality.[3]

There is now widespread scientific consensus that short term and long term exposure to particulate pollution causes adverse health effects, ranging from subclinical functional changes (e.g. reduced lung function) to symptoms (increased cough, exacerbated asthma) and impaired activities (e.g. school or work absenteeism) through to doctors' or emergency room visits, hospital admissions and death (WHO, 2006). The effects, in terms of escalating severity, are described as increased visits to doctors for many individuals, hospital admission for some individuals and death for a few individuals.

More recently, the International Agency for Research on Cancer classified particulate matter as carcinogenic based on an increased risk of lung cancer (IARC, 2013).[4] New research further indicates particulate matter is associated with artherosclerosis, adverse birth outcomes, childhood respiratory disease as well as Alzheimer's disease and other neurological endpoints, cognitive impairment, diabetes, systemic inflammation and aging (WHO, 2013 and 2016).[5]

Although all individuals repeatedly exposed to dust in the air will develop some health effects, those most at risk will be the elderly, the very young, the unborn, those with pre-existing heart or lung conditions, those with asthma or diabetes, and smokers. Many communities affected by high levels of dust pollution from traffic on unsealed roads tend to comprise high proportions of these already particularly at-risk groups.

There is a clear need to establish the health, safety, social and economic costs of dust from unsealed roads on human health and on the environment in New Zealand.

[3] Ministry for the Environment, (2003).

[4] IARC, (2013). Press Release No. 221, 17 October 2013.

[5] WHO, (2013). *Review of evidence on health aspects of air pollution – REVIHAAP Project*. Technical Report. Regional Office for Europe.Copenhagen. Denmark.

WHO, (2016). *Available evidence for the future update of the WHO Global Air Quality Guidelines*. Meeting report Bonn, Germany 29 September – 1 October 2015. Copenhagen. Denmark.

Appendix B – Dust Mitigation

It is illegal to apply used oil to roads as a dust suppressant. This was a common practice in the past. A 1997 study by the Ministry for the Environment found that used engine oil contains zinc, aluminium, cadmium, chromium, lead and copper, as well as polycyclic aromatic hydrocarbons (PAH) known to be carcinogenic. Using used oil to suppress dust involved these potentially more harmful contaminants binding to dust particles. When, after the lapse of sufficient time, the dust particles are transported into waterways or projected into the air, they carry these contaminants to waterways, rooves, gardens, pastures, animals and ultimately people.

One simple, and cost effective, mitigation option is to impose a reduced speed limit (emissions of dust being proportional to the number, weight and speed of vehicles on unsealed roads). However, this is only effective if implemented and enforced.

~~The cheapest dust suppressant is water, but its effectiveness can last from half a day to half an hour, depending on the traffic and the weather. Proprietary dust suppressants are being introduced to the market, ranging in cost from $5/m2 to $16/m2 and having an effective lifespan of from about five months to up to five years.6 The most effective long-term method of dust suppression is to seal the road, but this costs about $150,000 per km (or about $30/m2).7~~

~~The cost-benefit of these methods of mitigation needs to be considered carefully. The cheapest per m2 application, applied annually for a decade, would cost more than the likely cost of sealing the road and would deliver benefits lasting only a few months each time. Sealing critical sections of road may deliver a more cost-effective solution over the life of the asset. The longer-term benefits from the effects on reduced health costs, and social and economic benefits to the communities and the road users, would need to be taken into consideration in preparing a business case, too.~~

[6] Please provide reference for these costs?

[7] Please provide reference for these costs?

AGENDA

2 Memo regarding new research into health effects of road dust

Memorandum

To:	Jamie Cox (WDC) and Tom Simonson (LGNZ)
Organisation:	Convenors: Road Dust Working Group (Road Controlling Authorities)
Date:	31 October 2017
From:	Louise Wickham
Re:	New study: road dust and mortality

Dear Jamie & Tom,

On behalf of the Ministry of Health, please find attached a memo explaining some new research on the health effects of road dust presented at the conference of the International Society of Environmental Epidemiology in Sydney last month.

I welcome questions and discussion.

Regards,

Louise Wickham
Director and Senior Air Quality Specialist

New research into health effects of road dust

Researchers in Canada found a significant association between mortality and the coarse fraction of particulate matter (PM) attributed to road dust (Hong *et al.*, 2017).

The epidemiological study statistically analysed daily levels of PM in seven communities against daily mortality over the period 2003-2015. It found that an 8.6 µg/m^3 increase in coarse fraction particulate matter ($PM_{10-2.5}$) was associated with a 3.1% [95% confidence interval 0.8, 5.4] increase in non-accidental mortality during the road dust season – when adjusted for $PM_{2.5}$ (i.e. possible confounding effects of $PM_{2.5}$ removed).

The results suggest different impacts of different PM fractions by season, which in turn suggests different sources of particulate matter have different impacts. Few other studies have considered only the coarse fraction of PM attributed to a specific source.

Background

Particulate matter less than 10 and 2.5 microns in diameter (PM_{10} and $PM_{2.5}$) are key size fractions from a health perspective. This is because they are sufficiently small to penetrate the thoracic region of the lung (PM_{10}) and have a high probability of deposition in the smaller conducting airways and alveoli ($PM_{2.5}$). $PM_{2.5}$ can also cross the blood-gas barrier and transport around the body causing adverse cardiovascular effects (Du *et al.*, 2016).

The US EPA estimates $PM_{2.5}$ is only 10 per cent of PM_{10} in fugitive dusts arising from unsealed roads (US EPA, 2006). Further, although many studies have documented the serious health effects associated with $PM_{2.5}$ and PM_{10}, the effects of the coarse fraction ($PM_{10-2.5}$) are still under debate.

Implications

This new study focusing on the coarse fraction of particulate matter ($PM_{10-2.5}$) appears sufficiently robust to be a welcome addition to the scientific literature. It directly addresses a known gap in the data on health effects associated with the coarse fraction generally, and more specifically, road dust.

In New Zealand, most air quality monitoring programmes measure mass concentrations of PM_{10}. Like Canada, the Ministry for the Environment is considering changing to measurement of $PM_{2.5}$ instead (PCE, 2015) because studies have typically found that exposure to $PM_{2.5}$ is more strongly associated with cardiopulmonary health outcomes than PM_{10} (EPA, 2009; World Health Organisation Europe, 2013).

As noted in the paper, the acute and chronic health effects associated with exposure to the coarse fraction (PM_{10}) remain unclear. The researchers therefore, recommend that Canada maintain PM_{10} monitoring networks to provide feedback for future research and dust mitigation programmes.

It is apparent that it is not a matter of either PM_{10} or $PM_{2.5}$, but rather both are needed (at least until the research findings around health effects and the coarse fraction of PM are clearer and their implications in the NZ context have been determined).

Details

The study followed a time-series design using Poisson regression with analyses stratified by three seasons:

- Residential wood smoke in winter (Oct – Feb)
- Road dust in spring (Mar – Apr)
- Wildfire smoke in summer (Jul – Aug)

The study adjusted for temperature, relative humidity, influenza periods, year and month, day of the week and holidays. The researchers fitted two additional models to control for any residual confounding; one for $PM_{2.5}$ adjusted for $PM_{10\text{-}2.5}$ and one for $PM_{10\text{-}2.5}$ adjusted for $PM_{2.5}$. They also undertook a random effects meta-analysis to establish a pooled estimate.

The total population was 532,210 in seven communities for a total of 14,471 days of data. The average daily mortality ranged from 0.1 to 0.2 per 10,000 and dispensations of salbutamol sulfate (asthma medication) ranged from 3.1 to 5.4 per 10,000.

Median daily concentrations of PM_{10}, $PM_{2.5}$ and $PM_{10\text{-}2.5}$ were similar to levels in New Zealand, ranging from 13.4-18.2 $\mu g/m^3$, 4.7-6.5 $\mu g/m^3$ and 6.3-11.9 $\mu g/m^3$ respectively.

Specific findings were:

- An increase of 8.6 $\mu g/m^3$ in coarse fraction particulate matter ($PM_{10\text{-}2.5}$) was associated with a 3.6% [1.6, 5.6] increase in non-accidental mortality during the road dust season. This association reduced to 3.1% [0.8, 5.4] after adjustment for $PM_{2.5}$.
- Null result for $PM_{10\text{-}2.5}$ and dispensations of salbutamol sulfate during the road dust season.

The coarse fraction results for mortality during the road dust season are consistent with a recent study in Stockholm, Sweden (Meister *et al.*, 2012). However, unlike this study the Swedish study association was not statistically significant after adjusting for $PM_{2.5}$.

Saharan windblown dust studies have observed a similar phenomenon with stronger associations on days with sandstorms for $PM_{10\text{-}2.5}$, but not $PM_{2.5}$ (Mallone *et al.*, 2011; Perez *et al.*, 2008).

The null results for the respiratory indicator (salbutamol sulfate dispensations) during the road dust season are generally consistent with other studies (Pekkanen *et al.*, 1997, Penttinen *el al.*, 2001). One study did show a weak increase in cough during road dust season when averaged over 4 days (Tiittanen *et al,*, 1999). The researchers speculated, “Although the literature specific to road dust is very limited, the exposure may be more strongly associated with mortality than with respiratory outcomes.”

References

Du Y., Xu X., Chu M., Guo Y., Wang J., (2016). Air particulate matter and cardiovascular disease : the epidemiological , biomedical and clinical evidence. *J of Thoracic Disease*. Jan; 8(1): E8–E19

Hong Kris., King Gavin., Saraswat Arvind., Henderson Sarah., (2017). Seasonal ambient particulate matter and population health outcomes among communities impacted by road dust in British Columbia, Canada. *J Air & Waste Mgmt Assoc*. May. https://doi.org/10.1080/10962247.2017.1315348

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AGENDA

3 Feedback from: Low Volume Roads Workshop

Discussion Points

For Dust Working Group: Friday 3rd November 2017

(Selected slides from companion presentation)

Greg Haldane and Jon Cunliffe

Feedback from: Low Volume Roads Workshop

- Low level of awareness of funding and tools
- Very difficult to get dust risk score that will qualify for funding – no point in applying?
- Dust risk tool needs to be recalibrated
- Business cases expensive to develop
- Worked examples of business cases needed
- Dust risk mapping needed to assist TLAs identify high risk areas
- Guideline for the use of the Risk Tool needed

Tools and Resources

- **Current**
  - Initial Dust Risk Tool
  - General Circular 16/04
- **Under development**
  - Risk Tool calibration
  - Dust Risk Mapping
- **Stakeholder Requests**
  - Worked examples of business cases
  - Guideline for the use of the Risk Tool

Tools and Resources - From LVR Workshop I

David Jones: University of California City and County Pavement Improvement Centre:

- www.ucprc.ucdavis.edu/ccpi
- Assessing Road Dust Risk by reviewing Road construction materials and properties (FUNKY chart).
- Mitigation toolbox – Chemical selection guide – online tool
- Guidelines available. Eg.
  - Unpaved Road Dust Management: A successful Practitioners Handbook

Tools and Resources - From LVR Workshop II

- Economic assessment tools
  - High economic value of unsealed roads was widely acknowledged
  - Quantified and mapped by Wairoa DC
  - Could be included and assessed in RAMM?
  - Further consideration and development of economic assessment tools would be beneficial
- All LVR 2017 workshop presentations will be available on the website within 10 days

AGENDA

4 Unsealed Road Dust Risk

Unsealed Road Dust Risk

GIS Mapping Tool and Prioritisation

Greg Haldane

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What is the unsealed road dust risk tool?

- a GIS tool for calculating and displaying unsealed road dust risk
- uses data inputs currently held by the NZ Transport Agency
- hosted on the NZTA geospatial platform

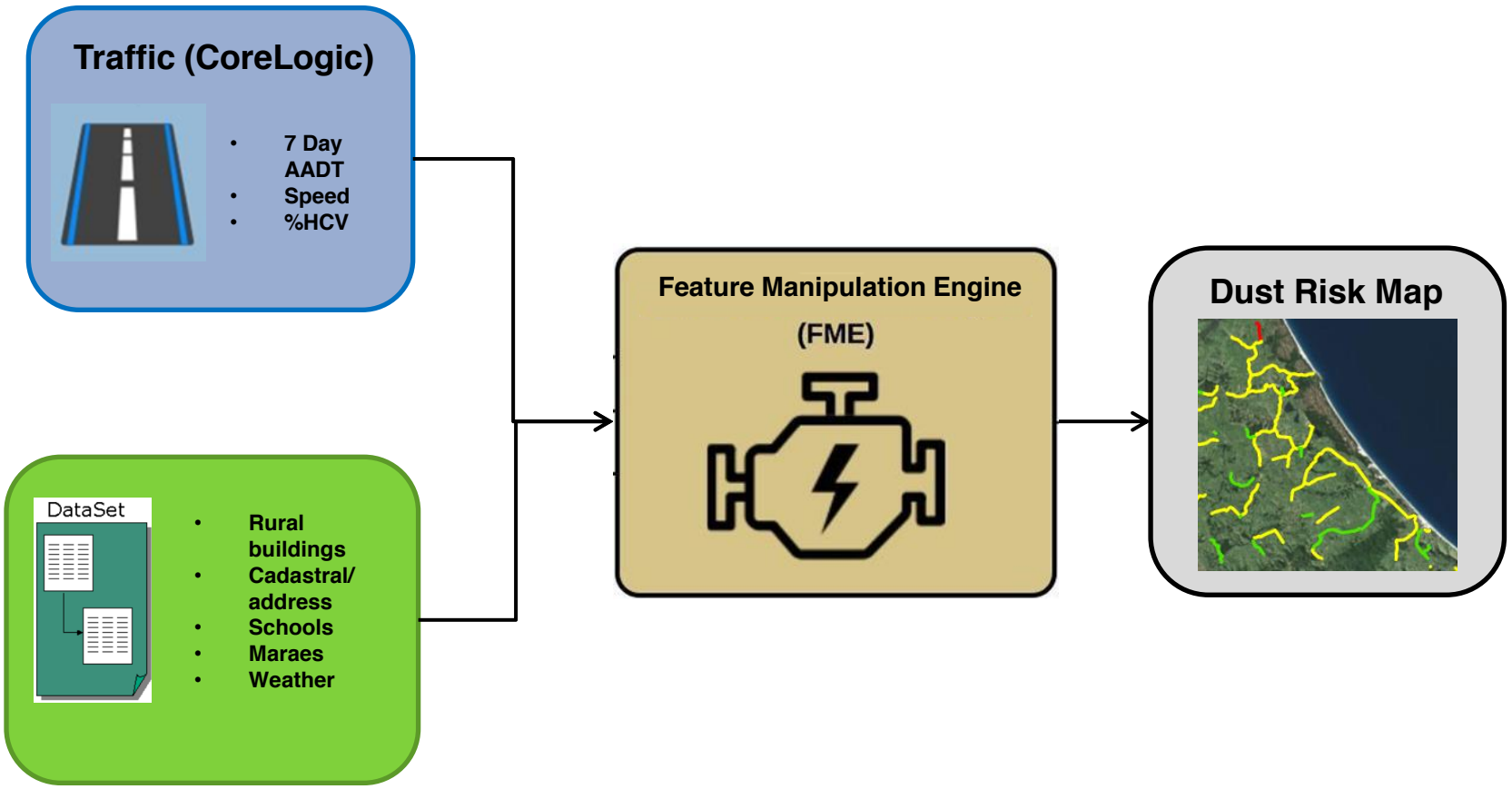
Tool Phases

1. Pilot study on Territorial Authority – current phase
2. Preparation of dust risk maps and scores for four nominated regions
3. National coverage

Tool Inputs

- Annual average daily traffic (AADT) data
- Territorial Authority boundaries
- Addresses
- Buildings
- Schools / Maraes
- Median annual average wind speed

Tool conceptual model



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Tool Calculations

- Dwelling locations
  - Rural address points are not commonly at the actual dwelling location, but in the centre of the parcel
  - Automated process to move to nearest building if the building point is closer to the road than the address point
  - Some dwellings unaccounted for due to building points not covering urban areas: in these areas, amended method to use address points only
- Wind speed categorisation – low, medium, high
- Applying dust risk scores – low, medium, high dust risk categories for each road section

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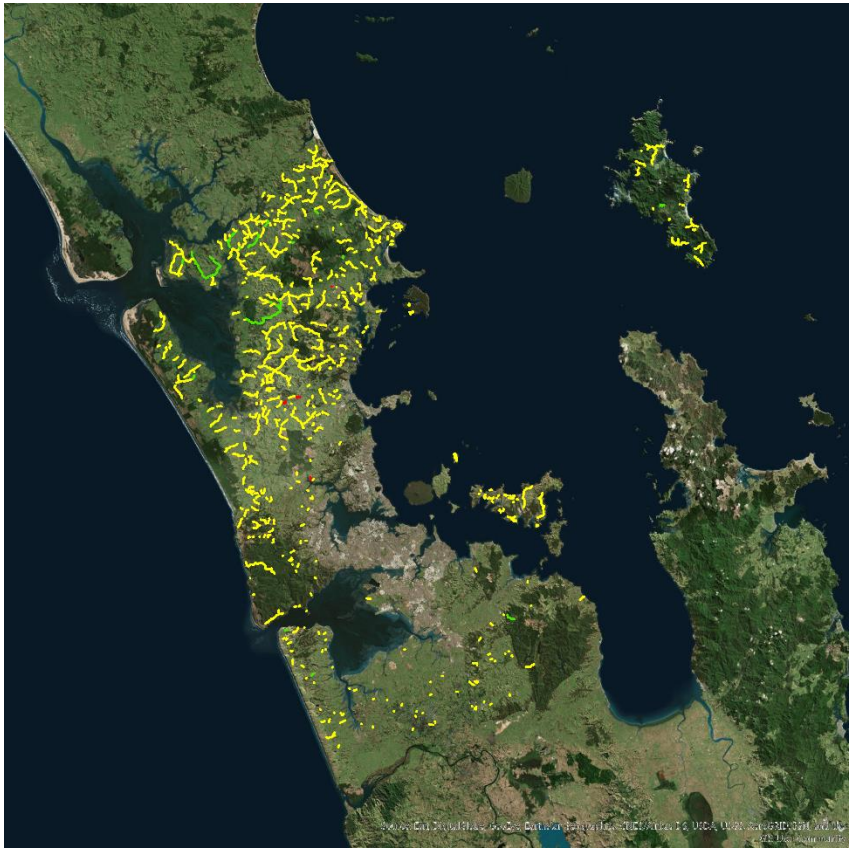
Tool Outputs

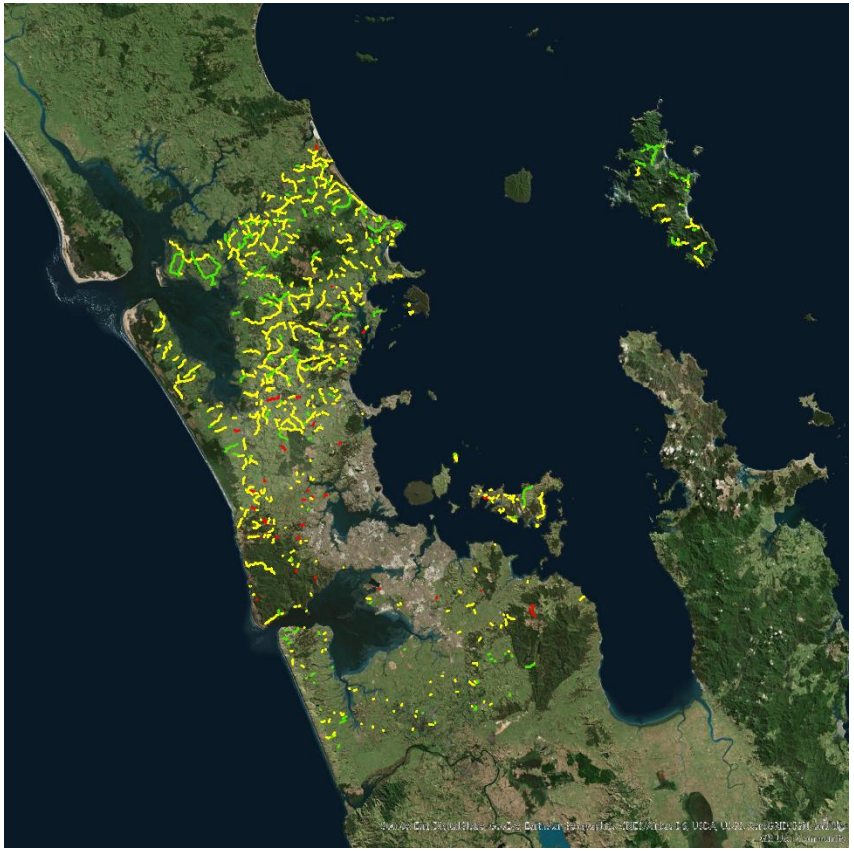
- Currently at pilot study stage: at Auckland region level but to be rolled out nationally
- Accuracy assessments
- Tool validation

Tool validation/outputs

Auckland Council Dust Risk Categories



NZTA Tool Dust Risk Categories



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Tool validation/outputs

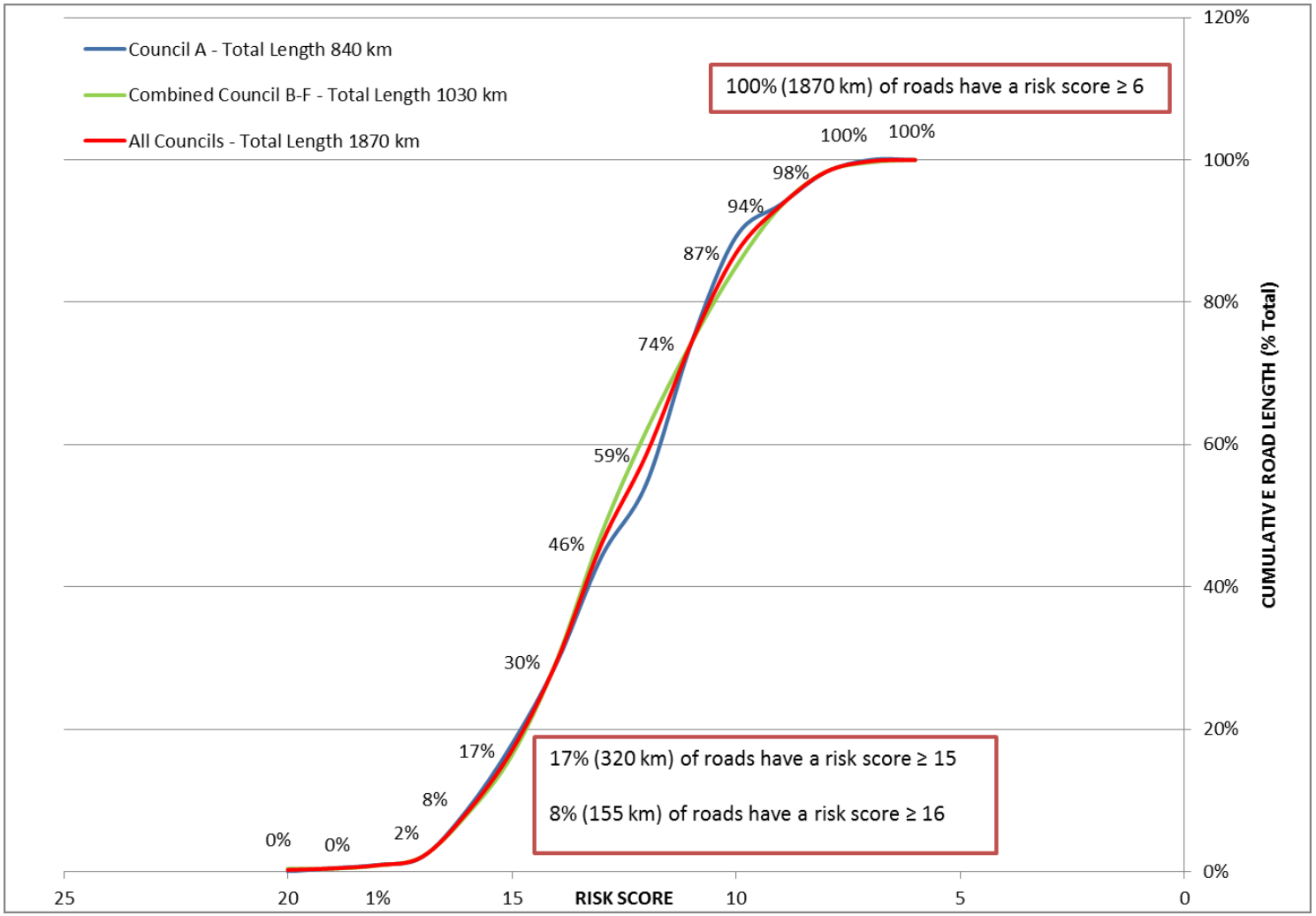
Auckland Council Dust Risk Categories

NZTA Tool Dust Risk Categories

Potential tool uses

1. Strategic (business) case evidence - first-order estimate of the dust risk and social cost (health)
2. Communications and engagement with stakeholders/decision makers
3. Calibration of risk categories (NZTA circular)
4. Land-use planning
5. High-level regional prioritisation for dust mitigation

The “S” curve



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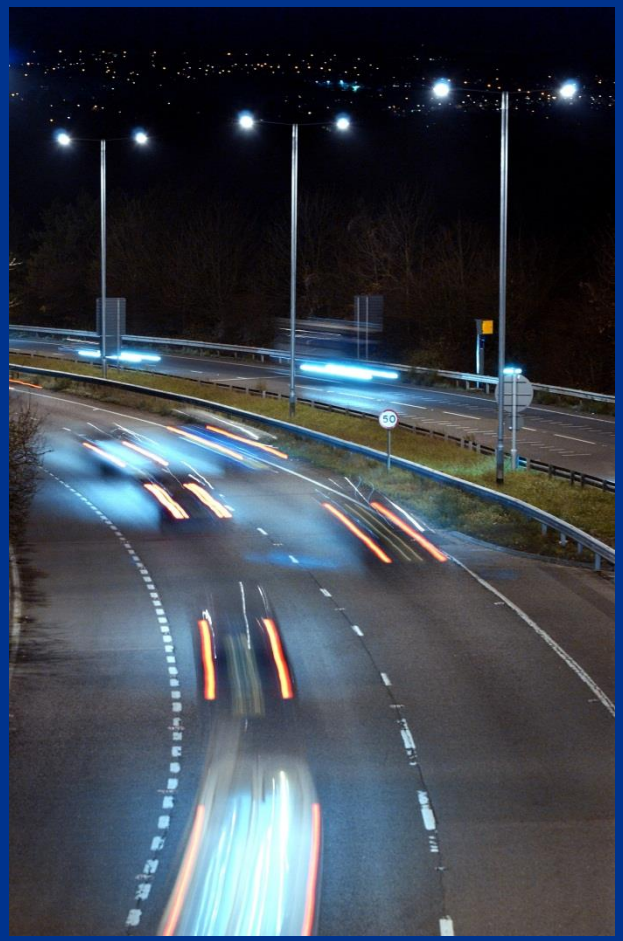
Discussion



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Mean annual wind