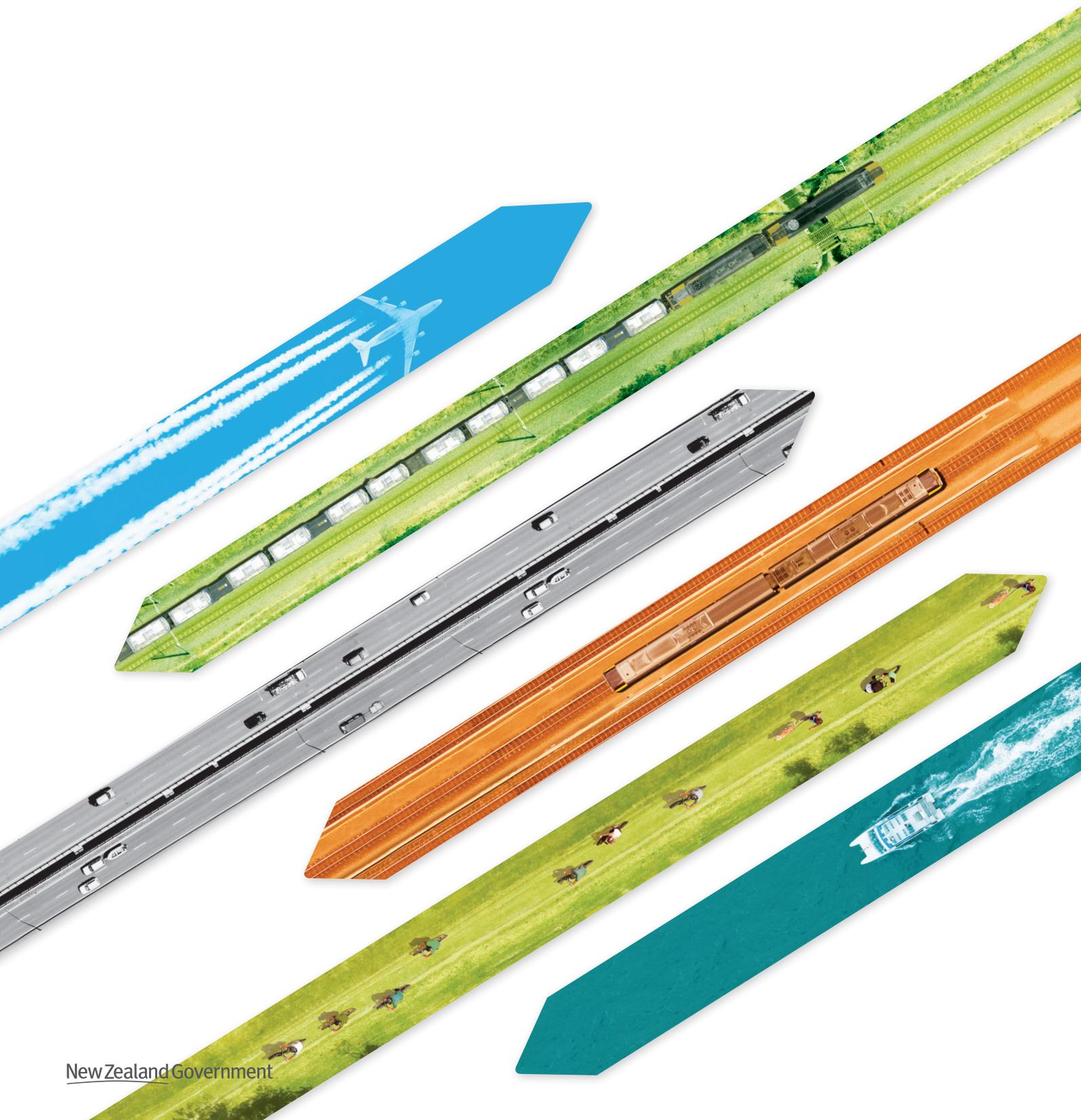


Regulation 2025

Scenarios summary and key findings

August 2016



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In 2025, how should we be regulating transport for the following decade?

How we regulate transport (through legislation, rules, guidelines, infrastructure, education, and other measures) has enormous impacts. It influences how people travel, including how swiftly, easily, and safely. It shapes movements of freight and economic growth. It affects quality of life in cities and regions. And it impacts on our health, as well as the health of our environment.

Regulations need to be forward-looking and responsive. But in times of flux, such as when technologies are rapidly changing and disrupting established customs, it is impossible to plan for a predictable future. Instead, we need to plan for different foreseeable, or possible, futures.

That is why these scenarios were developed. They are tools to explore future challenges and opportunities, and to act as testing grounds for designing future regulation. Each scenario looks at changes likely to be underway in 2025, and where these lead in the following decade.

Emerging insights informed by these scenarios are discussed in a separate document “Regulation 2025: Emerging Insights”. The final section of this scenarios summary document contains a selection of the findings that apply across the different scenarios.

Drivers of change

Our actual future will be shaped by many social, political, economic, environmental, and technological dynamics. These scenarios investigate the influence of two major drivers: *technologies* and *social attitudes*. Both of these will exert a strong influence on transport and regulation, but the nature of their influence is deeply uncertain. What we do know is:

Technologies will keep evolving rapidly.

We could be moving to a world where everything **seamlessly connects** electronically (regardless of brands, makes, or models).

...or...

Competition could lead to many incompatible standards and systems, that work in **silos** because devices do not speak the same “language”.

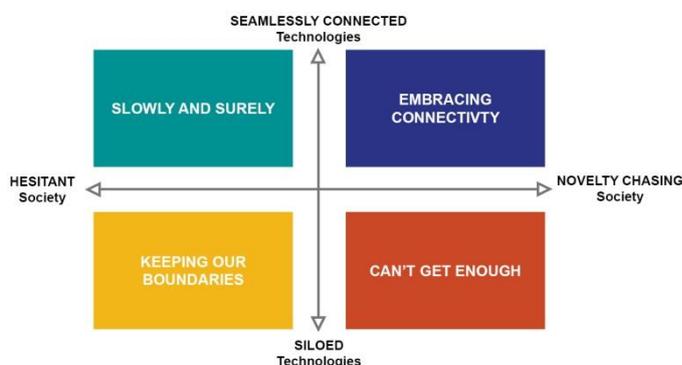
Choices will be shaped by what society accepts, and expects.

Many people could be slow to change, and **hesitant** when it comes to new technologies because of risks or insufficient benefits.

...or...

The allure of new technologies, and/or perceptions of their great benefits, could continuously lead people to be **novelty chasers**.

Combining the two extremes for each driver produces four scenarios. These four scenarios (labelled in the diagram below) let us explore how “fit for purpose” transport regulation could be designed from 2025 to 2035, if New Zealand moves in one of four different directions.



Each scenario includes:

- a short description of the prevailing **mood of future times**, and how we got there
- examples of **how movements of people and freight** differ in 2025-2035 compared to today
- what this could mean for **transport regulation**, including challenges and opportunities
- some **wider implications**.

Similarities and differences

These future scenarios share some common features. The primary aims of transport regulation in all four scenarios will be to improve:

- *safety* (e.g. a lower road toll)
- *equity* (e.g. affordable ways to access work and education)
- *economic efficiency* (e.g. smoother flows of goods and people), and
- *environmental stewardship* (e.g. lower greenhouse gas emissions).

Regulatory responses differ remarkably in each scenario. This is because each scenario is shaped by different attitudes and technologies, which lead to divergent challenges and opportunities.

Different attitudes and technologies also affect the range of regulatory tools available.

GLOSSARY

These future scenarios consider many emerging technologies that could be increasingly common by 2025, including:

Internet of Things / Everything

An evolution of the internet where everyday physical objects become electronically connected and can communicate with people, applications, infrastructure, and each other via sensors and networks.

Smart vehicles

Vehicles with technologies that assist driving, improve safety, and reduce travel time costs. The level of “smartness” can differ, including:

- technologies to wirelessly share information with other vehicles (e.g. data on traffic and hazards)
- technologies to share data with infrastructure (e.g. traffic lights)

Smart vehicles are currently being made in many parts of the world—all using different standards/languages.

Autonomous vehicles

Vehicles that are able to drive themselves, without human intervention. Vehicle automation can range from full autonomy, where no human intervention is required, to vehicles where human intervention may be required under certain conditions.

Smart infrastructure

Technology-enhanced infrastructure such as roads, bus lanes, railways, and traffic signals that can monitor and communicate with infrastructure users.

Vehicle platoons

A group of vehicles that can travel very closely and safely together at high speeds. Each vehicle communicates with other vehicles in the platoon, and is usually piloted automatically.

What these scenarios are *not*

None of these scenarios, including their regulatory regimes, describe preferred worlds or approaches planned today. Nor are they intended to be exhaustive. They are plausible descriptions of several possible futures, rather than predictions.

The prevailing moods described in each scenario do not (and never could) capture the wide diversity of New Zealanders living in each future. They simply reflect each scenario's dominant attitudes in society.

How to use these scenarios

These scenarios are designed to provoke further dialogue, thinking, and actions to shape future transport regulations.

By envisioning where New Zealand could be in 2025, and where we could be heading in the following decade, they enable us to make richer judgements about how to regulate transport for the future.

Although we have used our scenarios as a tool to think about the future of transport regulation, we encourage other organisations to use these scenarios as a template which can be adapted for other uses.

MORE INFO

For more information on the Transport Regulation 2025 project, including how these scenarios were developed and further implications visit: www.transport.govt.nz/regulation2025

The road to ride-sharing

“At first we weren’t sure about new technology and services, but we are seeing the light”

The Internet of Everything is a monument to human genius. It buzzes with boundless powers of imagination. It wows us with its wizardry. It’s also become one of the most disappointing things that we’ve ever created.

Anything we can see, feel, or touch can be “unified” via the internet. Bikes, buses, cars, cups, trucks, trees, toys, ships, shoes... you name it, it can connect. If it doesn’t, that just means no-one’s designed a clever way to do so yet.

“Technotopians” keep heralding the Internet of Everything as the next great leap in social/economic/conscious evolution. But the revolution keeps hitting limits. The barriers aren’t technical, they are human.

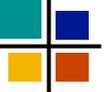
Most of us are sceptical about the benefits of connecting everything - and everyone - electronically. For one thing, it’s costly. It’s not just the price of replacing all our old appliances, machines, vehicles, and infrastructure with “smart” ones. It’s the ongoing cost of updating them every few years as interfaces age and software becomes unsupported. We rue the money we wasted on early tech that was unreliable and won’t “talk” with the latest systems. It makes more sense to buy unconnected stuff. Simple is wiser than smart.

Tech businesses keep trying to overcome our inertia, of course. They’ve solved our worries about technological lock-ins, and are boosting connectivity by co-operating on common standards. Devices of every brand, model, stripe, and colour integrate seamlessly. My vehicle of brand A can chat with your vehicle of brand C if it wants.

Despite many misgivings, connected things are becoming common. Sometimes we have no choice but to use them if we want to make life easier. The “weShare” system, offered by government and businesses, gives us plenty of sweeteners if we upgrade and share our data freely - like cheaper insurance, faster travel, more lenient speeding fines, and better entertainment channels. These incentives are slowly driving uptake of new technology and services.

What really holds us back from embracing the connected world in all its glory is more profound. We’re uneasy about how it’s shaping us as human beings. We wonder what happens to our ability to make personal decisions when everything is automated. We worry what the web is doing to us and our relationships with every click, flick, skim, scroll, swipe, share and like. We’re tense with suspicion that we’re always being tracked, watched, profiled, and manipulated by invisible forces online. We balk at the idea of our household appliances adding to the deluge of daily notifications. Being plugged in all the time makes us feel like we’re virtually living. We don’t need machines, or the interests behind them, telling us what to eat, when to walk, or how to optimise our sleep.

Everything is possible, but we don’t need everything to be connected to the Internet. We want to feel more connected with each other. We dream of a simpler existence, brightened more by natural light than the constant glow of touch-screens. Of course we’re not cutting all ties to the Internet (that’s impossible and freaky). We’re just looking for peace of mind. We’re being discerning. We’re in control. We’re taking things slowly and surely.



Are we moving to a world where government tries to lead people away from their technological aversions through “sweeteners” and “nudges”, for the greater good of society?

Transport **regulation challenges**

Convincing people of the benefits of connecting

- There is a growing gulf between countries that rapidly adopt smart vehicles and infrastructure, and those that are hesitant. New Zealand moves slowly, due to social attitudes.
- Between 2025 and 2035 smart technologies evolve. In countries that widely adopt these technologies, most vehicle accidents are prevented and travel is becoming more efficient. New Zealand’s government aims to boost uptake of these technologies to improve efficiency and reduce the road toll.

Encouraging smarter, cleaner travel

- People care about emissions, but are reluctant to keep buying newer, smarter, vehicles that produce fewer pollutants than older and more traditional ones.
- Smart infrastructure, which helps to reduce crashes and manage congestion, continues to be installed slowly.
- Government needs to invest in other initiatives to reduce emissions and congestion, such as public transport and encouraging more ride-sharing and active travel, alongside incentives for uptaking new, low-emissions vehicles.

Transport **regulation style**

Light-touch and guiding

- Government cannot coerce people to adopt smart technologies, but aims to improve safety, efficiency, equity, and environmental stewardship.
- It favours incentives to increase data sharing and the uptake of new technologies.
- It also “nudges” shifts in attitudes, such as by demonstrating the benefits of connecting/sharing.

Collaborative

- Governments and businesses share the goal of changing hesitant and negative attitudes towards new technology, to boost growth and the uptake of smarter systems. They offer discounts, rewards, and benefits for people who connect and share data.
- Citizens expect to be closely engaged on any initiatives that seek to influence social attitudes towards new technologies and data sharing.



Transport **regulation opportunities**

Leading change

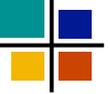
- To make connectivity more attractive, and to transform social attitudes, government is endlessly innovating. For example, people who freely share their data via *weShare* could enjoy less congested lanes, better parking spaces, higher speed limits, lighter traffic enforcement, and cheaper road charges than their unconnected fellow citizens (who in turn face stricter enforcement). Government could also lead by example by adopting smart vehicle fleets.

Improving equity and access through connectivity

- Government “nudges” public attitudes in a more positive direction by subsidising smarter technologies for disadvantaged groups (e.g. elderly drivers, low income families) and showcasing the benefits. This is seen as a “win win”.

How we emerge here

- Technological abilities to create the Internet of Everything keep growing exponentially.
- Companies collaborate to create a unified system that connects different brands, models, and devices.
- Most consumers remain unconvinced about the need to connect everything. The benefits are not great enough, relative to the costs of buying smarter products.
- To overcome consumer inertia, businesses collaborate with governments to make technologies and data sharing more attractive. People receive better service and rewards for joining “*weShare*” systems.
- Technologies integrate well, but people are still skeptical about connecting everything. They question whether smarter devices and networks are really making life better. They are wary of the powerful interests tracking, gathering, and using their data. The Internet of Everything keeps evolving, but slowly.



Changes in **how people travel** from 2025-2035

By **car**

Smarter cars become more common, but can easily be dumbed down

- New cars increasingly come with technologies to communicate with infrastructure and other vehicles.
- Sales of fully-featured smart cars, which cost more than simpler alternatives, are slow.
- Drivers of smart cars often switch off some features, and are selective about what they use.
- Autonomous vehicles remain very rare, and only operate in some inner-city streets.

Late in the decade...

Government offers citizens two different paths to improve safety, congestion, and carbon emissions: adopt smarter vehicles much more rapidly, or move to lower speed limits, higher investment in public transport, and more active travel.

By **public transport** and **ride-sharing**

Public transport becomes more widely used

- Better public transport moves more people, more quickly, to reduce congestion and emissions.
- Rides are cheaper for patrons who share data.

Ride-sharing is becoming popular

- People readily share rides with friends, family, neighbours, and colleagues. people enjoy the social aspect of this way of travelling
- People are initially wary of using online ride-sharing services, which they do not entirely trust.

Late in the decade...

Government encourages greater ride-sharing by giving priority access to *weShare* only lanes. Ride-sharers who join the *weShare* system receive lower fines for traffic and parking infringements than non-sharers. Ridesharing reaches a tipping point and has become commonplace.



Changes in **how people travel** from 2025-2035

By **air**

Airport security becomes a two-tier system

- Travellers who are willing to share all biometric data pass through *weShare* security more swiftly than those who do not.
- Sharers also receive small discounts on flights.

Late in the decade...

New Zealanders face increasing pressure to share biometric data and travel with smart sensors, to gain entry to most countries.

By **foot** and **bike**

Walking and cycling grow slightly more popular

- Active travel is heavily promoted to improve health and reduce obesity.
- New cycle lanes are needed, since uptake of anti-collision technologies is slow.

Late in the decade...

Cyclists enjoy cheaper insurance and faster settlements of accident claims if they embed sensors and collision-avoidance systems in their bikes.

How **freight movements** are changing 2025-2035

Freight movements grow modestly

- Freight logistics systems continue to evolve slowly, with businesses and exporters keen for innovation.
- We are seeing the first instances of autonomous trucks.

Retailers and freight operators are trying to convince people to connect

- Planning and logistics are increasingly done “on the fly”, with routes and operators updated according to congestion and customer locations.
- Businesses would like to share data freely, as they can clearly see the benefits. However, to retain the trust of their customers they limit sharing.
- To encourage greater connectivity, customers are rewarded if they activate more smart devices that automatically order more products for them. Retailers collaborate with freight operators to offer faster delivery for connected customers.
- Freight operators lobby government to make it mandatory for drivers to activate the communications technology in their smart cars. This is so that freight operators using smart trucks can receive information on traffic flows, congestion and accidents, and plan their routes accordingly.



Some wider **impacts** in this world



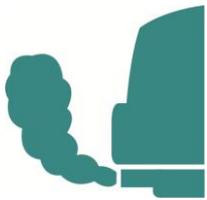
Equity and Access

There are growing gaps in access/opportunities between those who are willing to share their data, and those who want to maintain privacy of their data. Government subsidises smarter technologies and public transport for disadvantaged groups to relieve access issues. People prefer face to face interactions, which boosts social cohesion.



Road Toll

NZ's road toll falls more slowly than countries where smart technologies are widely used to boost safety. To reduce the gap, other measures are introduced, such as lower speed limits and stricter enforcement for non-*weSharers*.



Transport Climate Emissions

Vehicles become increasingly cleaner as the fleet is renewed. However, this is offset by longer commutes and greater freight movements, which limit total emissions reductions.



Crime

Drivers of traditional vehicles face tougher enforcement and stricter speed and drink-drive limits. This increases transport-related offences in the short-term, until *weShare* causes greater uptake of smart technologies

Mobility as a service

“Introducing autonomous transport, on-demand from your smartphone”

The evolution of the Internet of Everything—now simply known as the *Evernet*—is leading to the dawn of a new era, not just for technology, but for humans. There is data on everything and everyone. All data is one.

Most consumers are captivated by the gleam of ever-new devices and alluring apps that make us feel more connected, important, and ahead of the pack. Anything we can attach a sensor to connects smoothly to the *Evernet*: coffee makers, cars, cows, parcels, pets, wheels... the boundaries are limitless. Those who are not captivated are forced to connect anyway – for the greater good.

Ever-smarter and ever-faster are the keys to success. An open-source language for intercommunication—called *babelTEK*—enables all our devices to understand one another. *babelTEK* keeps everything humming: giving new life to old tech, and soothing data conflicts. Intelligence flows freely among diverse devices, sensors, and systems: forever shifting form like water. This ease of movement erodes all barriers—including objections from some groups about the loss of privacy, intimacy, and the old ways of connecting.

We reap the rewards of connectivity when we share our data freely. But hackers are still out there (while somehow seeming nowhere). Data vulnerabilities and breaches are rigidly policed and punished. We give thanks for surveillance. Sometimes it feels creepy that we’re always being tracked and watched by our goods and gadgets, but we try not to think about it. If there’s nothing to hide, there’s nothing to worry about.

Technologies are friendly, and understand us. They make life easier, more efficient, and less of a drag. Everyone aspires to, and can achieve, a frictionless existence. However, life looks very different if you’re on the margins of the *Evernet*: the disillusioned, the disempowered, or just the downright poor (who are increasingly being automated out of jobs).

Technologies also have a tendency to become unstable, unsafe, or disallowed, unless constantly updated and protected with the best security software. Unsupported tech is cast aside, and snapped up by the eager masses who can’t afford the latest firmware, software, travelware, or healthware. Everything becomes disposable, as new technologies quickly make old ones redundant.

Bugs can’t be avoided, but the *Evernet* has self-healing capabilities: infected systems and technologies are rapidly quarantined or decommissioned. This elevates anxiety among those with vulnerable tech, but avoids larger system failures. We’re constantly on our toes to ensure meltdowns don’t happen.

Sometimes our technological co-dependence gives us the wobbles. Relatively few people understand how most things work. When things go wrong they can go *really* wrong. Fortunately that doesn’t happen too often. Life’s risky, and the rewards are worth it.

In this seamlessly connected world, the physical and virtual realms are becoming increasingly unified. We dream of an *Evernet* that’s all-sensing, self-regulated, and in service of humanity. We aren’t there yet, but our evolution is blazing. We’re embracing the connected world.

Are we moving to a world where global technologies, and technology companies, do all the regulating and enforcement?

Transport regulation challenges

Compelling vehicles and drivers to connect

- Government increasingly needs to deal with “off-gridders” (owners of vehicles that do not communicate with other vehicles and infrastructure), as they create safety risks and limit the transport system from realising its full connected potential.

Technological dependence

- As society transitions to ubiquitous smart vehicles, and then to fully autonomous vehicles, drivers/operators need to retrain.
- Some people may become so reliant on technologies that they struggle to drive well when they occasionally take over controls, or drive different vehicles.
- Driver licensing ultimately becomes redundant as cars become self-driving.

Threats to system security

- Bugs or hacks could result in quickly cascading system failures across the transport system.
- The scale of these risks grow with increasing technological dependence.
- Ongoing investments in security are crucial.
- Private enterprises are better equipped than governments in understanding these technologies.

Transport regulation style

Liberal in places, hard-lined in others

- Early regulation ensured data could move more freely. Businesses were not permitted to hold back or control the data needed for system integration.
- All of society must be connected to reap the benefits of smarter technologies. Older “off grid” vehicles need to be retrofitted to meet minimum levels of smart technology, or be retired.
- To maintain security, there are strict punishments for people hacking systems, making non-compliant modifications, or faking their identities.
- Otherwise, regulation is increasingly liberal and light-handed. Ultimately all vehicles must obey “3 laws”, with technologies that prevent them from 1) colliding, 2) moving if unfit, or 3) going where they shouldn’t.
- Regulators are primed to step in quickly, should a particular technology be deemed unsafe. In order to facilitate this, regulators have open access to all vehicle data.

Regulations are shaped by international conventions

- Technologies are largely developed in other countries, and New Zealand follows their lead.
- An international body develops common standards for smart vehicles, infrastructure, data sharing, and system security. They are often guided by technology companies.

Transport **regulation opportunities**

Greater efficiency and safety

- Smart technologies and self-managing systems enable more vehicles and passengers to travel in existing spaces and use the current transport infrastructure. However, congestion could balloon if left unchecked, as vehicles flock to the fastest potential routes, and smart technologies make private travel more attractive, despite long commutes and heavy congestion.
- Ever-smarter technologies could reduce collisions between vehicles, people, and infrastructure. The road toll from human driver errors could one day be eliminated.

A new enforcement world

- Regulating technologies (and what they can do) becomes more important than regulating drivers. Smart cars grow increasingly capable of driving safely.

How we emerge here

- The Internet of Everything (*Evernet*) keeps growing exponentially.
- To avoid the pitfalls of competing systems, a universal computing language (called *babelTEK*) enables all devices, sensors, and systems to communicate and operate together easily.
- Consumers are captivated by the benefits of more connected devices and apps, and rapidly embraced them.
- To unleash the potential of the *Evernet*, people share their data (willingly, or unwittingly) for access to shared services and intelligent systems.
- Citizens and consumers are increasingly prevented from using some services, technologies, and infrastructure if they do not share their data.

Changes in **how people travel** from 2025-2035

By **car**

Cars become increasingly autonomous

- Functions such as braking and changing lanes, become increasingly automated.
- The concept of travel time changes, as people use their time differently when not actively driving.

Smart infrastructure grows

- Designated smart lanes for mixed passenger and heavy vehicle platoons begin on urban motorways.

Road users pay for roads directly

- Movements are tracked, with people charged for using roads according to their vehicle, distance, number of occupants, and time of day.
- This enables greater private sector provision of transport infrastructure.

Late in the decade...

Fleets of autonomous vehicles are used to deliver mobility as a service. This sees a tipping point shift to autonomous vehicles, leading to the eventual banning of driven vehicles.

By **public transport** and **ride-sharing**

Boundaries between public transport, vehicle-sharing, and ride-sharing blur

- The public transport system becomes increasingly integrated with ride-sharing services, to ensure they work with, rather than against each other.
- Individual car ownership declines with the rise of on-demand services.
- People ride-share to public transport hubs, where they can be conveyed to walking- and cycling-friendly inner cities.
- The threat of negative feedback and loss of online reputation encourages transport providers and users to behave well.

Late in the decade...

Ride-sharing declines as passengers prefer to catch rides from autonomous vehicles offered through various providers. Greater co-ordination of autonomous cars will be needed, to avoid urban congestion from vehicles roaming without passengers, while waiting for the next ride.

Changes in **how people travel** from 2025-2035

By **air** and **sea**

International travel becomes quicker

- Aircraft travel to higher altitudes and at faster speeds, making tourism more attractive.

Inter-island travel goes high-tech

- Super fast autonomous ferries are used to transport people and goods between the North and South Island.

Air spaces become more congested

- A variety of flying devices emerge, crowding airspace.
- Although crowded, airspace remains safe due to a high level of connectivity.

Late in the decade...

Rockets and supersonic high-altitude passenger craft seamlessly share airspace with conventional aircraft. Autonomous vehicles on land compete with domestic air travel.

By **foot** and **bike**

The majority of movements are tracked

- People rely on their devices to tell them what their bodies need, such as walking.
- Health insurers give discounts to the most active people (who track and share their motion data).

Bikes get smarter

- Proximity sensors become common, warning riders when vehicles are approaching.

Late in the decade...

Collision-avoidance sensors embedded in wearable tech and bikes communicate with cars, making active modes safer.

How **freight movements** are changing 2025-2035

“Cargobots” are all abuzz

- Automated vehicles increasingly make small deliveries via air, land, and sea.

Freight planning and logistics is increasingly done “on the fly”

- Routes, providers, and destinations shift in real-time according to data on the fastest/cheapest routes and the latest location of the customer.
- Freight movements therefore increase rapidly.
- Planning prioritises “right sized vehicles”, to avoid transporting empty space.
- Bulk freight still moves by rail, road, and sea, but increasingly uses highly efficient autonomous vehicles.
- Transfers between transport modes are rapid and well integrated.

Late in the decade...

A super-integrated freight system becomes highly self-organising. Vehicles, providers, and routes are chosen automatically, and dynamically updated, without human intervention.

Separated transport corridors for autonomous heavy vehicle platoons (i.e. buses and trucks) are being considered along major state highways.

Some wider **impacts** in this world



Equity and Access

Personal transport offered through fleets of autonomous vehicles improves transport access for all. People often live in virtual bubbles, which reduces social cohesion.



Road Toll

Road accidents and deaths have drastically reduced, thanks to technologies that ensure safer driving. Fewer hospital beds are required for transport-related injuries. Accidents are usually blamed on “human error”, including when autonomous cars pass back control to human operators.



Transport Climate Emissions

A younger vehicle fleet contributes to newer, more efficient and less polluting vehicles. However, technologies that enable ever-more vehicles to use existing infrastructure, and an increase in freight movements, limit overall emission reductions and heighten congestion.



Crime

Technology makes stealing, speeding, and breaking rules harder. Technocrimes (for example hacking, modifying vehicles, or falsifying data) are rising, but prison populations decline overall.

More of the same

“We’re not so keen on new technology and services, and it doesn’t work well anyway”

“Cars out of control: teenage hackers joyride from bedrooms.” “Coded to kill: planes hijacked by malware.” “Cyber stalkers: security agencies overact again.” With headlines like these, it’s no wonder people are shying away from digital life. We’re switched on to the perilous side of the internet, and we’re switching off the WiFi.

Technologies are still evolving at staggering speeds. Tech startups and internet moguls tempt us with endless arrays of “smart” consumer goods and gadgets that effortlessly connect online. But what’s so smart about putting our privacy and security on the line?

The pace of technological development is partly to blame for sagging consumer interest in the Internet of Everything. Businesses rabidly compete to create the latest connected devices and capture market share. With billions of devices connecting to different types of networks, in countless different ways, security is patchy. The services that connect these devices are also known to be plagued by malware, software bugs and viruses. Anything connected to the Internet is therefore vulnerable, exposing us to weakness. We’re haunted by the idea of hackers taking over our homes, controlling our cars, monitoring our movements, or holding our business files to ransom.

The multinational giants of the digital world have strong security systems in place. But we are still cautious with them. Our private contacts, emails, photos, movements, health, wealth, moods, and innermost thoughts are all just data to these faceless entities. Who knows how they could use, abuse, or sell our information? We don’t want insurers pricing all our heartbeats before we’ve even felt them. As for sharing data with Government: we’re not just sceptical of what we could gain, we’re downright suspicious of giving them too much power.

The promise of the all-connected society has lost its gloss. Remarkably though, we’ve discovered that life isn’t so bad in the void of a hyper-connected technological existence. Most of us lived alright before our bathroom scales, bikes, and babies were connected to the net. We take pleasure in small moments when no-one knows exactly where we are, what we’re eating, or how fast we’re travelling at four in the morning. That’s our business.

We enjoy handmade food, driving our own cars, and following our instincts. We don’t want “the system” to control us. We make time to master new technologies. The Internet is incredible, but connectivity of everyone and everything isn’t inevitable. We like to keep some distance. The best way to protect our privacy and stay secure is to keep some things offline. Connecting personally – not electronically – makes us feel closer, and is more real.

The best “firewalls” are separated systems. We don’t want our vehicles conversing with one another, let alone our fridges. If anything melts down, that keeps everything else safe, as the damage is easier to contain.

In this rapidly-changing world, we dream of determining our own destiny. We make our own choices, and keep a grip on our data. Who’s calling the shots? We are. We’re keeping our boundaries.

Are we moving to a world where new transport technologies are constrained due to concerns about privacy, security, and resilience?

Transport **regulation challenges**

Enabling innovation, slowly

- Privacy and security are vigorously protected, which impedes the adoption of new technologies that rely on data sharing. Traditional solutions may need to be re-invented.
- Privacy legislation has been strengthened, open data policies have been tightened, the private sector cannot share information without users' direct consent, and government agencies are very constrained in their abilities to access and share data.

Playing it safe may not be the safest option

- New transport technologies are being embraced in countries where citizens are willing to adopt new technologies and share data. Those countries successfully reduce crashes and lower their road tolls.
- These technologies will not function without high levels of data sharing, so risk averse New Zealand will need to rely on established approaches to boost safety, such as higher speeding fines, better roads, stronger vehicle standards, and lower speed limits.

Transport **regulation style**

Driven by citizens' demands for privacy and security

- People are suspicious of the motives of companies and governments who use personal data, and critical of their ability to protect information.
- Government is highly responsive to citizens' demands for privacy.

Deliberative and prescriptive

- Transport sector stakeholders demand to be closely involved in designing regulation to avoid any recurring technology nightmares. However, transport providers are often more attracted by new technologies than users, which leads to tensions.
- Regulation is often highly prescriptive and preemptive, to prevent misuse of data.



Transport **regulation opportunities**

Becoming a model of deliberative democracy

- Government needs to work closely with businesses and citizens to enable growth and innovation while protecting privacy and systems' security.
- This collaborative approach may slow the pace of new legislation and technologies, but lead to more robust and widely-accepted outcomes.
- If successful, this approach may also spread to other areas of regulation and transport planning.

Pioneering common standards

- New Zealand could become a leader in developing common standards for safely sharing data.
- However, there is also a risk that New Zealand could create its own peculiar standards that are out of sync with the rest of the world.

How we emerge here

- Businesses keep inventing novel ways to connect everything and everyone via the Internet.
- Designers and developers rush goods to market without sufficient data safeguards.
- Technological failures, malfunctions, hacks and government over-reach sour the dream of hyper-connectivity.
- People are protective of their privacy, and fear for the security of anything connected to the Internet.
- Personal autonomy and face-to-face connecting are highly valued. People do not want technology to do everything for them.
- Ongoing competition between different businesses, devices, and systems leads to many incompatible standards. People accept this, as it prevents any single organisation gaining access to all their data or devices. It also builds resilience, as damage can be contained when problems arise in unconnected systems.

Changes in **how people travel** from 2025-2035

By **car**

“Lo-fi” features are a selling point for new cars

- Most consumers do not want their vehicles to connect to wireless networks.
- They are inherently suspicious of autonomous cars, which have not been adopted in NZ.

Low emissions vehicles gradually dominate

- Vehicle turnover falls as people shun new technologies, so stronger support measures are needed to induce uptake of newer, cleaner vehicles.

Smart vehicles fill some market niches

- Smart vehicles are most popular for business fleets, where the business case for efficiency gains are more compelling.
- Some vehicle models can communicate with one another, but cannot connect across different brands. This strongly limits their safety and efficiency benefits.

Late in the decade...

Government scales up investments in smarter infrastructure (such as dynamic speed signs on motorways) as a substitute for smart vehicle technologies.

By **public transport** and **ride-sharing**

Public transport slowly moves ahead

- Investments in infrastructure make trips faster and more reliable.
- People prefer travelling in their own vehicles, or with trusted ride-sharers. This limits the rate of growth in public transport.

Ride sharing is not popular

- People do not trust online ratings and profiles, which may be faked. Dramatic stories of rides gone wrong frighten people away from these services.
- Sharing is more common in close-knit communities, among familiar contacts.

Late in the decade...

Smart and autonomous buses, trams, and trains become more popular. They face less public resistance due to lower privacy concerns.

Changes in **how people travel** from 2025-2035

By **air** and **sea**

Air travel becomes slightly less affordable

- Public resistance to share extensive biometric data leads to the ongoing use of more costly forms of conventional security for international travellers.
- New Zealand is an attractive place to visit for overseas visitors who want to be “off-grid”.

Business is advocating for the use of autonomous ferries

- But government and the public are yet to be convinced of its safety.

Late in this decade...

New Zealand faces growing pressures to extend security measures for international travellers to match those of countries where privacy protections are weaker.

By **foot** and **bike**

Cycling becomes safer, in low-tech ways

- Riders are protected by separated cycleways in many towns and cities, but the cost of these cycleways limits their rollout.

People are on their feet more

- People enjoy walking to disconnect from digital life.

How **freight movements** are changing 2025-2035

Freight movements grow modestly

- Locally, there have been no technological leaps in road, rail, air, or sea freight transport.
- Exporters clamour for productivity gains to remain globally competitive with rivals in more connected countries.
- Freight logistics systems continue to advance slowly, with gains largely confined to proprietary systems (used by separate operators).
- Innovators in the freight sector continually agitate for more modern methods of moving freight – including highly-efficient autonomous trucks. The public appetite for these technologies is limited due to strong ongoing preferences for privacy and safety.

“Cargobots” remain an impractical novelty

- People see small autonomous or remotely piloted vehicles as threats to privacy.
- Public pressure opposes use of cargo bots in the freight network.
- The lack of integrated systems to coordinate their actions also means widespread use would be unsafe.

Some wider **impacts** in this world



Equity and Access

Low uptake means technology divides are slow to emerge. But so too are solutions to existing access issues.



Road Toll

Road safety campaigns and lower speed limits contribute to reductions in the road toll. New Zealand increasingly lags behind countries with greater uptake of smart transport technologies. Hospital beds continue to be needed for transport-related injuries.



Transport Climate Emissions

People regularly commute long distances by private vehicles or public transport. Vehicle fleet turnover is low as people prefer to hang on to their older, less efficient vehicles. Emissions reductions are hard to achieve as a consequence.



Crime

Heightened public anxieties about security have led to a stronger police presence and harsher punishments for offenders. Convictions for traffic infringements add to prison populations, especially with stricter enforcement of lowered speed limits.

A mixed world

“We like a bit of everything, even though it doesn't quite work together”

We share the same universe, but inhabit different worlds. The Internet touches everything, but everything's divided into neatly packaged parts.

There's no end to human ingenuity and our appetite for more. We marvel when our digital assistants understand us better than we know ourselves. We delight in our powers to co-create and customise everything: from our "build-your-own" burgers to the hex coloured hue of our clothes. We're queens and kings of consumer choice. So why, oh why, are our choices so many, yet so few?

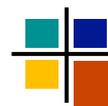
Smart appliances, vehicles, gadgets, and add-ons are abundant and easily available. But if you'd like all your tech to connect together (or with anything owned by anyone else) they had better be part of the same branded empire, otherwise you're out of luck. The big tech companies keep building their own digital territories, splintering the net as they fight for market power. They control who and what can connect to their proprietary systems, while we're locked-in to different brands. The operating systems of our phones, entertainment systems, vehicles, and buildings are locked down to prevent tampering.

Tech companies insist that these lock-ins and lock downs are in our best interests. It keeps things secure. If systems were open, crimeware, spyware, and malware would run amok. Technological protection measures, or digital locks, are rigidly enforced internationally. It's illegal for anyone to customise or "jailbreak" their kit. Smaller innovators favour open-source systems that may be more vulnerable, but also adapt quicker.

Where does this leave us consumers? We can pledge our technological allegiance to one of the big players (in their own separate universes); we can jailbreak their systems to enable better connectivity (and possibly end up in jail ourselves); or we can risk the more innovative open-source approach. It's our choice.

Some countries and regions try to keep a tight reign on technologies. They limit what's available, or legal. But that's not how we do things in New Zealand. All technologies are welcome here, so long as they're reasonably safe. Our openness is turbo-charging innovation. We're a testing ground for new "species" of smart devices that enable different brands and systems to co-exist. Admittedly, things sometimes get messy. Technologies rebel or respond in unexpected ways. But innovation thrives on risks, accidents, setbacks, hacks, mash-ups, mistakes, and malfunctions. It's all learning.

Our world sparkles with endless arrays of smart technologies. Most were designed to only work in separate systems. We dream of a united world, unconstrained by technological tribes or castes of connectivity. Technologies mirror our society: open, multi-cultural, and increasingly multi-lingual. This heady mix of rapid change and endless choice gives us a rush. It's edgy and adventurous. Who'd want to live anywhere else? Really, we can't get enough.



Are we moving to a world where we openly embrace a multitude of incompatible transport technologies and systems?

Transport **regulation challenges**

Improving interoperability and safety

- Consumers and innovators want technology silos to be broken down, but other businesses want to protect their past investments in proprietary technologies – regulators must balance these conflicting demands.
- New Zealand imports smart vehicles with a multitude of different technologies. They have all been designed for different jurisdictions (e.g. Europe, Japan, China, USA, India), and have incompatible systems. This limits connectivity between vehicles, and stunts their performance (for example, vehicles can only travel in platoons if they share the same brand).

Reducing confusion and risks

- Human operators, or drivers, are confused when they switch vehicles (e.g. between different systems, or between old and new vehicles).
- Pedestrians and cyclists get confused over which vehicles have collision avoidance systems.
- International tourists, accustomed to their own countries' vehicles, are particularly confused.

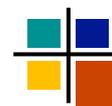
Moving in a two-speed world

- A divide grows between people using the latest, smartest technologies, and people using older technologies. Infrastructure needs to be designed for different vehicles/operators/drivers.
- Enforcement must become much smarter to accommodate multiple technologies.

Transport **regulation style**

Light-handed, for now

- New Zealand faces a choice: mandate some technologies (e.g. only accepting vehicles from one or two regions); or try to foster a common platform to unite different operating systems.
- Government is reluctant to ban some technologies, or make others mandatory. It wants to avoid picking “losers”, or becoming locked-in to technologies from some regions.
- Industry self-regulation is favoured to develop common standards for connectivity (government does not have the capabilities to develop this common platform itself, but can encourage it).



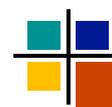
Transport **regulation opportunities**

An innovation incubator

- While some countries are cautiously allowing the uptake of new technologies, New Zealand is racing ahead.
- Because New Zealand welcomes technologies from many jurisdictions, it becomes an attractive place to test new technologies and platforms. It also becomes a niche developer of software for inter-connected transport systems.

How we emerge here

- Tech companies keep building their own digital territories. They tightly control how devices connect to each other and the internet (via their own proprietary systems).
- Some jurisdictions try to avoid technological chaos by mandating some technologies or standards.
- Many smart technologies are only designed to work in separate systems.
- New entrants add further disruption, by developing new technologies based on open-source systems.
- New Zealand takes a highly liberal approach, and is open to all digital technologies.
- We pioneer new devices and systems. This is partly due to necessity (to encourage different devices to work together), but also to foster growth through rapid innovation.



Changes in **how people travel** from 2025-2035

By **car**

Vehicles become more sensitive

- Smart cars become increasingly well-equipped with sensors that assist them to navigate their environment.
- Autonomous vehicles which work independently using sensing technology, rather than communication between vehicles, are adopted.

Smart infrastructure bridges differences

- Different makes and models of cars cannot communicate with each other, but they can increasingly “talk” to sensors in infrastructure such as roads and traffic lights.
- Public infrastructure is increasingly designed to be “multi-lingual” to work with all vehicles.

By **public transport** and **ride-sharing**

Different systems need to be integrated

- Government tries to induce greater connectivity between different service providers by requiring it in public transport tenders.

Growth of ride-sharing is inhibited by a lack of system integration

- While there is some use of ride-sharing, many potential ride-sharers (e.g. the elderly) are deterred by the dizzying variety of different services and their proprietary systems.



Changes in **how people travel** from 2025-2035

By **air**

All planes are fully compatible with international standards

- Because of the international nature of air travel, there have been fewer clashes between competing technologies and systems.
- New Zealand ensures that safety and security standards for air travel meet international standards.

By **foot** and **bike**

People straddle two different worlds

- Pedestrians and cyclists slowly get accustomed to vehicles that stop automatically when they move in front of them.
- Not all vehicles are equipped with these technologies, this sometimes leads to accidents.
- Safety campaigns remind people that not all cars are fully equipped with cyclist and pedestrian avoidance systems, and that it is a serious offence to jaywalk or ignore traffic safety regulations.

How **freight movements** are changing 2025-2035

Freight planning and logistics gets done “on the fly” (while in motion), if industry collaborates

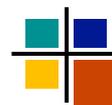
- People expect freight to be delivered quickly and directly.
- Routes, providers, and destinations shift in real-time according to data on the fastest/cheapest routes, and the location of the customer. Freight operators seek to collaborate and harmonise their systems to enable this.
- Bulk freight still moves more slowly by rail, road, and sea, but efficiencies are emerging from autonomous trucks.

“Cargobots” are clashing

- Small autonomous vehicles that deliver parcels by air, land, and sea are emerging.
- The lack of an integrated system creates collision risks. This makes it necessary to confine these vehicles to limited corridors, with large spaces between vehicles. Government requires industry to harmonise its approach (i.e. self-regulate) before expanding these corridors.

Heavy vehicles are platooning, but only in small packs

- Freight operators are lobbying government to enable heavy vehicles to travel in platoons on selected urban motorways (and eventually highways). However freight operators use different incompatible systems. Government will not grant regulatory approval until the freight industry develops common standards.



Some wider **impacts** in this world



Equity and Access

People who can afford the latest technologies enjoy much better access than those who cannot. Growing inequalities reduce social cohesion.



Road Toll

Smarter vehicles are making roads safer. Autonomous vehicles have the potential to provide larger safety gains. However, this will be a long time coming, as individuals prefer to own their own vehicle (rather than purchase services through fleets) and it will take some time for new costly autonomous vehicles to become common place.



Transport Climate Emissions

Newer, more efficient vehicles are entering the fleet and are used by those that can afford them. Emissions reductions are limited as the vehicle fleet turnover continues to be slow.



Crime

Heavily modified smart cars can become unsafe, and are more vulnerable to theft and hackers. Illegal modifications (which threaten safety) are hard to detect, but rigidly policed. Autonomous vehicles emerge slowly, so drivers still go to jail for traffic offences.



Introduction

Project findings were developed by looking at how transport regulation in 2025 compared across the four scenarios. These comparisons were made for a broad range of themes, such as who to regulate, and what regulatory tools to use. Doing so highlighted where regulatory challenges and opportunities are the same in all scenarios, and importantly, where they are different. Making these comparisons helps us to boil down what we can say now about the future of regulation, and what we will need to continue thinking about, and plan for, as uncertainties resolve with time. Some of the key findings are summarised below.

5

Key regulatory challenges

New technologies and business models rebalance transport ecosystems

Transport systems – like ecosystems – involve complex interactions between people, vehicles and places. New technologies shift the balance between those interactions. For example, ride sharing could reduce the demand for vehicle movements, but also for public transport. A resulting fall in public transport viability could mean more cars on roads and worse congestion. Alternatively, driverless vehicles could shift where people live and work, changing where and when transport issues like congestion arise. Driverless vehicles could also free up urban spaces such as carparks.

Transport regulators cannot make simplistic assumptions about how new technologies and business models will change, but need to allow for complex and hard-to-predict interactions – between urban design and ICT, as well as transport. Managing systemic transport risks is likely to become a critical regulatory function, as it has in other highly connected systems (e.g. electricity).

The human factor changes, but never disappears

New technologies like driver-assistance and fully autonomous vehicles may mean dangerous behaviours such as speeding and drink driving will no longer pose the same levels of risk, with technology picking up the slack. However, new behaviours which regulators will need to monitor and influence take their place. These include hacking or inappropriate repairs or modifications of those technologies, or misrepresenting which technologies are in use. More generally, regulators will become more interested in the design of technologies that substitute for driver choices. While drivers are local, technology designers are often international, shifting who is, or can be, regulated.

If vehicles become truly “intelligent”, regulators would need to influence their behaviours, not just those of humans. As and when these technologies emerge – if society embraces them – transport and other regulators would need radically new skills to stay on top of emerging problems in choices and behaviours.

Shape-shifting regulation will be either a regulatory tool or regulatory response

If society is keen to adopt new technologies that resolve transport issues, regulation could respond by becoming more responsive – allowing adoption rather than controlling it. Likewise, regulation might become more pan-modal in response to new technologies that operate across modes (e.g. vehicles that fly and drive). Even if there are technology or attitudinal barriers to adopting new technologies, Government might choose to make regulations more pan-modal or responsive, as a tool to induce greater uptake. Finally, regulation might become both prescriptive and highly mode-specific as a tool to manage the risk of new technology uptake if society is highly cautious.

The lesson is that we may need to fundamentally change how regulators are organised, what and who they regulate, and how they regulate them, in response to changing social attitudes and technology possibilities. Regulation may also need to take multiple forms if there are prolonged transitions involving a mixture of technologies.

Playing it safe could be risky

Transport regulators will reflect social attitudes towards safety, privacy (etc) when making choices about whether, how, and when to allow new technologies. A precautionary approach could allow New Zealand to learn from other countries' mistakes before taking the leap. Alternatively, it could entrench traditional approaches when new ones are superior.

The regulatory challenge is to balance society's preferences for things like safety and innovation. Alternatively, it is to appropriately influence those preferences, if countries less hesitant to technology uptake are demonstrating clear benefits, or to introduce measures (e.g. safer roads) compensating for lack of technology. Ultimately, the rate of new technology uptake reflects not just its availability, but social and regulatory choices – we regulate ahead of or behind “the curve” depending on social attitudes.

Getting out of step with other countries affects competitiveness

Similarly, New Zealand faces economic challenges if transport technology is constrained by over-regulation or society's hesitant adoption, but other countries embrace technology more willingly. Exporters and importers must improve logistics to remain competitive. They lose competitiveness if regulators in their rivals' countries allow new technologies that improve competitiveness, but New Zealand regulators do not. Examples include overseas regulators allowing driverless delivery vehicles that operate cheaply and around the clock, or platooning trucks with dedicated lanes for high-speed and hence more efficient freight movement.

Likewise, our tourist and export sectors could suffer if social hesitance towards tracking technologies constrains regulators to using current security screening technologies at ports and airports, while partner countries adopt (or insist on) new approaches. The regulatory challenge is to maintain competitiveness by introducing other measures (e.g. stricter traditional security checks) to compensate for any hesitant technology uptake. Alternatively, it is to appropriately influence social attitudes to accept greater technology uptake, so New Zealand regulation can keep pace with that in competitor countries.

4 *Key Regulatory Opportunities*

New technologies can make transport regulation more viable, or unnecessary

If society accepts widespread sharing of personal movement data, this better enables new congestion management approaches, such as real-time road pricing or tradable rights to use specific transport corridors at certain times. In turn, this relieves the need for traditional congestion approaches (e.g. T3 lanes), and also could fund the provision of transport infrastructure. It also enables new approaches such as remote enforcement. Likewise, driverless vehicles could see driver licensing replaced with licensing vehicle technology (eg software, just as real-time vehicle monitoring technologies could see a move away from vehicle inspections being undertaken on a 'one size fits all' timetable. New technologies could make transport regulation so effective that aspects of it are no longer needed.

Enforcement could be replaced by auto-compliance

Traditional traffic enforcement relies on the intermittent detection of rule breaches. Greater availability of real-time personal movement data makes such detection less intermittent, potentially increasing its effectiveness. More fundamentally, technologies that assist drivers – or remove the need for them – introduce the possibility of automatic rule compliance, with technologies programmed to eliminate rule breaches such as speeding. While new enforcement needs such as detecting hacking or improper vehicle modifications will arise, auto-compliance could result in much-reduced overall enforcement needs.

Regulation could focus more on the “what” than the “how”

Better access to vehicle monitoring data and technologies for auto-compliance mean transport regulation could become far more performance-based than prescriptive. Instead of specifying acceptable vehicle and transport system technologies in order to achieve objectives such as transport safety, it could simply specify performance standards, and rely on high-tech monitoring and control to ensure compliance. Such control could include the ability of regulators to remotely force vehicles to make safe stops if they breach performance requirements, with performance constantly monitored remotely in real time.

In turn, the ability to expand performance-based regulation could facilitate more pan-modal regulation – both in response to technologies that operate across modes, and to enable such technologies. In effect, a high uptake of new technologies could create a virtuous circle of innovations that enable less prescriptive regulation, and hence the possibility of even greater innovation.

Regulating for advantage

Regulation can facilitate transport sector innovations that help society, the environment and the economy. By keeping New Zealand at the forefront of innovation, and appropriately managing the risk of those innovations, society gains through better access to new transport technologies and business models. The environment gains with the adoption of new technologies that disrupt older, more polluting ones. Businesses and the economy gain through improved productivity, new services, and maintaining or extending our international competitiveness.

