



A Study of New Zealand Road Accidents Involving Overseas Drivers

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Introduction

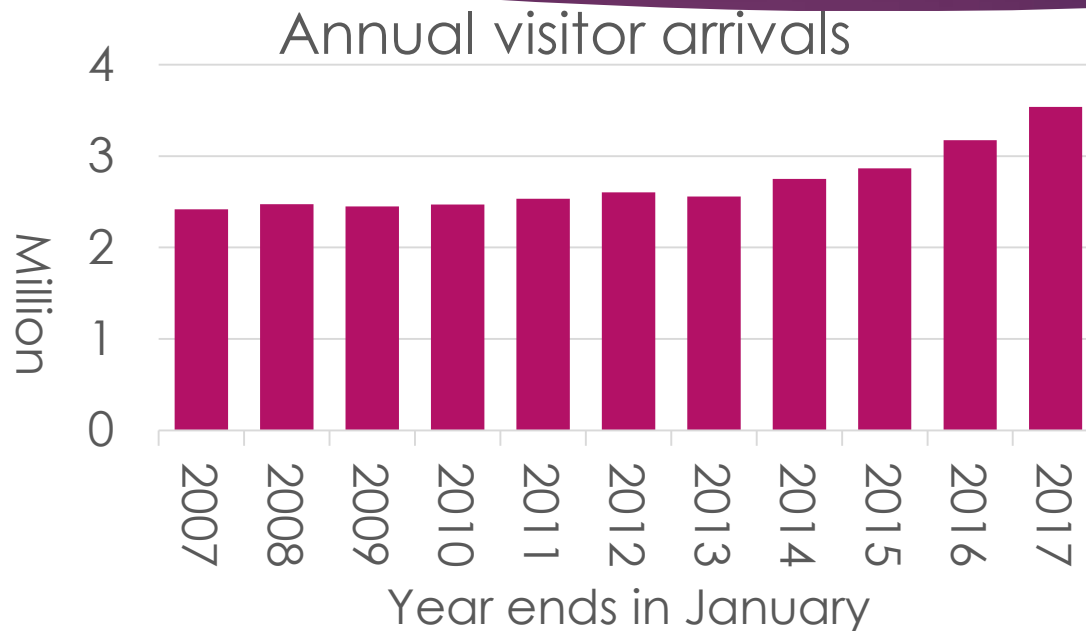
- ▶ Research Background:

See also Kim (2015), *A Study of New Zealand Road Accidents Involving Overseas Drivers: Finding from CAS database*, NZMUG 2015

- ▶ Tourism in NZ
- ▶ Case Study: Tasmania, Australia
- ▶ Road accidents in NZ (CAS Analysis)
- ▶ The causes of road accidents
- ▶ Survey method and sample
- ▶ Analysis: Rank Ordered Logit (ROL) Model
- ▶ Modelling Results
- ▶ Conclusion & Research Direction



Background



Tourism has gone up by **46.3%** since year 2007
(StatisticsNZ, 2017).

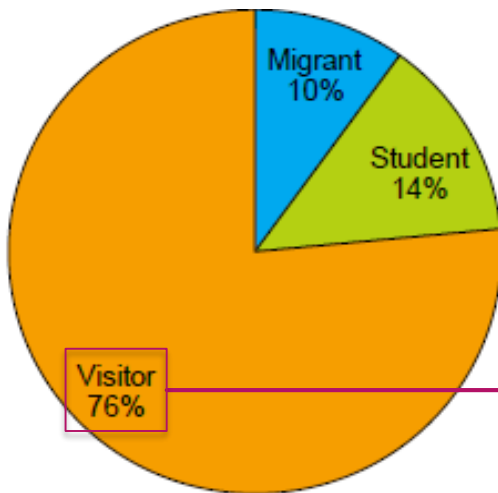
- ▶ Driving is most common way for tourist to travel around the country, **63%** driving themselves by car and 27% going by bus, **10%** by campervan, 7% by plane, 4% by train and 1% by bicycle.

(Source: The Press, 2015)



Road Accidents Statistics: Overseas drivers

- ▶ Previous ten years crash involving overseas drivers rose from 0.6% (1994) to **4.2%** (2012).



Note: 38% of overseas licence holders are not categorised on crash forms and are not included on this chart

- ▶ How many are tourists?

The majority of foreign drivers involving in car accidents is

Visitors

	Fatal	Serious Injury	Minor Injury	Sum
Overseas Drivers Involved	11	90	448	549
Overseas Drivers At Fault	11	78	328	417

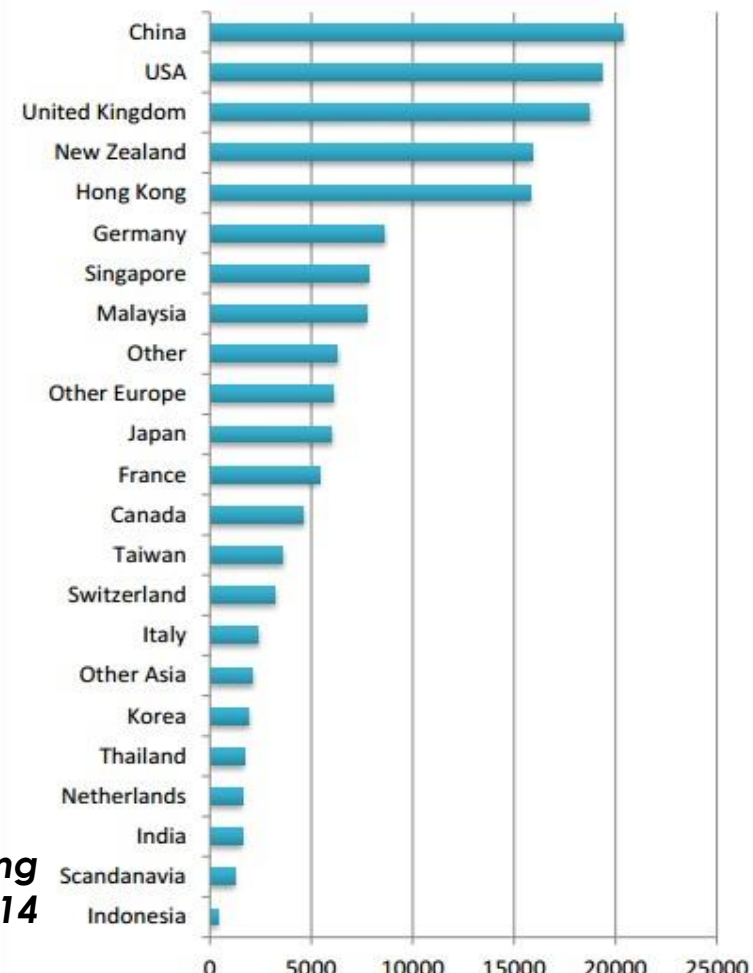
Source:
MoT (2014 & 2015)

Case Study: Tasmania, Australia (2014)

Source: Department of State Growth (2015), Investigation of Tourists as Drivers and Motorcycle Riders in Tasmania and Road Safety interventions

- ▶ In 2014, **six** million international visitors arrived in Australia
- ▶ 167,800 overseas tourist visit to Tasmania (share of **2.7%** visitors to Australia)
- ▶ Almost **1/4** of all international visitors to Australia choose to use a **private or company vehicle, hire car or campervan**

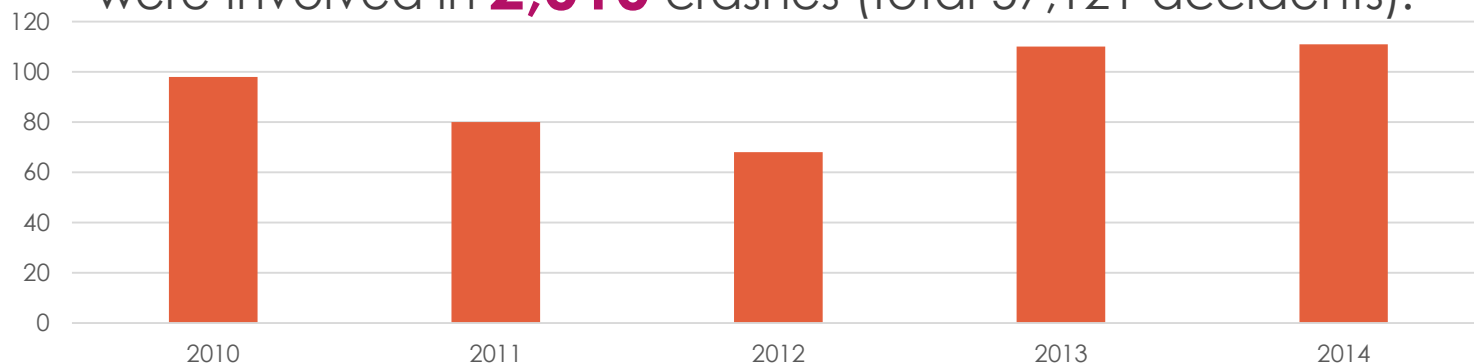
Origin of International tourists visiting Tasmania 2014



Case Study: Tasmania, Australia (2014)

Source: Department of State Growth (2015), Investigation of Tourists as Drivers and Motorcycle Riders in Tasmania and Road Safety interventions

- ▶ Between 2010 and 2014, interstate and international tourists were involved in **2,010** crashes (total 57,121 accidents).



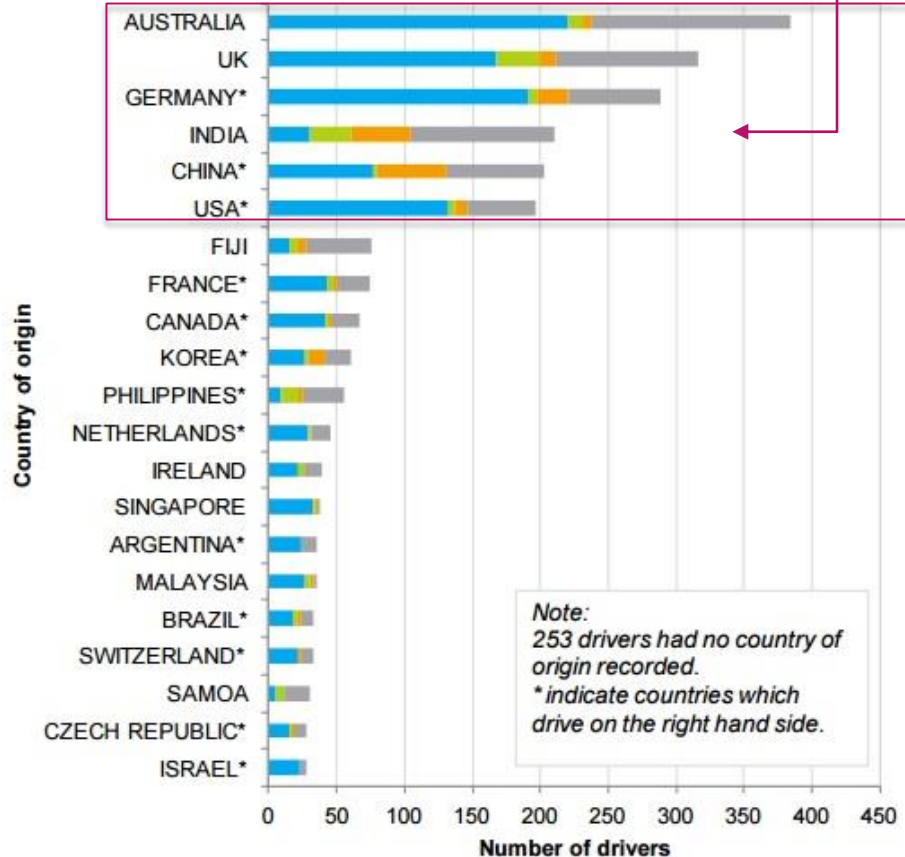
- ▶ Of these 2,010 crashes, 77 % were interstate tourists and **23 %** were international tourists.

	Fatal	Serious Injury	Minor Injury	Property Damage Only	Sum
Overseas Drivers Involved	4	12	91	363* <i>(included 2 unknown)</i>	470

Road Accidents Statistics (CAS): Country of origin

Fatal or injury crashes (2009-2013)

Visitor Migrant Student Unknown

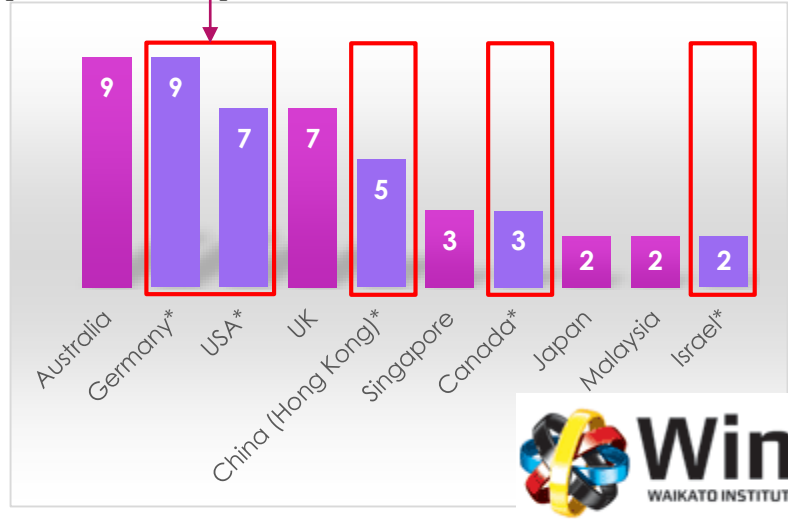


Note:
253 drivers had no country of origin recorded.
* indicate countries which drive on the right hand side.

Six countries are contributing 55% of overseas drivers in crash

56% are overseas drivers from a right-hand-side driving country

Otago, Southland and Westland regions (2010-2014)



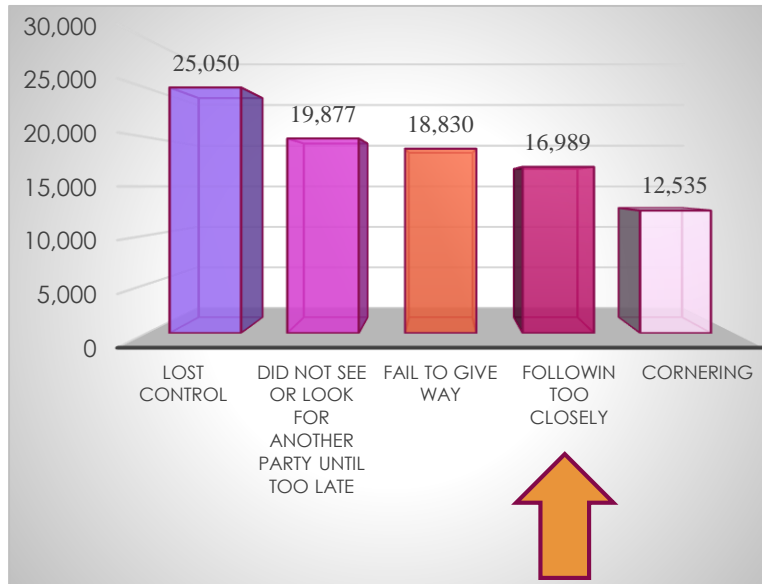
Source: NZTA (2014)

CAS Analysis (2010-2014): Top 5 causes

Source: Kim (2015), A Study of New Zealand Road Accidents Involving Overseas Drivers: Finding from CAS database, NZMUG 2015

Domestic driver related crashes

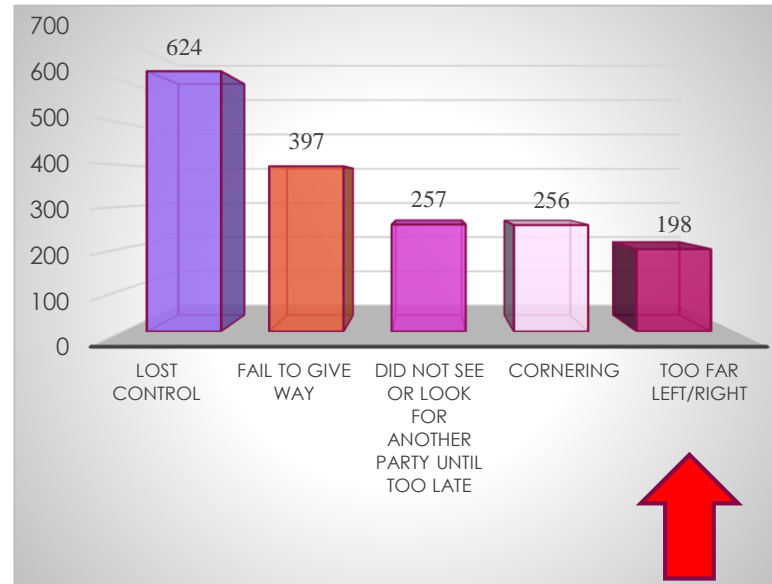
(Total 156,739 accidents, 59.7%)



10.8%
Following Too
Closely

Foreign driver related crashes

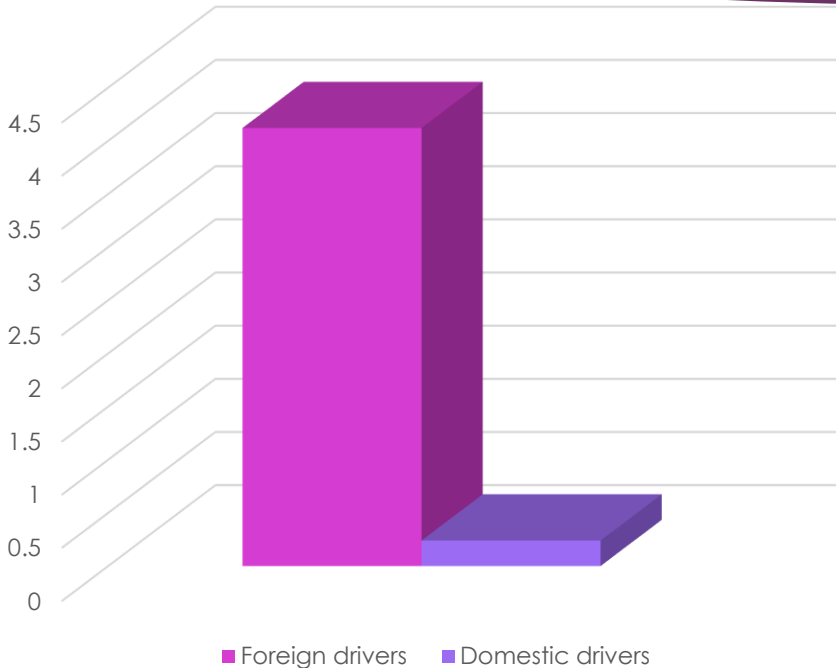
(Total 2,328 accidents, 74.4%)



8.5%
Including Wrong
Side Driving

Driving on the 'wrong' side of the road

Source: Kim (2015), A Study of New Zealand Road Accidents Involving Overseas Drivers: Finding from CAS database, NZMUG 2015



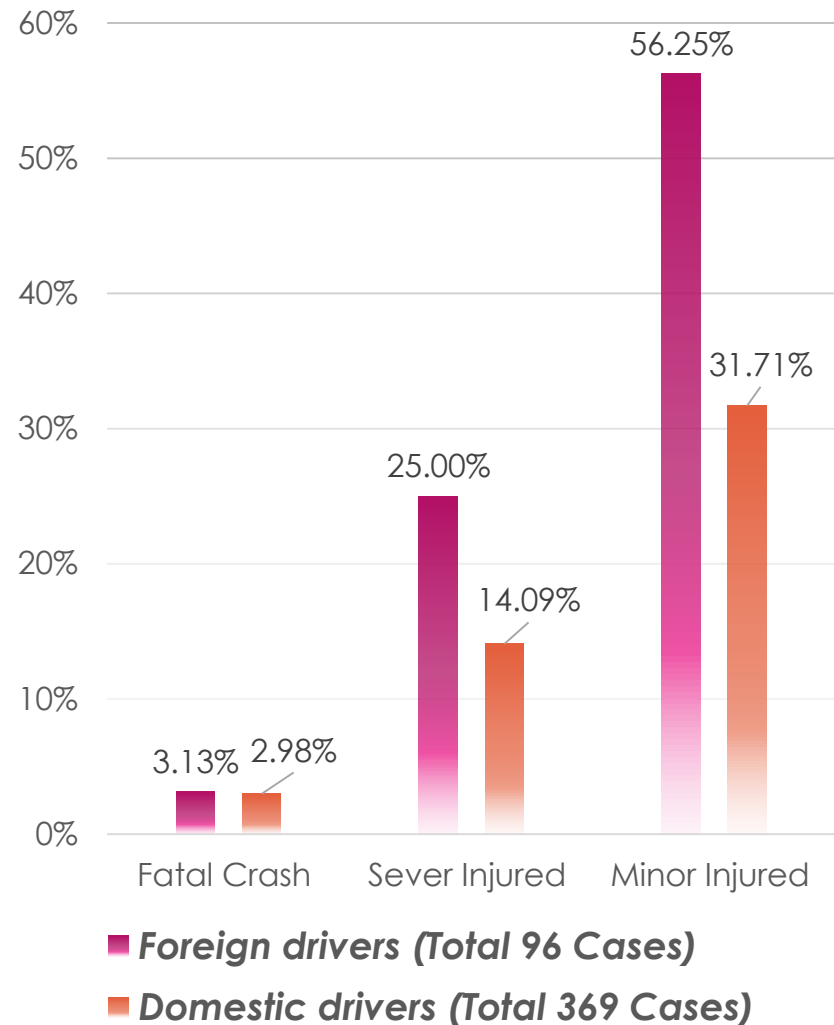
	Incidents	Total Incidents	% involved
Foreign drivers	96	2,328	4.12
Domestic drivers	369	156,739	0.24



Driving on the **'wrong'** side of the road

*'For the crashes due to driving on the wrong side of the road, foreign-driver-related accidents have **84%** of chance (**49%** for domestic) in leading to at least minor injuries'*

Source: Kim (2015), A Study of New Zealand Road Accidents Involving Overseas Drivers: Finding from CAS database, NZMUG 2015



Category of Causes: Common causes of road accidents

Source: Kim (2015), A Study of New Zealand Road Accidents Involving Overseas Drivers: Finding from CAS database, NZMUG 2015



Internal

- Drivers' behaviour and physical characteristics
- Fatigue
- Distraction
- Inexperience
- Road rules and regulations



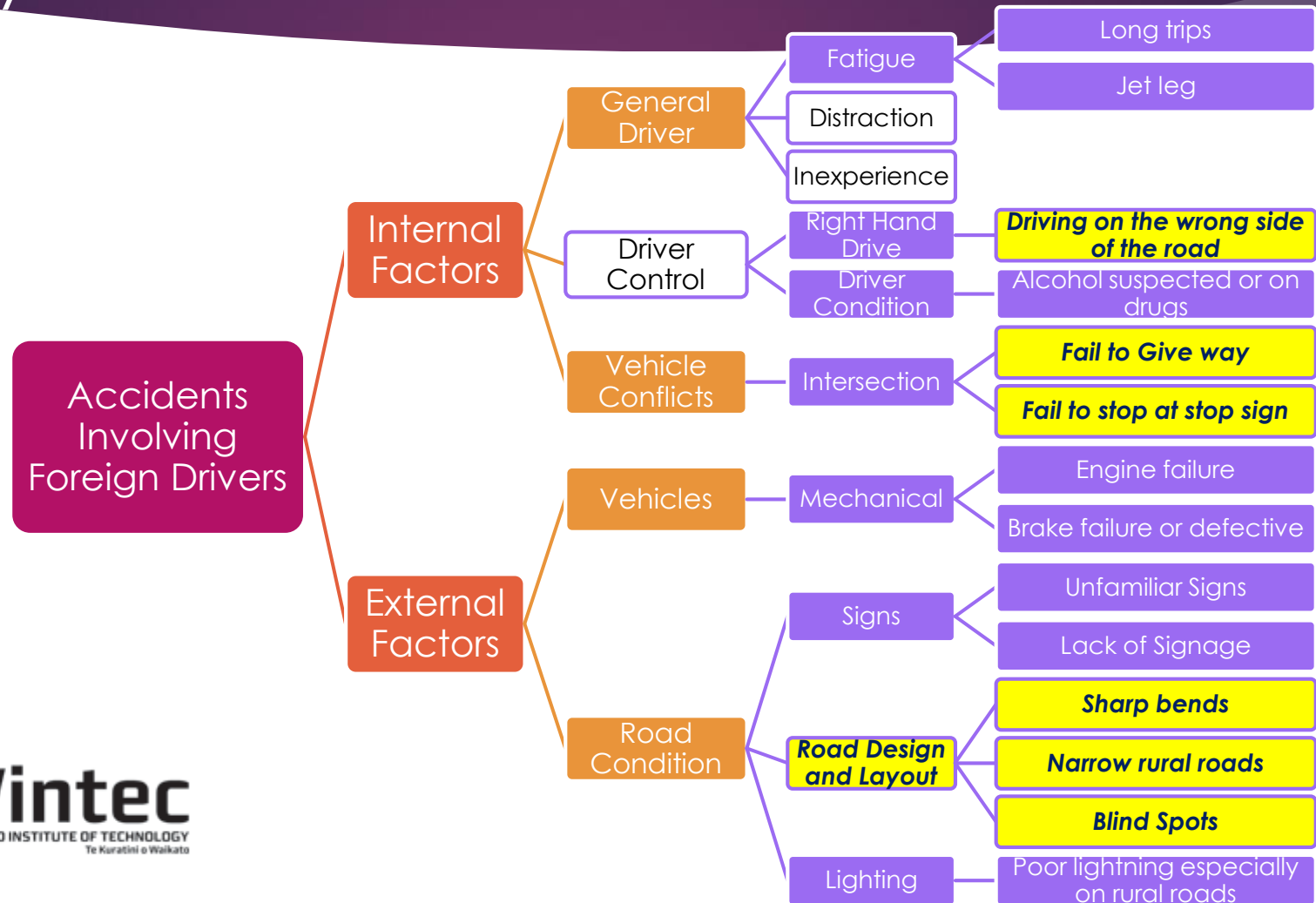
External

- Mechanical (Vehicles)
- Road Signs (Road)
- Road Design and Layout (Road)
- Weather and lighting (Road)



Causes of road accidents by overseas drivers

Source: Kim (2015), A Study of New Zealand Road Accidents Involving Overseas Drivers: Finding from CAS database, NZMUG 2015



Rank-ordered logit (ROL) model

- ▶ Extended from **conditional logit model** (McFadden, 1974; Beggs et al., 1981; Hausman and Ruud, 1987; Pundj and Staelin, 1978; Chapman and Staelin, 1982; and Allison and Christakis, 1994)

$$\begin{aligned} Pr(U_1 > U_2 > \dots > U_j) &= Pr(U_1 > U_j, j = 1, 2, \dots, J) \\ &\bullet Pr(U_2 > U_j, j = 3, 4, \dots, J) \bullet \dots \bullet Pr(U_{j-1} > U_j) \\ &= \frac{e^{V_1}}{\sum_{j=1}^J e^{V_j}} \bullet \frac{e^{V_2}}{\sum_{j=2}^J e^{V_j}} \bullet \dots \bullet \frac{e^{V_{j-1}}}{e^{V_{j-1}} + e^{V_j}} = \prod_{j=1}^{J-1} \left[\frac{e^{V_j}}{\sum_{m=j}^J e^{V_m}} \right] \\ Pr(U_1 > U_2 > \dots > U_K, K \leq J) &= \prod_{j=1}^{K-1} \left[\frac{e^{V_j}}{\sum_{k=j}^K e^{V_k}} \right] \end{aligned}$$

- ▶ ROL model can be estimated by SAS[®] statistical analysis software

Analysis of rankings

Factor	Respondents' Ranking										Mean Rank	Rank Order	
	A	B	C	D	E	F	G	H	I	J			
F _A	1	1	1	1	1	1	1	1	1	1	1	1	1
F _B	2	2	2	2	2	2	2	2	2	2	2	2	2
F _C	3	3	3	3	3	3	3	3	3	3	3	3	3

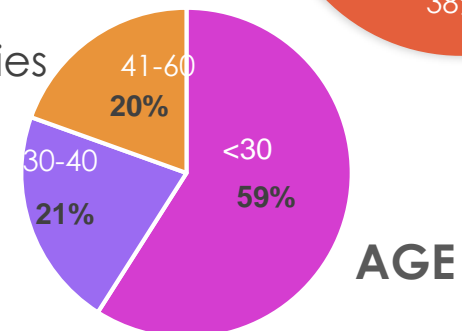
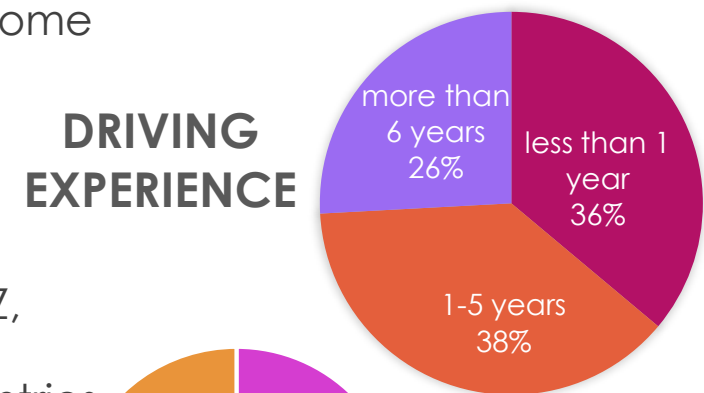
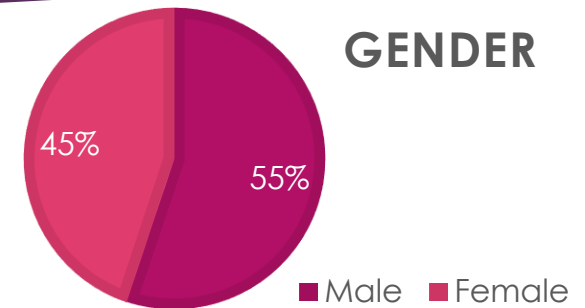
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Factor	Respondents' Ranking										Mean Rank	Rank Order
	A	B	C	D	E	F	G	H	I	J		
F _{A'}	1	2	1	2	2	2	1	1	1	2	1.4	1
F _{B'}	2	1	2	1	1	1	2	2	2	1	1.6	2
F _{C'}	3	3	3	3	3	3	3	3	3	3	3	3

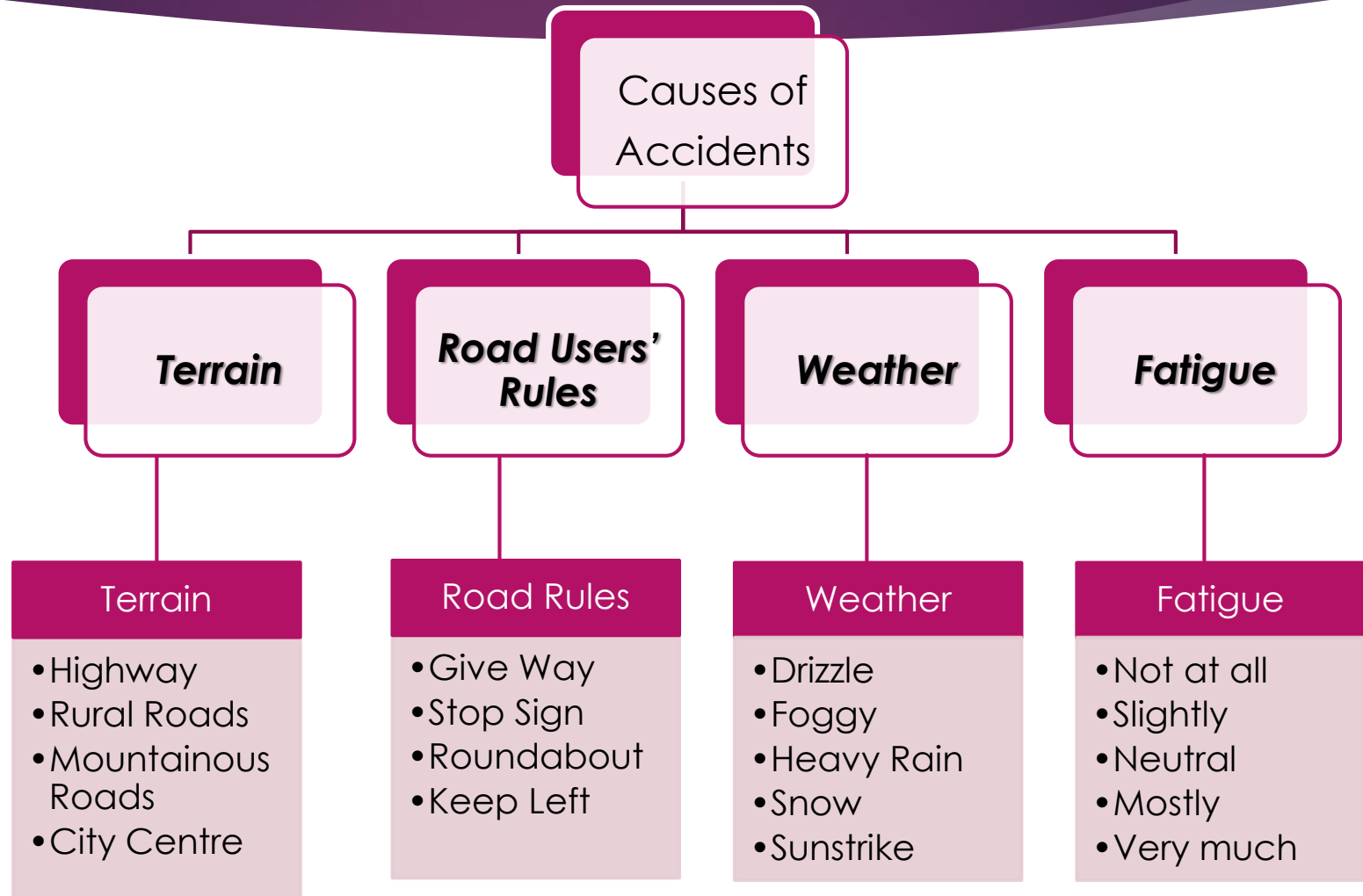
- **Rank-ordered logit** (ROL) model enables assessment of the statistical significance of differences in rankings.

Survey, Sample and modelling

- ▶ Revealed Preference (RP) Survey: **205** tourists from tourist spots in the North Island such as Hamilton, Rotorua, Napier and Gisborne
- ▶ Survey Sample:
 - ▶ **15** different countries, 62% of respondent come from Australia, China and India,
 - ▶ **74%** of all participants come with driving experience,
 - ▶ **18%** had previous driving experience in NZ,
 - ▶ **60%** of respondents were came from countries driving on the right-hand side of the road



Model Parameters: Causes of road accidents by overseas drivers



ROL Modelling Results: General

	Mean	ROL
Road terrain (Base)	2.42 (2)	1.00 (2)
Road user rules	2.68 (4)	*0.82 (4)
Weather	2.40 (1)	1.06 (1)
Fatigue	2.51 (3)	0.91 (3)

- ▶ Road user rule was considered the least difficult factor when driving in NZ

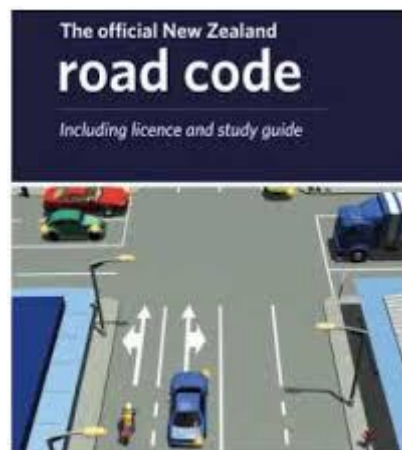


Figure 4: New Zealand road code



ROL Modelling Results: by Subfactor- Road Terrain

	Mean	ROL
Highways (base)	2.80 (3)	1.00 (3)
Rural roads	2.44 (2)	***1.52 (2)
Mountainous roads	1.96 (1)	***2.40 (1)
City centre	2.80 (3)	0.95 (4)

- ▶ Overseas drivers are significantly likely to select the option of **mountainous** and **rural roads** as being difficult for driving.



ROL Modelling Results: by Subfactor- Road User Rule

	Mean	ROL
Give way (base)	2.51 (2)	1.00 (2)
Stop sign	2.60 (3)	0.88 (3)
Roundabout	2.07 (1)	***1.52 (1)
Keep left	2.81 (4)	***0.71 (4)

- ▶ Overseas drivers ranked **roundabouts** as the greatest challenge but with driving on the left being ranked as less significant than using give way.



ROL Modelling Results: by Subfactor- Weather

	Mean	ROL
Drizzle (base)	3.83 (5)	1.00 (5)
Fog	2.54 (2)	***3.16 (2)
Heavy rain	2.35 (1)	***3.77 (1)
Snow	3.22 (4)	***1.70 (4)
Sunstrike	3.02 (3)	***2.00 (3)

- **Heavy rain** has 3.78 times the chance of being chosen than drizzle, followed by fog (3.16 times), sunstrike (2 times) and snow (1.694 times)



ROL Modelling Results: by Age

Respondents' socio-demographic characteristics

Age Under 30	Factors	Mean	ROL
Road Terrain	Rural Roads	**0.596	1.814
	Mountainous Roads	***0.899	2.457
	City Centre	***0.718	2.050
Road Rule	Roundabout	**0.518	1.679
Age Over 30	Factors	Coefficient	ROL
General	Fatigue	*0.438	1.550

- ▶ *"The report shows that very few short-term visitors crash within their first few days in New Zealand, and of those that do crash, **fatigue** is generally not a contributing factor" from Overseas drivers in crashes, April 2016*

ROL Modelling Results:

By Respondents' socio-demographic characteristics

by Duration of stay: long term visitors

	Factors	Mean	ROL
Road Terrain	Mountainous Roads	**0.629	1.876
Road Rule	Roundabout	*0.486	1.626

by Country of origin: drive on the right

	Factors	Mean	ROL
Road Rule	Keep Left	*0.659	1.933

by Driving experience in NZ: less than one month

	Factors	Mean	ROL
Weather	Heavy Rain	*0.479	1.615

Conclusion

- ▶ The increased tourism coming into New Zealand result in an increased car accidents.
- ▶ However, any additional legislation for overseas drivers may impact negatively on the NZ tourism industry.
- ▶ What policies that both promote a road safety and protect the tourism industry?



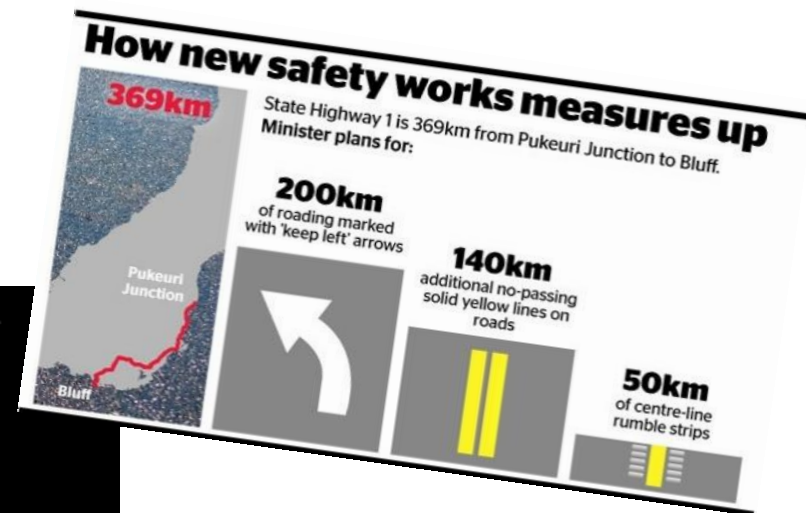
Conclusion: How to lower the risk of accident? (Identify feasible policy options)

'Tailored' programmes to educate overseas drivers (e.g. IRD tax code and guides)

- ▶ General education for all overseas visitors,
 - ▶ NZ Road terrain: Driving mountainous roads
 - ▶ NZ Weather: Warning system - heavy rain and fog
- ▶ Customized education for the various socio-demographic groups
 - ▶ By country of origin: NZ road user rules (e.g. Roundabouts)
 - ▶ Visitors from right-hand-side driving countries: Keep left
 - ▶ Less experienced drivers: restriction (e.g. L and R)

Limitation

- ▶ Sample size, the location of sample collected and seasonal fluctuation of visitors
- ▶ Limited access to CAS database
- ▶ Lack of overseas case studies and statistics



Research Direction

- ▶ Discrete choice (Behaviour) models allow researchers to analyse and predict how people's choices are influenced by their personal characteristics and by the alternatives available to them
- ▶ See 'Inquiry into Serious Injury' (2014) by Road Safety Committee (Parliament of Victoria)
- ▶ Apply policy options to estimates the demand changes in comparison with the 'do-nothing' policy
 - ▶ Increasing insurance premium for rental vehicle (or tax)
 - ▶ Compulsory driving education (or test)
 - ▶ Restriction for rental car
- ▶ Measure Willingness-to-pay (WTP) to evaluate elasticity of tourist demand based on new road safety policy/regulation