TRANSPORTATION FAILURES – ROAD SAFETY

LESSONS TO BE LEARNT

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te ao rangahau

CONTENTS

This document summarises the webinar developed and led by Jeanette Ward, Glen Koorey, and Bridget Burdett (**Transportation Group NZ**) for Engineering New Zealand in 2021.

The Transportation Group has about 1000 members and runs branch events, an annual conference, has subgroups on specific topics, and has regular publications.

1: INTRODUCTION

Failures in transportation engineering can take many forms.
For example:

- Loss of life or serious injury
- Loss of time
- Loss of or damage to property
- Loss of normal levels of service or service quality (all modes).

This summary looks at issues with road safety, resulting in loss of life or serious injury, and the potential lessons for us from moving away from a traditional approach (based on improving crash/injury data) to an approach based on keeping people safe and healthy.

2: WHAT IS A FAILURE?

In transportation terms, for engineers, failure doesn't need to be a specific event.
It can also be seen as a "lack of success".

At least four types of failures can occur in transportation projects.

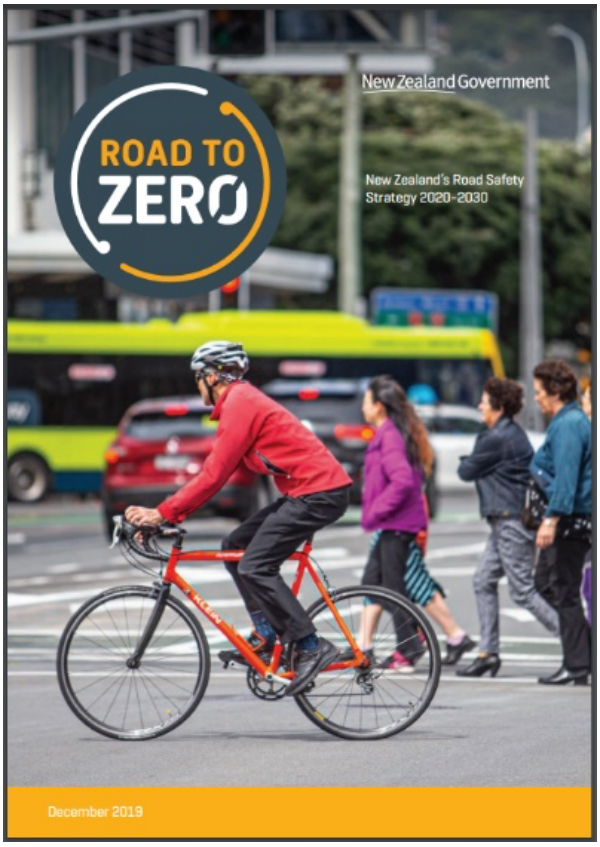
1. **Objectives are not met** e.g. Insufficient traffic on toll road/bridge/tunnel.
2. **Objectives are met but with undesirable side-effects** e.g. Traffic noise from new motorway.
3. **Inappropriate objectives** e.g. Economic evaluation prioritises travel time over lives.
4. **Design failures** e.g. Slip bolts on break-away posts for signs.

Figure 1: Road to Zero Vision

People being killed or seriously injured in road crashes is a serious failure.

On average, one person is killed every day on New Zealand roads and another seven are seriously injured.
Waka Kotahi (NZ Transport Agency) says deaths or serious injuries should **not** be an inevitable cost of travelling. Their Road to Zero Road Safety Strategy (2000-2030) sets out a vision for a New Zealand where **no one** is killed or seriously injured in road crashes. It outlines seven guiding principles and five key focus areas:

- infrastructure improvements and speed management
- vehicle safety
- work-related road safety
- road user choices, and
- system management.



*See **https://www.transport.govt.nz/area-of-interest/safety/road-to-zero/***

3: CURRENT MEASURES OF ROAD SAFETY

Traditionally our transportation engineering on road safety has been focussed on crash and injury data, and how to reduce injuries and fatalities. Road safety is measured and assessed by:

1: DATA SETS

Some of the key sources of data we use include:

- Records of crashes attended by Police through the Crash Analysis System (CAS)
- Hospital admissions (Ministry of Health = MoH))
- Injury treatment details from ACC

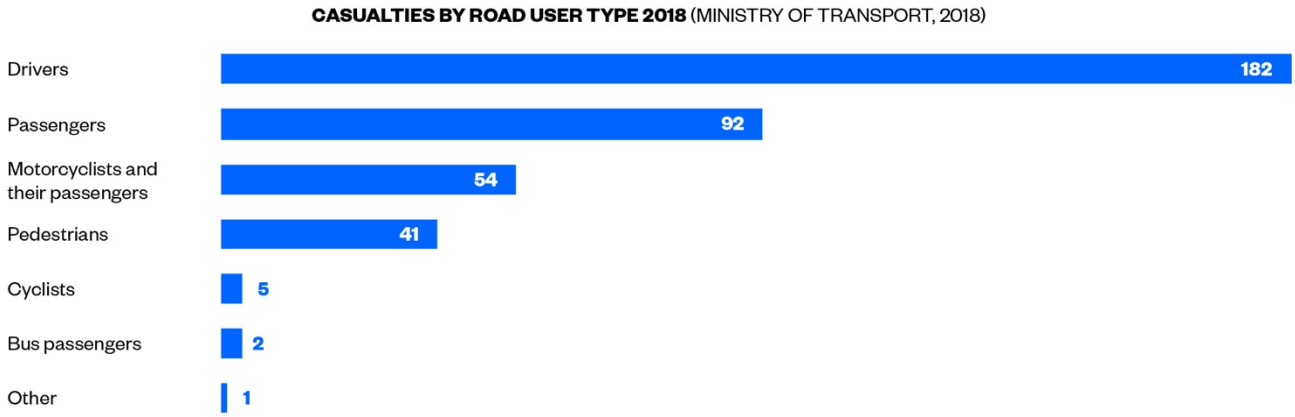
2: ANNUAL REPORTING

Annual reports of our transport agencies also provide key information.

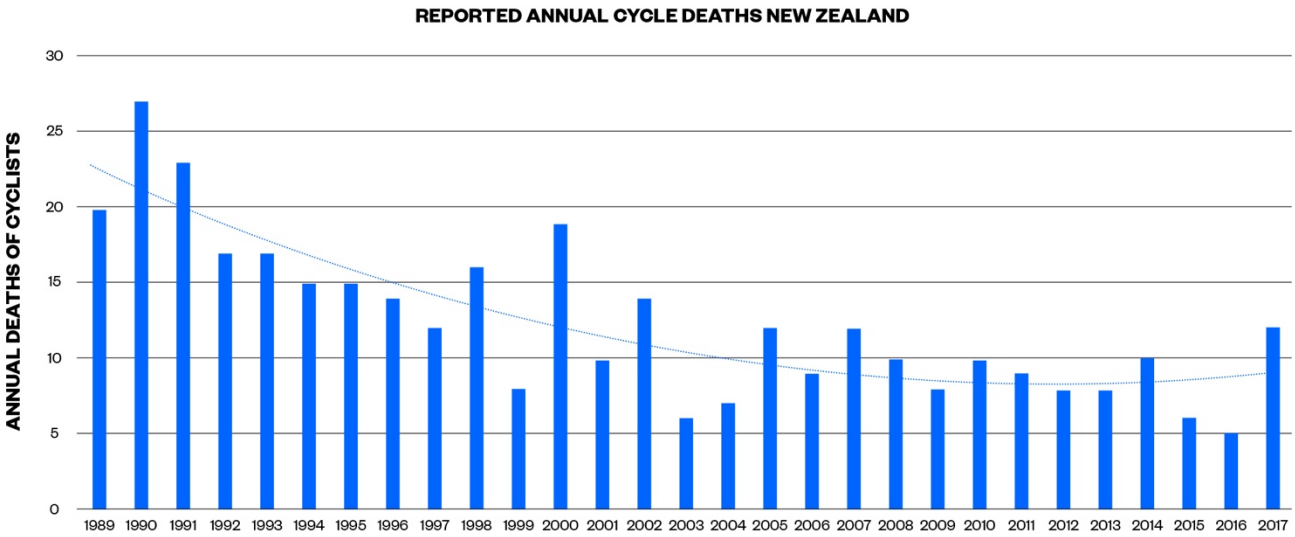
- Ministry of Transport (MOT) provide annual crash statistics (CAS data)
- Road Controlling Authorities (RCAs) also provide data.

FOLLOWING ARE SOME EXAMPLES

Example: Casualties by road user type

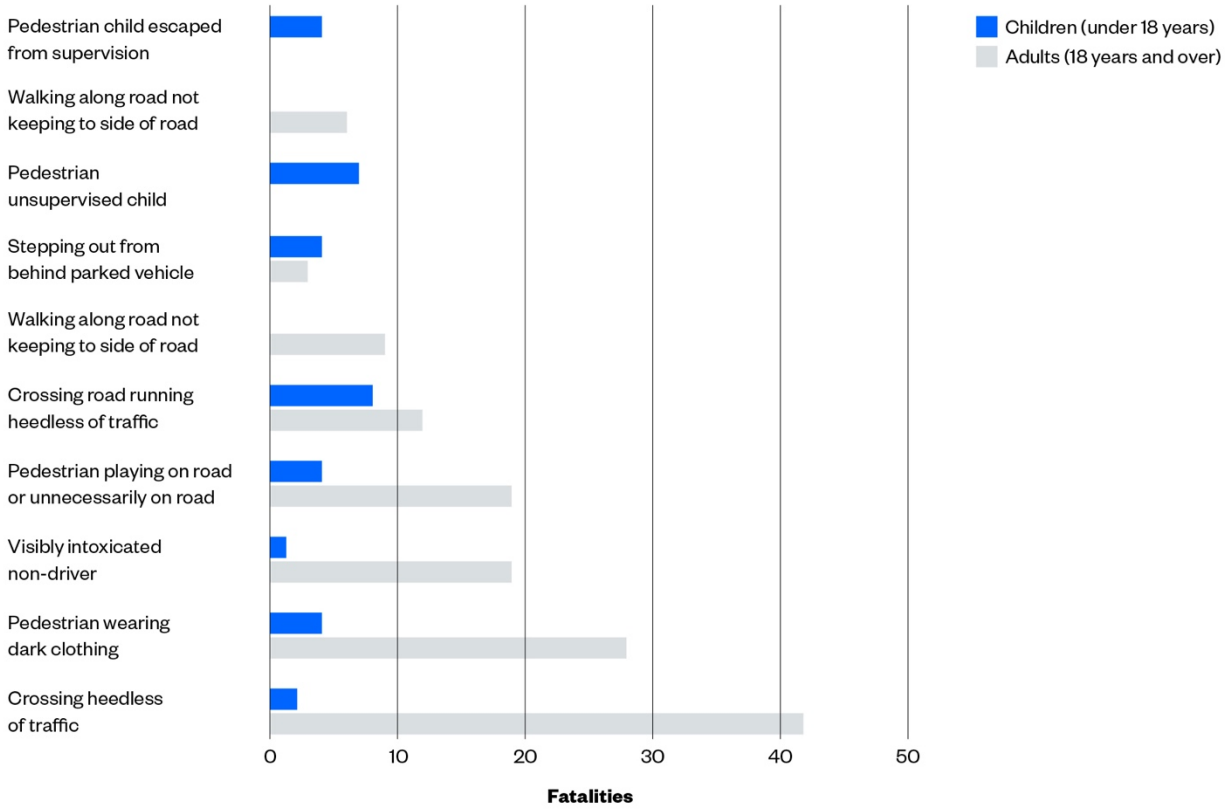


Example: Numbers of crashes (year/location)

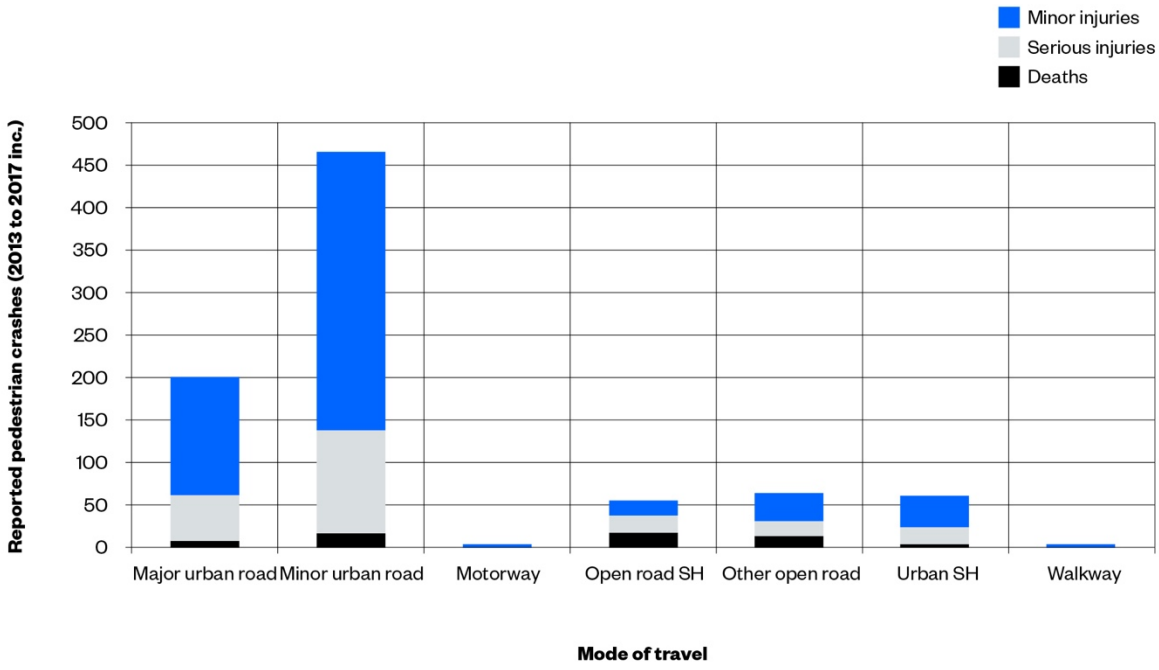


Example: Crash factors

FIGURE 8: TEN MOST FREQUENT PEDESTRIAN FACTORS CONTRIBUTING TO A FATAL CRASH

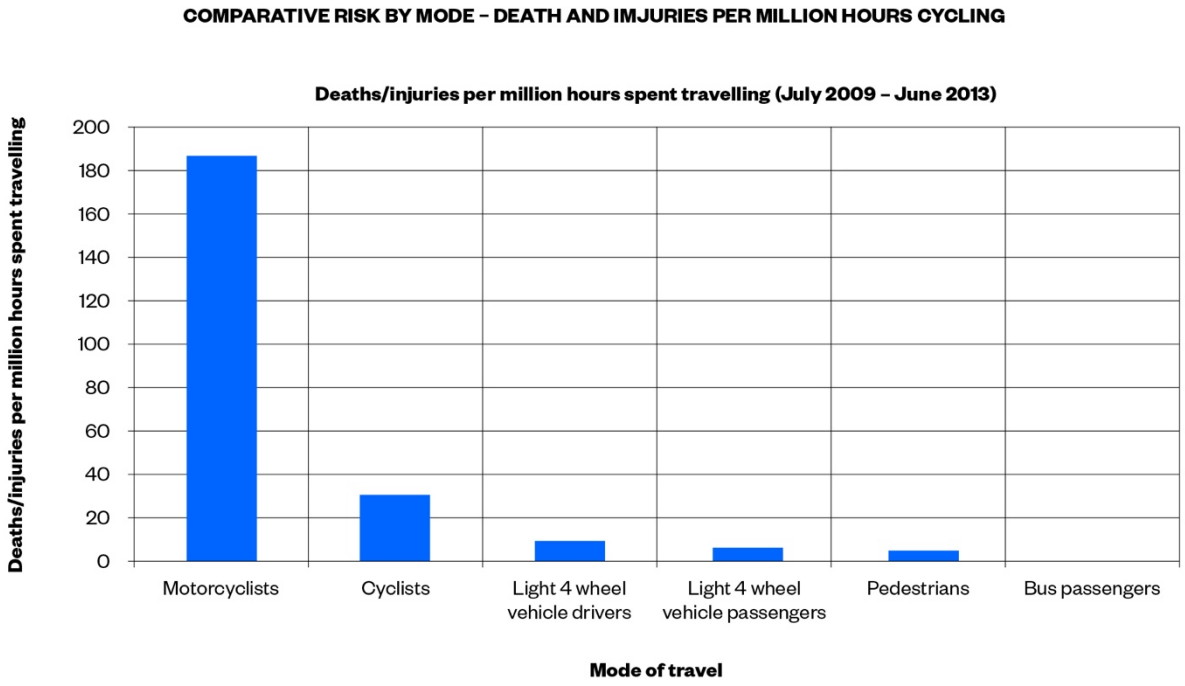


Example: Location and severity



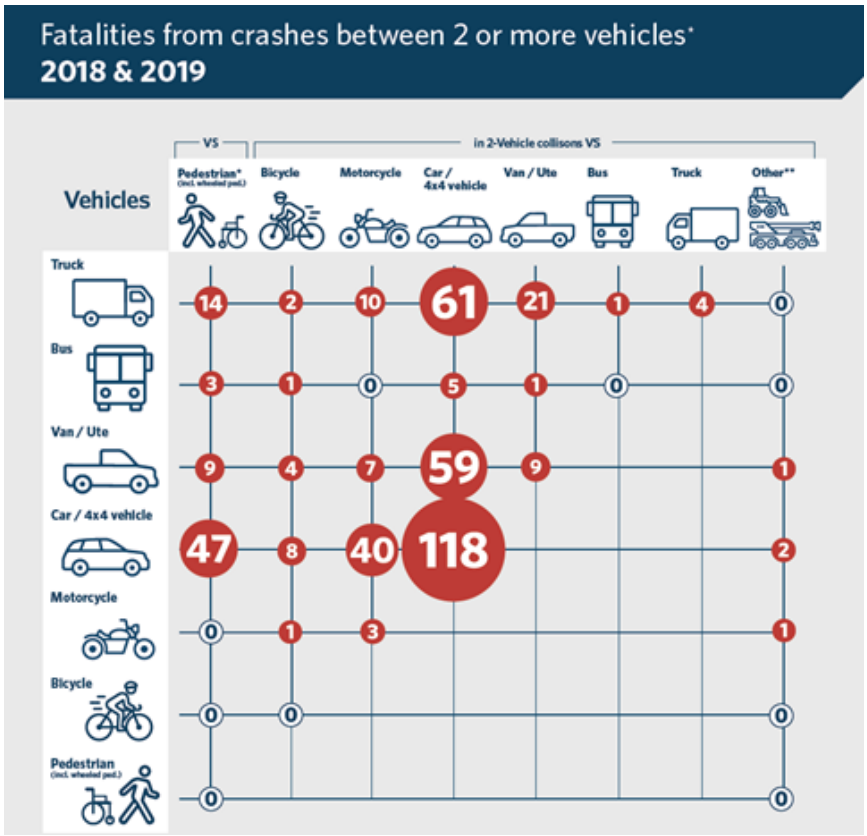
Example: deaths and injuries by risk

(Note: Cyclist and pedestrian risk is actually a bit lower, because the MoT Household travel survey underestimates the amount of cycling and walking - because it overlooks many recreational trips.



Example: fatalities from crashes between two or more vehicles.

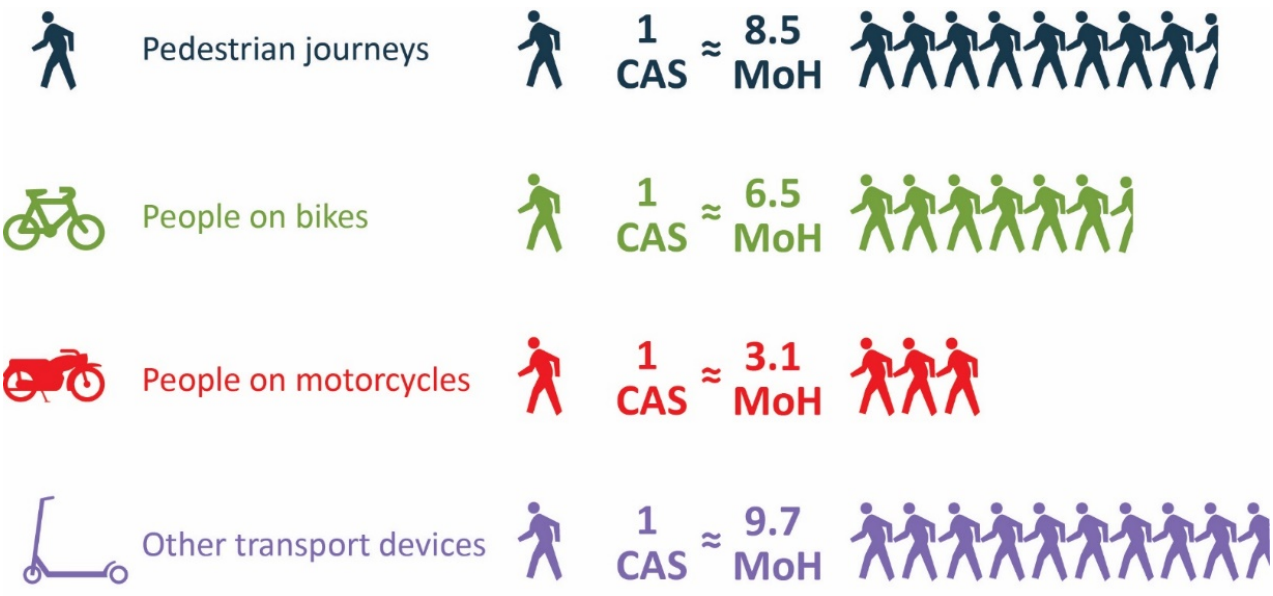
(Note: Car to car is the highest type of incident)



While transport-focused datasets like CAS can provide a lot of specific detail about the nature of road crashes, they miss many crashes that are not reported to police or that do not involve a motor vehicle. For example, tripping on pavement or falling off a scooter may not be reported to police but may require medical attention.

These disparities can be seen when compared with hospital admission data and are particularly an issue for more vulnerable transport users such as pedestrian and cyclists. The graph below compares the statistics from Police (CAS) vs admissions to a hospital (MOH).

Example: Auckland vulnerable transport user serious injuries (2016-19) (Note: Reasons for the disparity: (1) Under-reporting to Police (2) Not capturing non-motor-vehicle injuries in CAS)



3: PROJECT ASSESSMENTS

Project assessments of transport facilities are also a current method of capturing safety failures.

- In-house design checks and reviews are the most common method of assessing the safety of a transport project. As you work through a project it is also appropriate to have the work peer reviewed, before delivery to clients, contractors, and other stakeholders, depending on the complexity and scale of the project.
- Road safety audits are also common to assess the potential for various facility features to contribute to an injury crash. An audit is usually undertaken by a suitably experienced independent party, at the concept design phase, detailed design, and post-construction and is a chance to pick up any safety issues and rank these appropriately.
- Safe System Assessments undertaken by a suitably experienced team are less common and offer another way to look at a design from a safety perspective. They identify the aspects of a facility that affect the exposure to, likelihood of, and severity of different types of crashes. These assessments are becoming more common as they focus on safe system outcomes and can be undertaken at various stages as the project develops. They do not replace a peer review or Road Safety Audit
- Non-Motorised User Audits are a review of a transport project regarding the travel needs of non-motorised users (NMUs). NMUs are considered to include pedestrians, cyclists and equestrians. These audits are not commonly used in NZ as the procedures are not finalised (they remain Interim) or added to project development requirements.

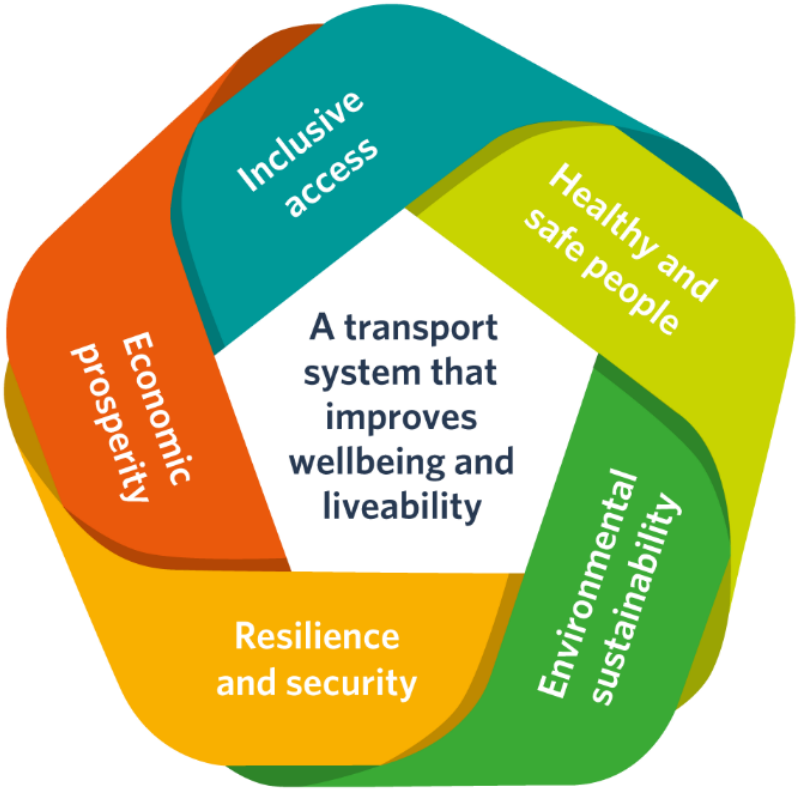
Despite these common audit and review tools, problems often remain in the final implementation, resulting in injuries and even deaths. This calls into question the relevant specialist training of the personnel used for these audits/reviews and the final decisions made by RCA clients regarding whether to implement some of the recommended changes.

4: ALTERNATIVE METRICS

Simply measuring the numbers of road deaths and injuries (D&Is) may not always be the best safety metric. There are other ways to measure the safety of a transport project, which can give us a more holistic view of its effects.

Think about what else can affect road safety, including effects on:

- Environmental and sustainable outcomes
- Accessibility for a wide range of people
- Public health and wellbeing
- Local economy



See https://www.transport.govt.nz/area-of-interest/strategy-and-direction/transport-outcomes-framework/

Ministry of Transport's Outcomes Framework describes a 'transport system that improves wellbeing and liveability'.

"To help government and the transport sector take a strategic approach, we developed the Transport Outcomes Framework, which sets a purpose for the transport system centred around the wellbeing of New Zealanders and the liveability of places. It outlines 5 outcome areas to contribute to this purpose: inclusive access, healthy and safe people, economic prosperity, environmental sustainability, and resilience and security. The Transport Outcomes Framework clarifies for everyone involved what we are aiming to achieve, why this is important and how we will work together to achieve our goals.

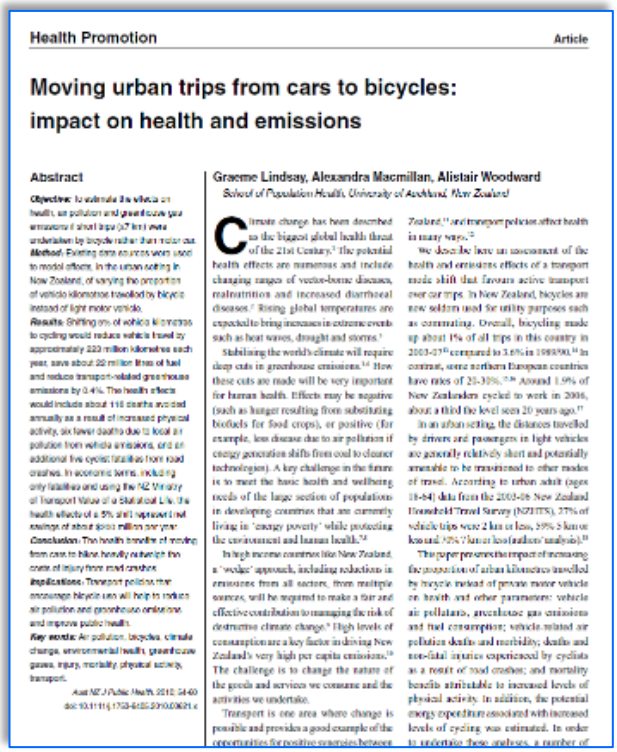
As engineers, we should be considering and balancing these five outcome areas for each project

EXAMPLES OF ACHIEVING OUTCOMES OF 'HEALTHY AND SAFE PEOPLE'

Taking one "outcome area" of the framework, to achieve 'Healthy and safe people', requires us to change our approach and thinking as engineers.

1: Health versus safety

There are potentially competing objectives, as we want more people to take up active modes like walking and cycling (which are beneficial for health), but more walking and cycling may lead to more deaths and injuries, since pedestrians and cyclists are more vulnerable on the road.



Health Promotion Article

Moving urban trips from cars to bicycles: impact on health and emissions

Abstract

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So how do we reconcile this? **Our traditional approach** is not to encourage these modes of transport (and therefore reduce death and injury). However, **current thinking** is that the health benefits outweigh these safety losses.

Health data support the current thinking. *Lindsay et al (Australian/New Zealand Journal of Public Health, vol. 35, 2011)* showed that the effect of shifting 5% of NZ vehicle-kms to cycling:

- Led to an **additional 5** cyclist fatalities per year from road crashes
- **But overall, led to 116 fewer** deaths per year due to increased physical activity and **6 fewer** deaths due to a reduction in air pollution (vehicle emissions).

2: Safety versus efficiency

This is a traditional dilemma where slowing traffic down is good for reducing injuries but regarded as 'bad' for travel times. Many safety projects are often rejected on this basis.

But the **new approach** starting to emerge is the view that slowing speeds down to the calculated 'safe and appropriate speed' is a **good** thing (despite effects on travel times) and for some locations (e.g minor streets), effects on travel times are insignificant anyway.

3: Safety versus danger

Safety projects are often prioritised by crash and injury numbers, but what if no one uses a facility because it's ***too dangerous***?

How can we measure the latent demand? Identifying these sites may require other data sources such as:

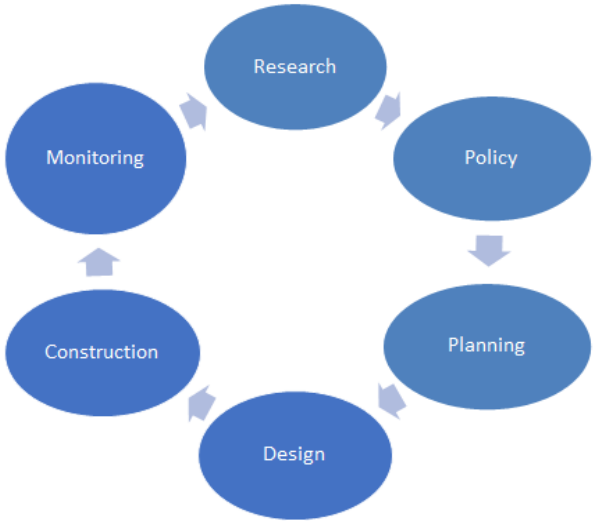
- feedback from local individuals
- review or audits of facilities (Safe System Assessment?)
- crash prediction models proactively flagging sites.

WHAT DOES THIS MEAN FOR OUR 'SYSTEMIC' INDUSTRY APPROACH?

Road safety is a hard topic for engineers. We haven't been able to stop people dying on our roads every day, and there are many complexities and constraints.

A systemic industry approach based focused solely on metrics like crash and injury data is pigeon-holing our thinking. It does not capture all the aspects of the system and ignores data and research from other disciplines.

The table below compares these ways of thinking.



Process	**Crash/injury data approach**	**Barriers to overcome so we can take a multi-disciplinary approach**
Research	Patterns and crash prediction models e.g. for an intersection or pedestrian crossing, inform transportation project and investment.	• Transport and health are linked, and research exists to confirm this, however the two sectors should work together to achieve better safety outcomes for society. • We rarely consider how perceptions of safety affect walking, cycling, and public transport. This requires input from a range of professionals and engaging with the community
Policy	National crash numbers and patterns.	• There is a limited transport budget for recreation trips, with solely a health benefit. The 'journey to nowhere' like a run around the block is not a transport model input.
Planning	Policy and local crash data help to set priorities.	• It's difficult to prioritise for walking and cycling improvements without good measures of the *potential* walking and cycling volumes and *potential* health benefits.
Design	Crash outcomes inform design standards.	• Measures such as travel time savings for people in cars are widespread and powerful, with unfair design outcomes for different modes.
Construction	Crash outcomes inform construction standards inform policy.	• We rarely go back to check whether promised travel time savings were achieved. • We do not measure 'trips not made' due to severance effects of high-speed, high volume streets.
Monitoring	New patterns of crashes resulted in lessons.	

5: LESSONS TO BE LEARN

WHAT IS THE LESSON TO BE LEARNT? IT IS ABOUT LOOKING FOR NEW WAYS OF APPROACHING TRANSPORTATION PROJECTS TO MEET THE REQUIRED OBJECTIVES.

For example, to achieve the 'healthy and safe' objective of the framework, we may ask:

- Do we need more tangible connections between transport and health sectors?
- Are the health benefits of transport properly accounted for?
- How can we value the cost of a 'trip not made'?
- Are the values of 'life' in transport high enough?

We need to ask questions, promote discussion and share ideas, research, and results to help us achieve the objectives of Road to Zero. Ideas include:

- Diverting and reducing driving and traffic.
- Reducing single-occupancy cars.
- Acknowledging travellers who walk and bike (rather than drive) are happier and more efficient.
- Investigating how ride-sharing can support communities to keep people safe and mobile.

6: IMPLICATIONS FOR PRACTICE

This example of changing our objective, shows how we can bring 'new thinking' to our traditional 'systemic' industry approach.

- We can work in a more joined-up way with other disciplines and research, such as health, which encourages us to ask questions, share ideas and bring new solutions to the table.
- We can take a more holistic approach, which means we must learn and apply the technical details of engineering and the non-technical. In this example, we focussed on the outcome of healthy and safe people to help achieve the Transport Outcomes Framework. But we could also have focussed on the other outcome areas identified – inclusive access, economic prosperity, environmental sustainability, and resilience and security.
- We can research and draw on examples from our international community to see the innovative and fresh thinking they contribute and springboard off their research and results to make further improvements.

WHAT WILL YOU STOP DOING AND/OR START DOING?

New objectives in road transport to support healthy and safe lives show us that our designs and practice need to keep up with current and future thinking, and we encourage you to keep challenging your current practice.

This mindset applies to other changes in transportation (think driverless cars, electric cars, e-bikes, car-sharing services) and across other engineering disciplines.

7: REFERENCES

- **https://www.transport.govt.nz/area-of-interest/safety/road-to-zero/**
- **https://www.transport.govt.nz/area-of-interest/strategy-and-direction/transport-outcomes-framework/**
- **https://www.transport.govt.nz//assets/Uploads/Report/Road-to-Zero-strategy_final.pdf**