The Changing Demands and Transport Experiences in the Future

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Prof of Urban Transport and Public Health

Wednesday Aug 12, 2015

Overview

- Background
- Burden of Road Injury in New Zealand
- Achievements in Road Safety
- Challenges in the Transport System
- Transport System of the Future
    - Intelligent Transport Systems
    - Automation of the System
    - Sustainable Transport
- Integration of Transport across the Urban System

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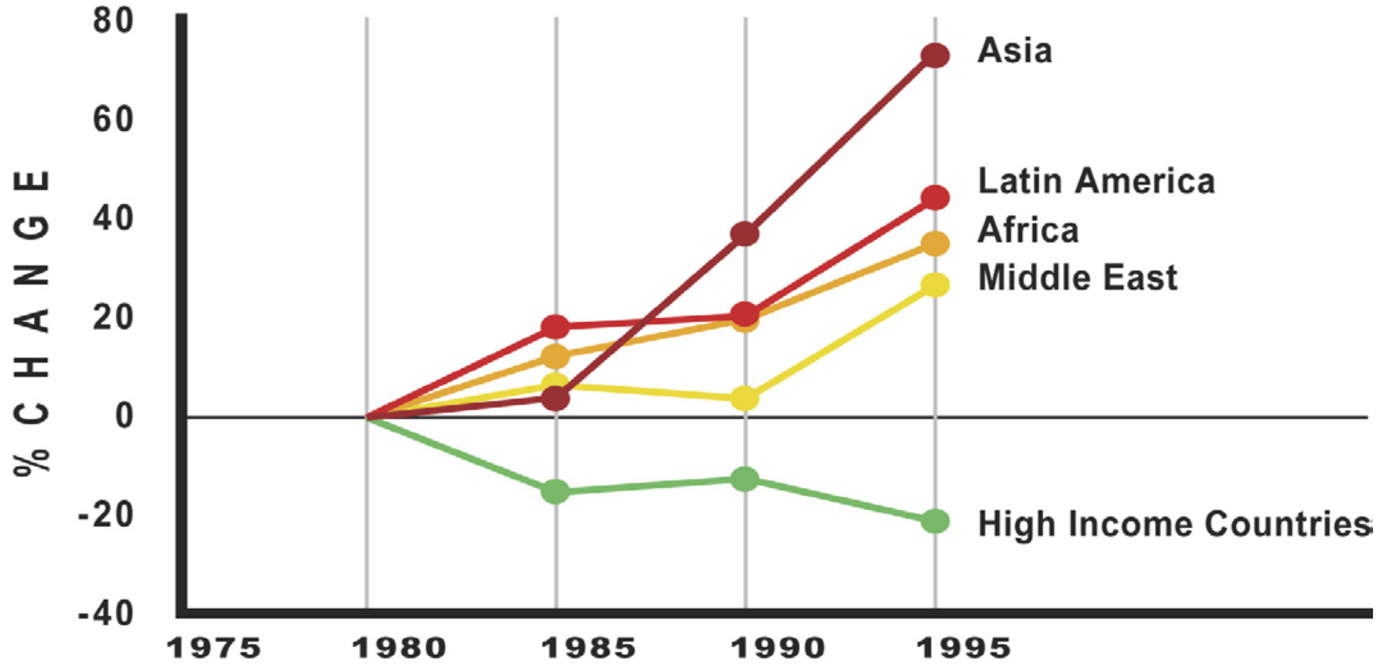
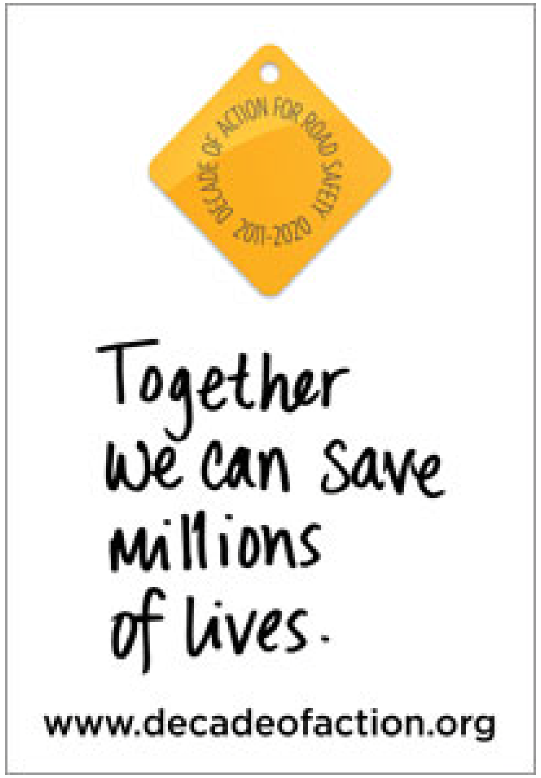
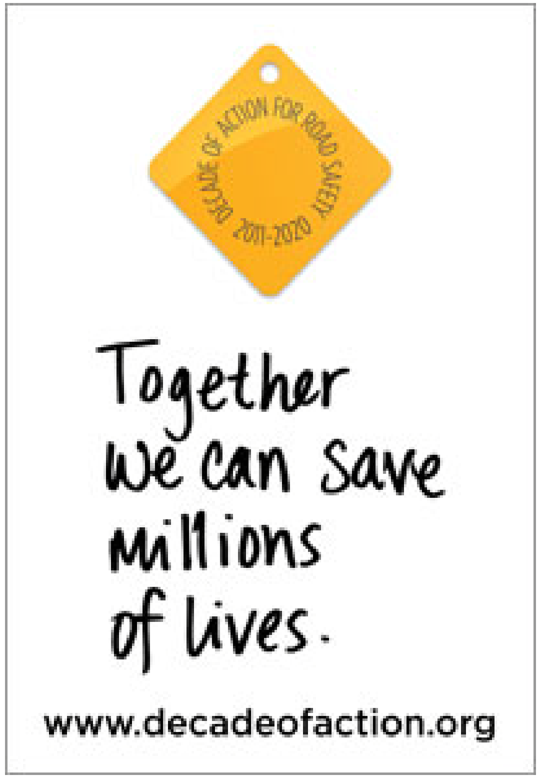
Globally, Road Traffic Injuries kill 1.2 million people per year and seriously injure 20-50 million people. Fatality rates are expected to rise by 87% by 2020.



- 3500 people die, globally, each day from road trauma.
- May 11, 2011 UN General Assembly declared a Decade of Action for Road Safety 2011-2020.
- Purpose: to highlight that road injury is a public health issue that merits concern and attention as a global development priority.



- From 2000-2030 more cars will be produced than in the first 100 years of motorisation.
- Most of these cars will be introduced into LMIC (where vulnerable road user predominates).
- More than 50 million deaths and 500 million serious RTI's are projected over the first 50 years of this century.



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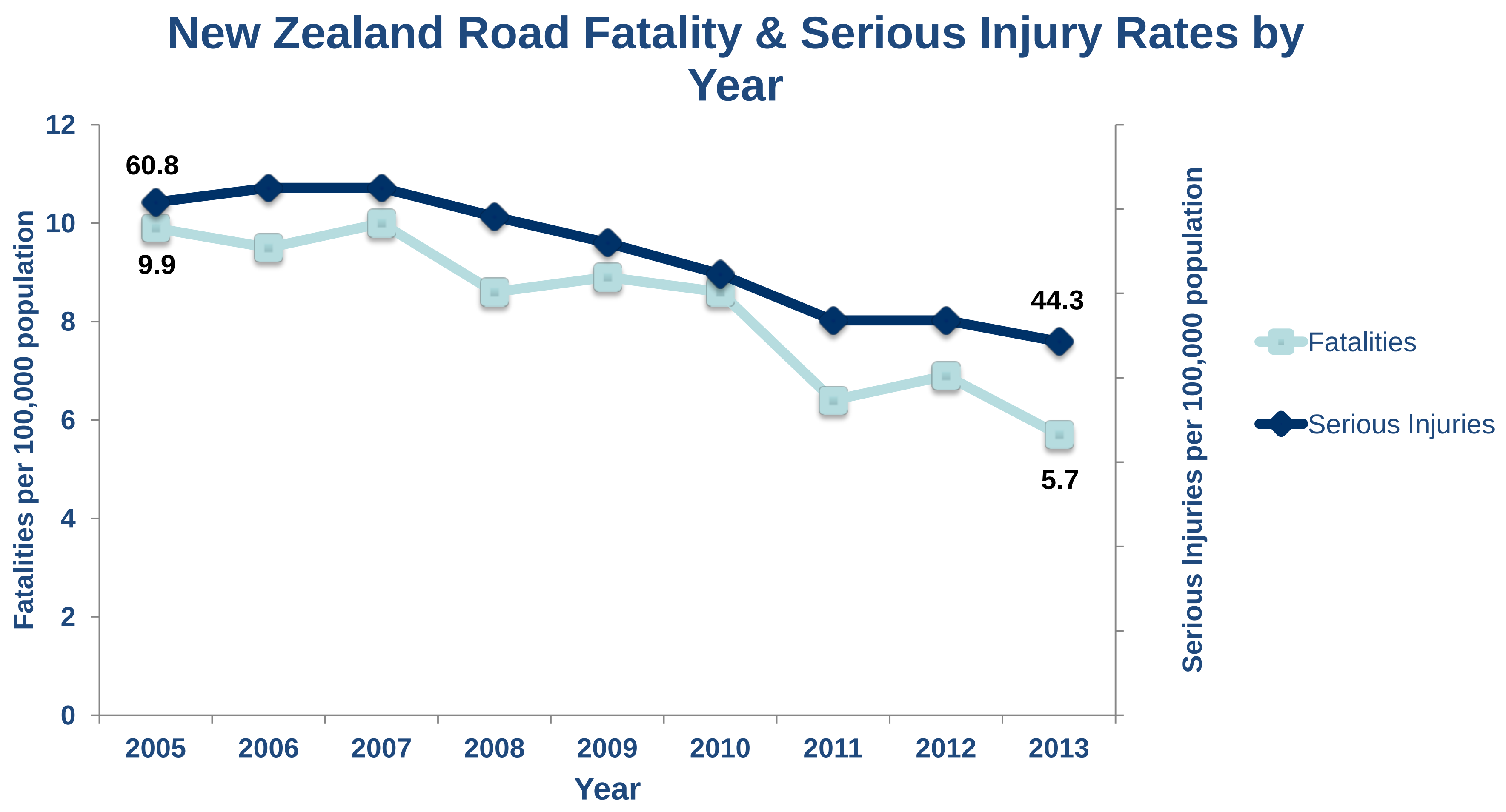
NEW ZEALAND TODAY

297 Fatalities

1,981 Serious injuries

$ 3.14 Billion

Ministry of Transport, Motor Vehicle Crashes 2013
Ministry of Transport, The Social Cost of Road Crashes and Injury, 2014



Ministry of Transport, Annual Road Historical Information – Historical Deaths since 1921
Ministry of Transport, Motor Vehicle Crashes 2005 - 2013

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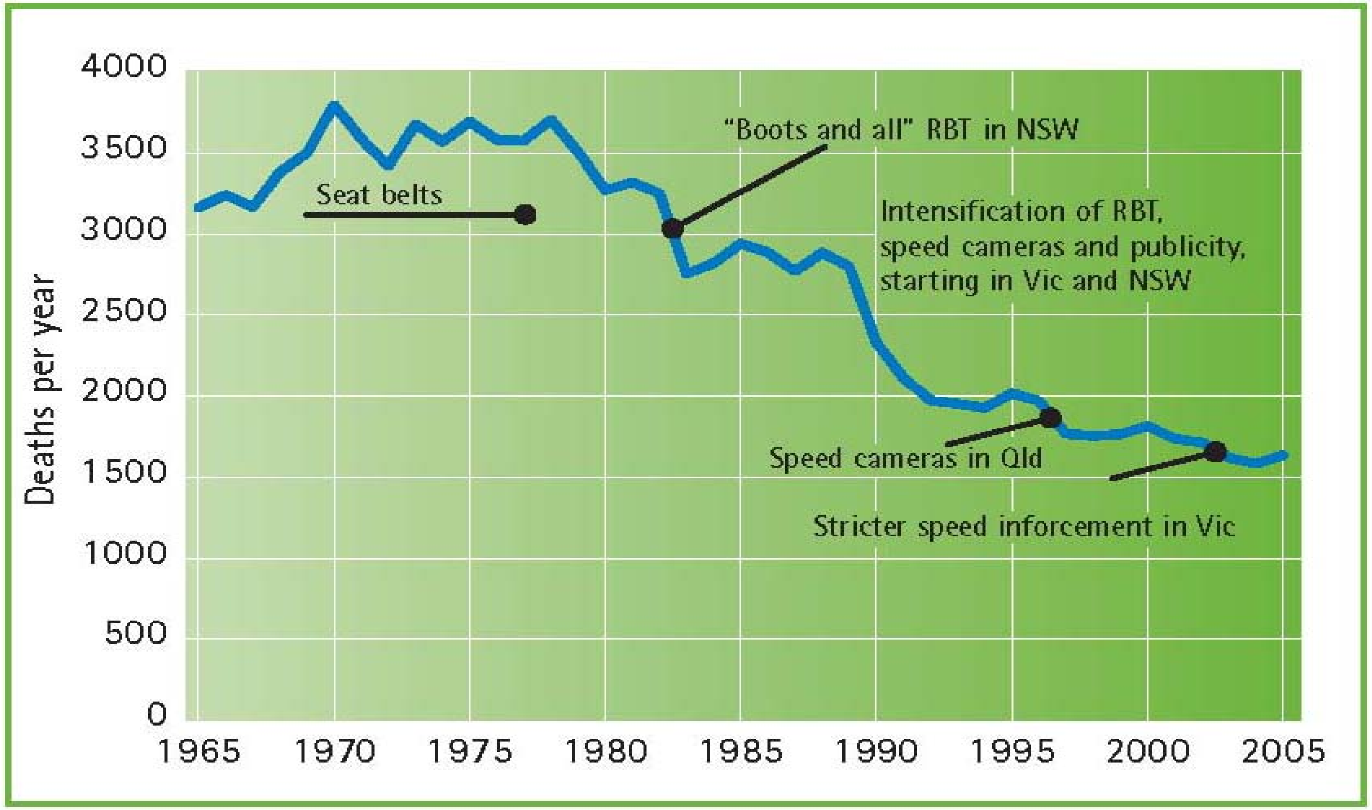


Source : Australian Transport Council (2006)

1950’s
Blame the Victim
Road User Focus

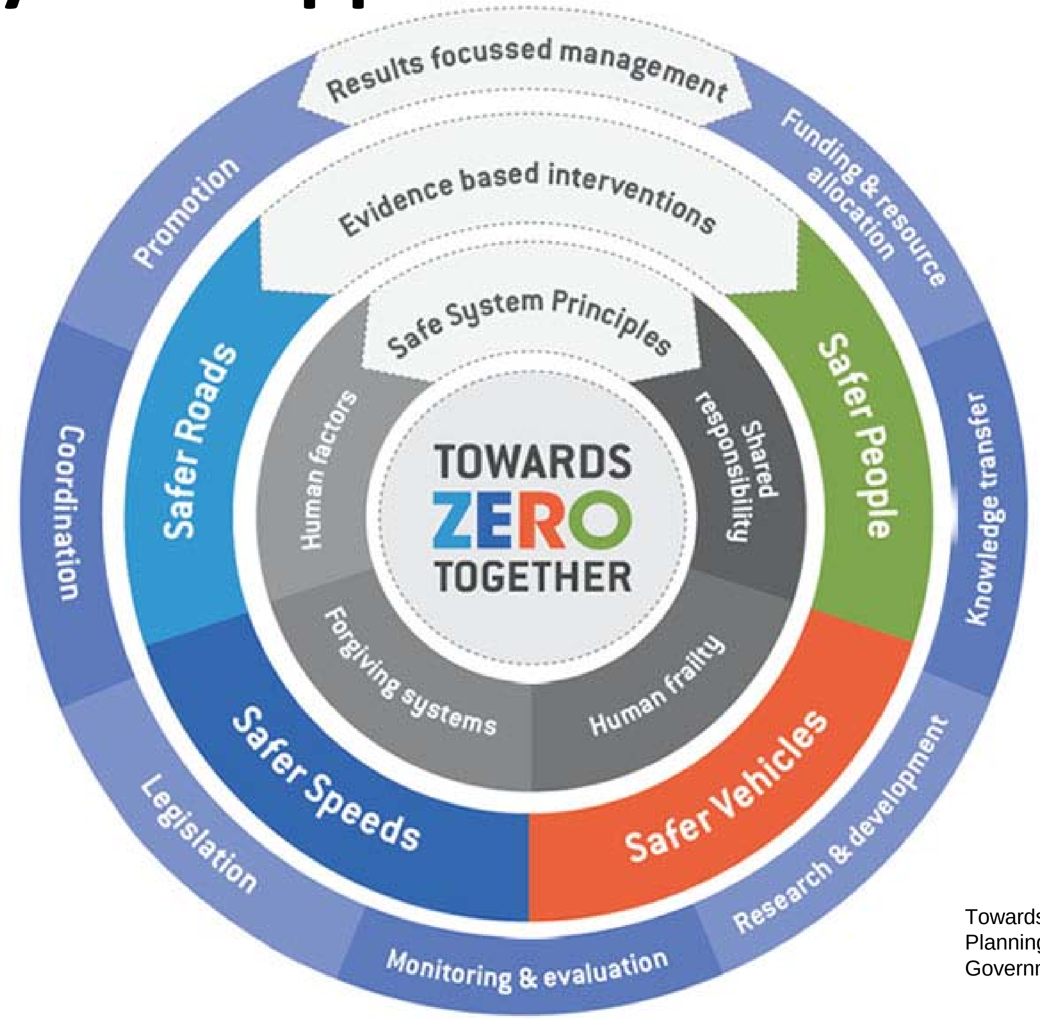
1960-1970’s
Systemic Interventions
Haddon Matrix

1980-1990’s
Agency Accountability
Targeted National Plans

2000 onwards
Shared Responsibility
Safe System Approach

Slide attributed to Tony Bliss, 2015

Safe System Approach - Australasia



Towards Zero Together. Department of Planning Transport and Infrastructure Government of South Australia, 2011.

Safe System Approach – New Zealand

Ministry of Transport, New Zealand's Road Safety Strategy 2020: Safer Journeys, 2010.

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Population Demographics

- 2007 51% of worlds population live in cities
- 2050 70% of worlds population will live in cities
- Urbanisation in New Zealand?

Population Demographics

Traffic and Air Quality

- Exposure to traffic-related air pollution and pulmonary diseases
- Emissions from traffic exacerbate asthma
- Prevalence of asthma amongst adults in New Zealand 11%

Ministry of Health, Annual Update of Key Results 2013/2014 – New Zealand Health Survey

Population Demographics

Traffic and Air Quality

Deteriorating Infrastructure

- Annual Depreciation
- Ongoing Maintenance
- Extending the Infrastructure

Population Demographics

Traffic and Air Quality

Deteriorating Infrastructure

Reduced Revenues

- Growing funding gap

Population Demographics

Traffic and Air Quality

Deteriorating Infrastructure

Reduced Revenues

Congestion and Productivity

- Significant cost – US Studies

Population Demographics
Traffic and Air Quality
Deteriorating Infrastructure
Reduced Revenues
Congestion and Productivity
Road Safety Gains

Population Demographics
Traffic and Air Quality
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Road Safety Gains

Smarter Transportation

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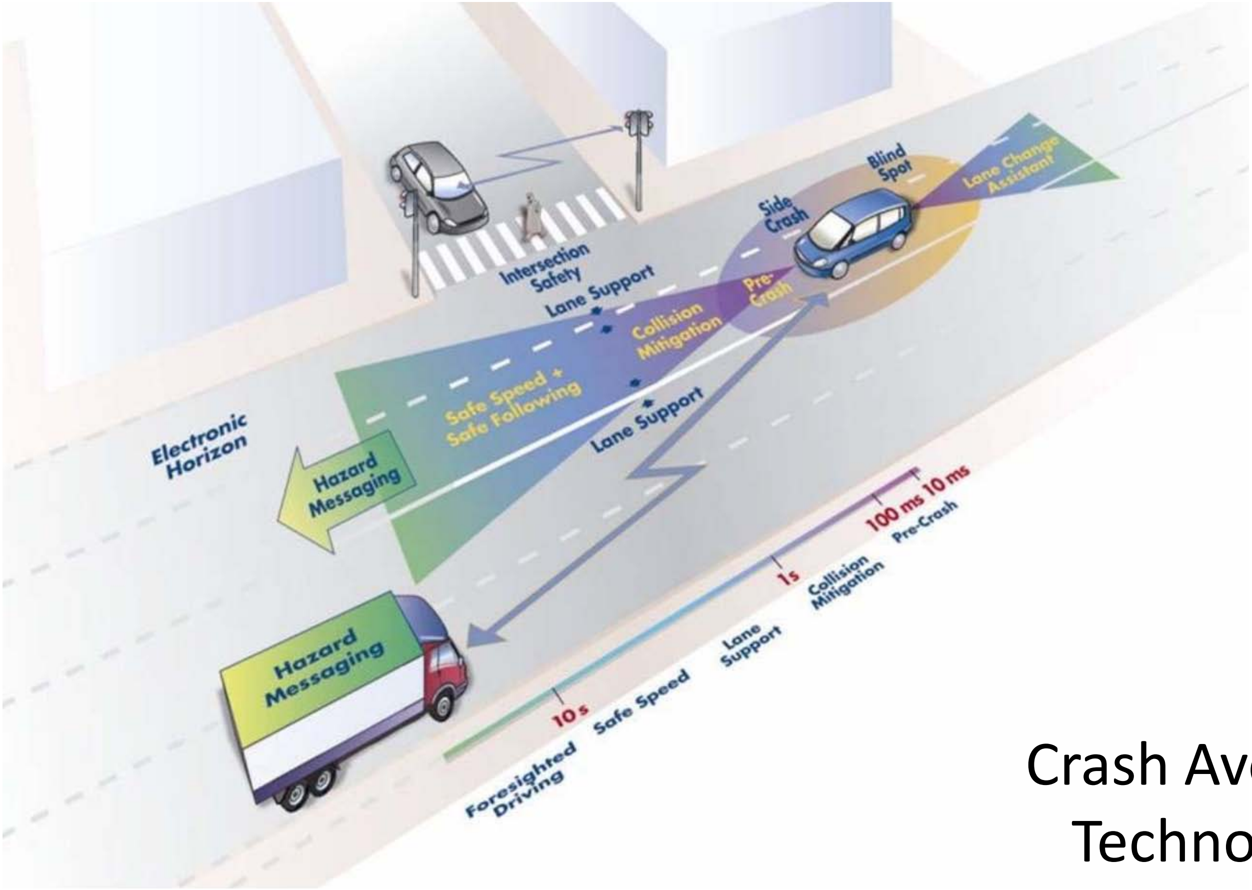


Crash Avoidance Technologies

Intelligent Transport Systems

Technology	Estimated annual crash reductions in Australia[1]		Estimated benefit cost ratio
	Fatality (percentage of all fatals)	Non-fatal injury[1]	
Forward collision avoidance, all speeds	181 (12%)	52,886	1.3
Alcohol interlocks	153 (11%)	7,294	0.5
Fatigue management systems	115 (8%)	7,805	0.5
Seatbelt interlocks	83 (6%)	617	1.6
Seatbelt reminder (disruptive)	66 (5%)	493	1.3

[1]Based on BITRE estimates of the numbers of crashed in Australia, 2006

Technologies with High Potential

Opportunities for road safety gains by 2020?

ITS Technology	Estimated annual crash reductions in Australia[1]
Forward collision warning	16%
Alcohol interlocks	15%
Fatigue management systems	10%

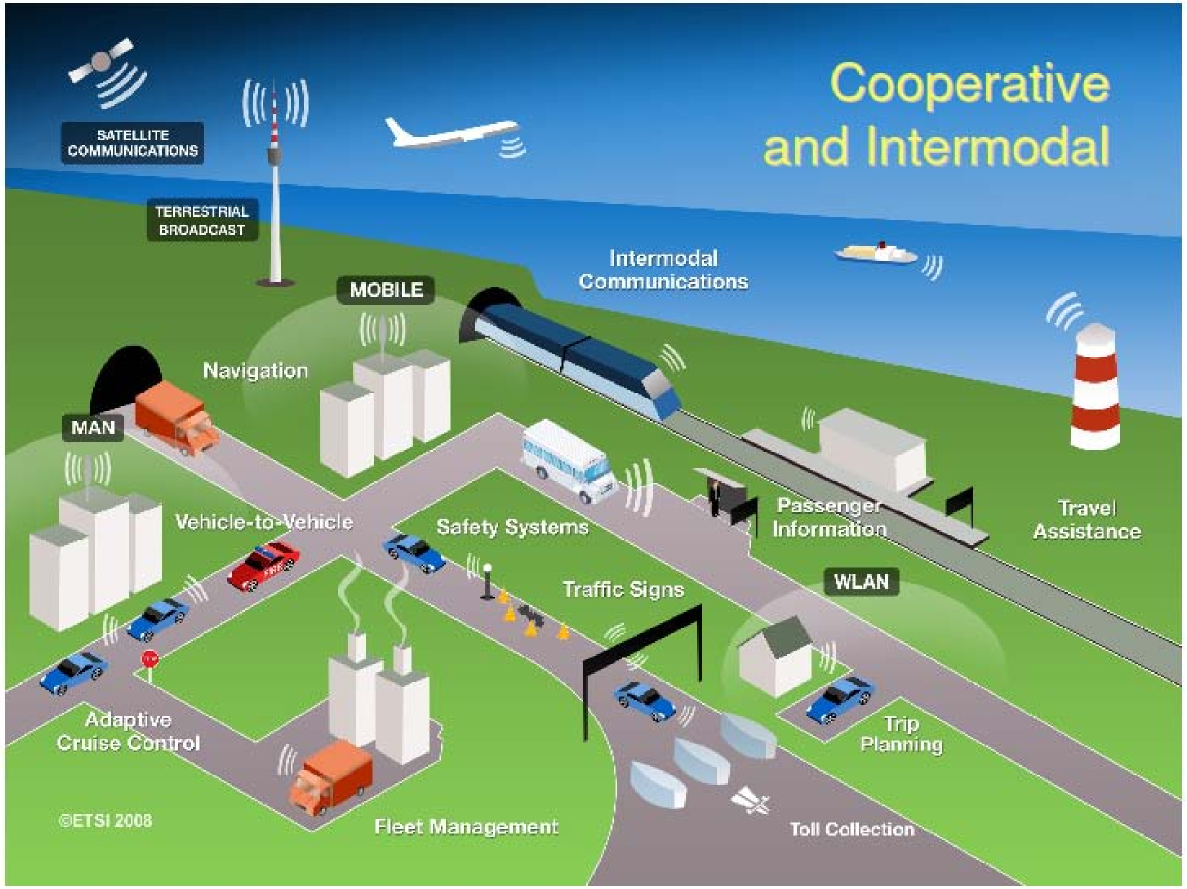
[1] Anderson R et al, CASR Report 094, April 2011

In-vehicle Telematics and Urban Transport

Telematics Device

Phone App Display

Intelligent Transport Systems

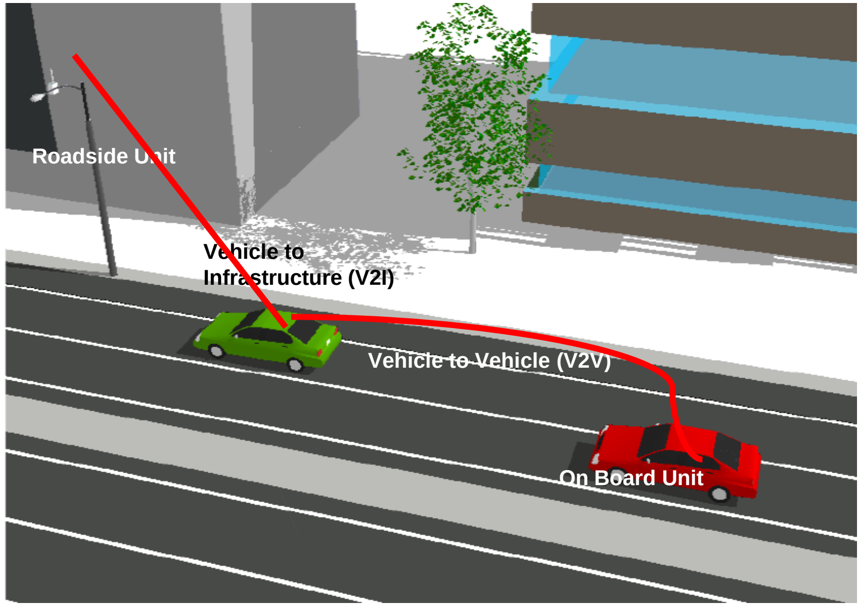


Source: Michael Noblett, Beyond 2012 Conference, Melbourne, April 2012.

Intelligent Transport Systems

What are the estimated benefits from Cooperative ITS?

- US Department of Transport Estimate
  - Between vehicles (V2V) can address 79% of crashes
  - Between vehicles and the road infrastructure (V2I) can address 26% of crashes
- Measureable road safety gains achieved with only 5%-10% of cars using cooperative ITS



On Board Unit

Source: Paul Gray, Beyond 2012 Conference, Melbourne, April 2012.

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Automation of the Transport System

> Regulatory change required?

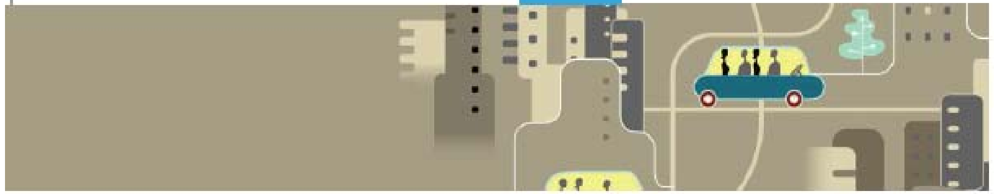
< Driver / Vehicle >	Level 0: No Automation	Level 1: Function-specific Automation	Level 2: Combined Function Automation	Level 3: Limited Self-Driving Automation	Level 4: Full Self-Driving Automation
Driver	Driver in complete and sole control and at all times	Driver can regain control or stop faster than if driving without the specific function	Driver is temporarily relieved of these driving functions	Driver must be available to take over controls	Driver not expected to take control at any time
Vehicle	No automation	Involves 1 or more specific control functions (e.g. stability control, pre-charged breaks)	Involves automation of at least 2 primary control functions working in unison (e.g. adaptive cruise control in combination with lane centring)	Enable all safety-critical functions to be automated (incl. steering, throttle, brake). The vehicle monitors any changes in conditions that require a transition back to driver control	Vehicle is designed to perform all safety-critical driving functions and monitor road conditions for an entire trip (includes both occupied and unoccupied vehicles)
	NOW	NOW	2013 +	2020 + ?	2025 + ?

Source: NHTSA *(modified)*

Source: Ballingall S. Enabling connected and automated vehicles. 2014 Oct.

Automation of the Transport System

THE WORLD IF



SCIENCE & TECHNOLOGY

IF AUTONOMOUS VEHICLES RULE THE WORLD

FROM HORSELESS TO DRIVERLESS

Overturning industries and redefining urban life, self-driving cars promise to be as disruptive and transformative a technology as the mobile phone

IF 90% OF CARS ON AMERICAN ROADS WERE AUTONOMOUS, ACCIDENTS WOULD FALL FROM 5.5M A YEAR TO 1.3M

Automation of the Transport System

"The average premium car today has more than a mile of cables, between 50 and 70 control units and the computing power of 20 advanced PCs. But….
only the black box unit, the rooftop wifi hotspot and the driver's smartphone can send and receive data beyond the car itself."

Source: Sharman A (2015). *Tyred and wired,* Financial Times Big Read. Connected Cars, Financial Times, 4/5 April.

Automation of the Transport System

Google Driverless Car – driven 500,000 km accident free

Lexus – retrofitted Google Driverless Car

Automation of the Transport System

South Australian Driverless Car Trial

7-8 November, 2015

Automation of the Transport System

- **Data access:**
  - Dynamic & static. Includes SPaT, intersection map, speed zones, road closures, lane use, VMS messages.
- **Road design & maintenance:**
  - Consideration to the req'ts of vehicle sensors, particularly with line marking & signage.
- **ITS infrastructure:**
  - Decisions required regarding approach to deployment, including services, locations, etc.

Source: Ballingall S. Enabling connected and automated vehicles. 2014 Oct.

Automation of the Transport System

- **Security:**
- Increased connectivity means increased attack surfaces. Risk of cyber attacks & malicious acts.
- **Liability:**
- Exposure will increase, particularly as shifting from supporting advisory, to warning, to automated systems.
- **Registration & licensing:**
- What level of automation will be supported by R&L?

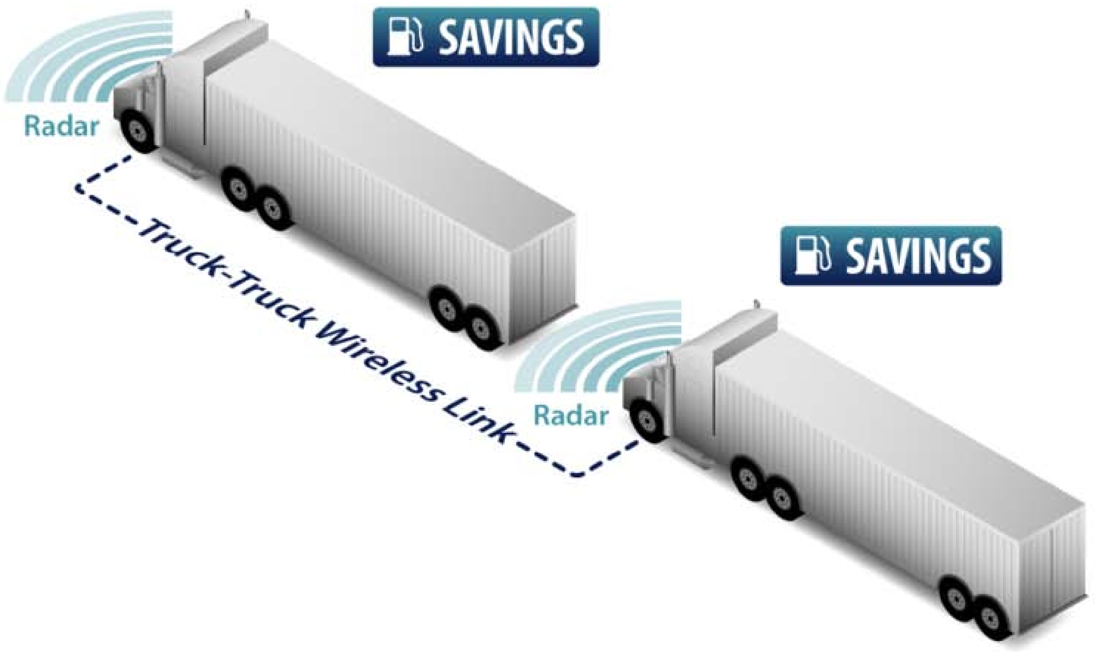
Source: Ballingall S. Enabling connected and automated vehicles. 2014 Oct.

http://www.wired.com/2015/07/hackers-remotely-kill-jeep-highway/

Heavy Vehicle Platooning

- Latest Intelligent Transport Systems (ITS)
- Heavy vehicles travel single file with small inter-vehicle distances
- Radar, magnetic sensors and wireless communication systems

Heavy Vehicle Platooning



*http://www.peloton-tech.com/about/

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Sustainable Transport

Sustainable Cities Index

Overall | People | Planet | Profit

Europe · North America · All · Asia-Pacific · Central & South America · Middle East · Africa

1	Frankfurt	11	Sydney	21	Houston	31	São Paulo	41	Doha
2	London	12	Toronto	22	Philadelphia	32	Mexico City	42	Moscow
3	Copenhagen	13	Brussels	23	Tokyo	33	Dubai	43	Jeddah
4	Amsterdam	14	Manchester	24	Rome	34	Abu Dhabi	44	Riyadh
5	Rotterdam	15	Boston	25	Washington	35	Shanghai	45	Jakarta
6	Berlin	16	Paris	26	Kuala Lumpur	36	Istanbul	46	Manila
7	Seoul	17	Melbourne	27	San Francisco	37	Johannesburg	47	Mumbai
8	Hong Kong	18	Birmingham	28	Los Angeles	38	Buenos Aires	48	Wuhan
9	Madrid	19	Chicago	29	Dallas	39	Beijing	49	New Delhi
10	Singapore	20	New York	30	Santiago	40	Rio de Janeiro	50	Nairobi

From www.sustainablecities.com

Traditional Transport Policy Packages (Western Cities)

1. Cities provide incentives for cars and public transport
   - Outcome: imbalance in mode share towards car travel
2. Cities provide incentives for cars while transit services decline
   - Outcome: imbalance in mode share towards car travel

Traditional Transport Policy Packages (Western Cities)

3. Cities provide coordinated incentives for public and active transport and disincentives for cars

Zurich's Travel Mode – All Trips
- 52% Walking and Cycling
- 19% Public Transport
- 29% Car

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Transport and the Urban Systems

Economic Factors
Nested IO-EC model
ANZSIC 2006 industrial groups
Job and revenue flow-on effects

Land Use Change
Scalable Cellular Automaton
Urban zoning LU classes
Census dwelling categories

Demographic and Health Change
Scalable Synthetic Population
Census household categories
Health & lifestyle characteristics

Transport Patterns
Scalable Activity-based Traffic
Private & public transport
Passenger & freight services

Model Integrator
Model-based System Design
HPC distributed computing
Automated model testing

Services & Utility Demand
Arc-Node network diffusion
Water & energy demand
Education & health services

3D Virtual Urban Landscape
BIM-based precinct modelling
Shading, wind and noise effects
Building sustainability

Urban Governance
Urban master plans
Zoning maps
Strata & DA regulations

Environmental Impact
Aggregated point-source effect
Sewage & solid waste production
Gas & particle emissions

Primary Data
Compact City Observatory
Natural experiments
Specific CCS surveys…

Secondary Data
Census & CURF 2011
Household travel surveys
LIDAR & high-res imagery…

Expert Judgement
Urban design best practice
Building sustainability
Policy & technology change

Natural Experiments
Community-based activities
Policy trials
On-going project evaluation

Scenario Exploration
Serious games
Interactive simulation outputs
Third-party model validation

Compact City Alternatives
Round tables
Sharing international examples
ARDI workshops

Health Impact Assessment
- Exposure to crash risk
- Exposure to air pollution
- Exposure to cardiovascular risk
- Commuting time/work hours loss
- Level of social cohesion
- Level of well-being
- GINI index

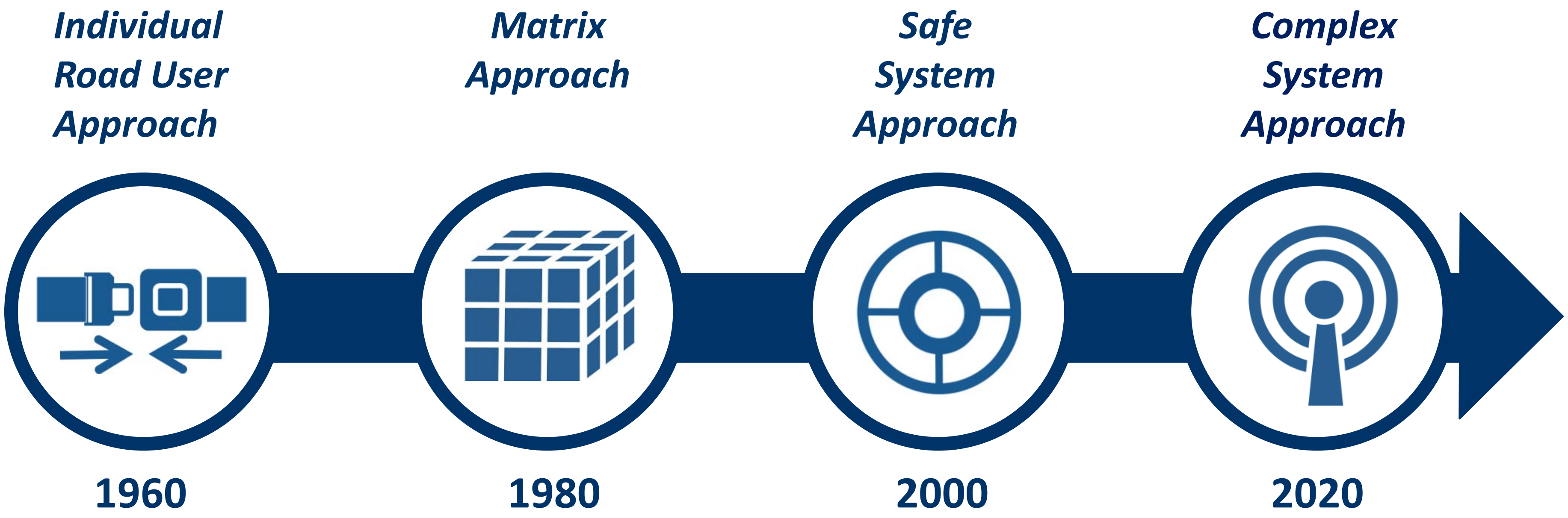
Economic Impact Assessment
- Employment rate
- Revenue per ANZSIC group
- Public infrastructure cost
- Private development cost
- Productivity gain
- Social cost
- Environmental cost

Environmental Impact Assessment
- Level of Greenhouse gas emission
- Level of air particle emission
- Water footprint
- Energy footprint
- Solid waste residual cost
- Sewage residual cost
- Biodiversity cost

Policy Forum
Government representatives
Industry representatives
Community representatives

Australian & international standards and benchmarks

Conclusion



Integrating Safety and Sustainability

Stevenson and Bliss, 2015

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Thank you

Questions?