Using crash and injury data to assess vehicles: Used Car Safety Ratings
OUTLINE

- Use of crash data – injury severity as a marker of safety
- How secondary safety is evaluated using NZ and Australian crash data
  - Crashworthiness
  - Aggressivity
  - Total safety
- Related research using fleet data from NZ and Australia
  - Safety of NZ vehicle fleet vs. Australian states
  - Correspondence between ANCAP ratings and crashworthiness
  - Rollover risk for different vehicle types and driver groups
  - Effectiveness of Electronic Stability Control for different vehicle types
  - Side airbags
  - Are high powered vehicle restrictions for you drivers worthwhile?
  - Injuries to pedestrians according to vehicle type
  - Impacts of NZ WoF regime
Levels of injury severity in crash data assigned by the Police officers who attend and report the crashes.

- Crashes in NZ are not regularly recorded if no-one is injured. Victoria (Australia) is similar.

- But crashes in some Australian States are recorded if a vehicle needs to be towed, even if there is no injury. These States include: New South Wales, Queensland, Western Australia, South Australia

- **Minor** injuries are those requiring medical attention, but not hospital admission

- **Serious** injuries require hospital admission but the victim does not die within 30 days as a consequence of the injuries sustained

- **Death** (within 30 days as a consequence of injuries in the crash)
Female driver fatality risk by age (Evans, 2001)

\[
R = \frac{\text{Risk at plotted age}}{\text{Risk to age 20 MALE}}
\]

- \(\alpha = (31.1 \pm 2.2)\%\)
- \(\beta = (2.16 \pm 0.10)\%\)

All female occupants
93,389 Fatalities
Risk of pedestrian severe injury and death by impact speed (Tefft, 2012)

**Fig. 1.** Risk of severe injury (left) and death (right) in relation to impact speed in a sample of 315 pedestrians aged 15+ years struck by a single forward-moving car or light truck model year 1989–1999, United States, 1994–1998. Risks adjusted for pedestrian age, height, weight, body mass index, and type of striking vehicle: standardized to the population of pedestrians struck in the United States in years 2007–2009 with respect to pedestrian age and type of striking vehicle. Dotted lines represent point-wise 95% confidence intervals. Severe injury is defined as AIS score of 4 or greater and includes death irrespective of AIS score.
How can ACC levies based on vehicle safety ratings improve safety?

- NZ currently has a vehicle fleet that is considerably less safe than the Australian fleet (see some examples later in presentation)
- This is almost certainly influenced by the relatively low price of imported second-hand vehicles
- We need initiatives to increase safety
- Via levies, vehicle purchasers may become more aware of $ value of safety (as well as personal value)
- This may affect resale value of used cars (increase value for safer vehicles)
- Signal to market leading to changes in fleet
  - Potential small influence on manufacturers (in vehicle production)
  - Influence on importers of new and used vehicles
INTERNATIONAL VEHICLE SAFETY RATING SYSTEMS USING CRASH DATA

- Insurance Institute for Highway Safety, USA
- Highway Loss Data Institute, USA
- Folksam Insurance, Sweden
- Department of Transport, UK
- University of Oulo, Finland
- Monash University Accident Research Centre, Australia
CRASH DATA: 2014 UPDATE

• Light vehicles (cars, SUVs and light commercial vehicles) manufactured during 1987-2012

• Crashes reported to police in 6 Australasian jurisdictions
  - Injury crash data (injury severity)
    o Victoria 1987-2012
    o New Zealand 1991-2012
  - Tow-Away (Injury and Non-Injury) crash data (injury risk)
    o New South Wales 1987-2012
    o Queensland 1991-2012
    o Western Australia 1991-2012
    o South Australia 1995-2012

• Total Data
  • Over 4 million involved drivers
  • 1 million injured drivers
Vehicle Makes and Models: Identification and Classification

- Identification
  - VIN Decoding
  - Registered make and model clustering

- Market Group Classification
  - 12 groups
  - broadly following VFACTS

- Light
- Small
- Medium
- Large
- Luxury
- Sports
- People Mover
- Commercial - Ute
- Commercial – Van
- Small 4WD
- Medium 4WD
- Large 4WD
CRASHWORTHINESS RATING

= INJURY RISK \times \text{INJURY SEVERITY}

Measures the risk of death or hospital admission for drivers involved in tow-away crashes as a function of vehicle model or market group driven.
FACTORS TAKEN INTO ACCOUNT

• DRIVER AGE
• DRIVER SEX
• SPEED LIMIT AT THE CRASH LOCATION
• NUMBER OF VEHICLES INVOLVED
• JURISDICTION AND YEAR OF CRASH

The crash speed was not available in the data
RATINGS RESULTS: CRASHWORTHINESS

Make and Model

1. Daihatsu Charade 82-86
2. Daihatsu Charade 88-92
3. Daihatsu Charade 93-00
4. Daihatsu Pyzar 97-01
5. Daihatsu Sirion / Storia 98-04
6. Daihatsu Mira 90-96
7. Daewoo Matiz 99-04
8. Daewoo Kalos 03-04
9. Ford / Mazda Festiva WA / 121 87-90
10. Ford / Mazda Festival / WA / 121 87-90
11. Ford Ka 99-02
12. Holden Barina 00-01
13. Holden Barina TK 05-07
14. Holden Barina XC 01-06
15. Holden Barina WB 05-07
16. Holden Barina XB 88-92
17. Holden Barina XB 95-00
18. Holden Barina TK 05-07
19. Holden Barina XT 06-07
20. Holden Barina XT 05-07
21. Honda / Mazda 121 / Autozam Review 94-96
22. Honda City 83-86
23. Honda Jazz / Fit 02-07
24. Honda Jazz / Fit 02-07
25. Honda City 85-86
26. Honda City 85-86
27. Honda Civic 96-99
28. Subaru / Suzuki / Swift 82-86
29. Subaru / Suzuki / Swift 86-88
30. Suzuki Swift 82-85
31. Suzuki Swift 89-99
32. Suzuki Hatch / Alto 82-84
33. Suzuki Ignis 00-02
34. Suzuki Swift 05-07
35. Suzuki Swift 04-07
36. Suzuki Swift 02-07
37. Suzuki Swift 01-07
38. Suzuki Swift 00-02
39. Suzuki Swift 96-99
40. Suzuki Swift 96-99

Light

- Crashworthiness
- Benchmark
- Worse than benchmark + 1 increment
- Worse than benchmark + 2 increments
- Worse than benchmark + 3 increments
AGGRESSIVITY RATING

= INJURY RISK x INJURY SEVERITY

• Measures the risk of death or hospital admission for drivers and unprotected road users (pedestrians, bicyclists and motorcyclists) as a function of the *colliding* vehicle model or market group
FACTORS TAKEN INTO ACCOUNT

- Other driver / Unprotected road user age and sex
- Type of collision partner: driver or unprotected road user
- Focus car driver age and sex
- Speed limit at the crash location
- Jurisdiction and year of crash
RATINGS RESULTS: AGGRESSIVITY

Commercial - Utes

1. Ford / Nissan Falcon Ute / XFN Ute 82-95
2. Ford Falcon Ute 96-99
3. Ford Falcon Ute AU 00-02
4. Ford Falcon Ute BA/BF 03-07
5. Ford Ford F-Series 82-92
6. Ford F-Series 01-06
7. Holden Commodore Ute VG/VP 90-93
8. Holden / Isuzu Rodeo / Pickup 82-85
9. Holden / Isuzu Rodeo / Pickup 86-88
10. Holden / Isuzu Rodeo / Pickup 89-95
11. Holden Rodeo 96-98
12. Holden Rodeo 99-02
13. Holden WB Series 82-85
14. Holden Commodore Ute VR/VS 94-00
15. Holden Commodore VU Ute 00-02
16. Holden Commodore VY/VZ Ute 02-07
17. Holden Rodeo 03-07
18. Mitsubishi Triton MK 96-06
19. Kia Ceres 92-00
20. Ford / Mazda Courier / B-Series / Bounty 98-02
21. Ford / Mazda Courier / Bravo / Bounty 03-06
22. Nissan 720 Ute 82-85
23. Nissan Navara 86-91
24. Nissan Navara 92-96
25. Nissan Navara 97-05
26. Subaru Brumby 82-92
27. Suzuki Mighty Boy 85-88
28. 4Runner/Hilux 82-85
29. 4Runner/Hilux 86-88
30. 4Runner/Hilux 89-97
31. Hilux 96-02
32. Hilux 03-04
33. Hilux 05-07
AGGRESSIVITY RATINGS VS CRASHWORTHINESS RATINGS

![Graph showing the relationship between aggressivity ratings and crashworthiness ratings for different vehicle types. The graph includes various markers representing different vehicle categories such as 4WD - Compact, 4WD - Medium, 4WD - Large, Commercial - Van, Commercial - Ute, Large, Medium, People Mover, Light, and Small.](image-url)
The Need for an Index Combining Crashworthiness and Aggressivity

- If consumers are left to decide on relative importance of crashworthiness and aggressivity
  - May not lead to fleet mix that optimises overall secondary safety and hence achieves best possible trauma reductions across the community

- Even regulators and vehicle safety advocates unsure of appropriate optimum weighting
  - Many only consider crashworthiness
The Total Secondary Safety Index Concept

- Light Vehicle to Light Vehicle (Both Drivers) Crashworthiness + Aggressivity: 45.3%
- Single Light Vehicle (Light Vehicle Driver) Crashworthiness: 28.9%
- Light Vehicle to Heavy Vehicle (Light Vehicle Driver) Crashworthiness: 16.0%
- Light Vehicle to Unprotected Road User (Unprotected Road User) Aggressivity: 9.7%
Total Secondary Safety

- Relative safety of vehicles in preventing severe injury to all road users (vehicle occupants, bicyclists and pedestrians) involved in a crash with rated vehicle

- Combined crashworthiness and aggressivity performance – total social impact

- UCSR Total Secondary Safety Metric:
  - Risk of death or serious injury (hospitalisation) to all vehicle drivers, bicyclists or pedestrians in a crash involving rated vehicle
Total Secondary Safety

Compact 4WD

Make and Model

1. Daihatsu Feroza / Rocky 89-97
2. Daihatsu Rocky / Rugger 85-98
3. Daihatsu Terios 97-05
4. Holden Cruze 02-06
5. Hyundai Tucson 04-07
6. Mitsubishi Pajero iO 99-03
7. Mitsubishi Outlander 03-06
8. Kia Sportage 98-03
9. Kia Sorento 03-07
10. Ford / Mazda Escape / Tribute 01-06
11. Nissan X-Trail 01-07
12. Lada Niva 84-99
13. Honda CR-V 97-01
14. Honda CR-V 02-07
15. Honda HR-V 99-02
16. Land Rover Freelander 98-06
17. Subaru Forester 97-02
18. Subaru Forester 02-07
20. Suzuki Grand Vitara 99-05
22. Suzuki Jimny 98-07
23. RAV4 94-00
24. RAV4 01-06
25. RAV4 06-07
Total Secondary Safety by Market Group

Vehicle Market Group

- 4WD-Compact
- 4WD-Large
- 4WD-Medium
- Commercial-Ute
- Commercial-Van
- Large
- Medium
- People Mover
- Small
- Light
Crashworthiness is strongly related with TSSI
Aggressivity is less strongly related

Figure 13: Aggressivity vs. Total Secondary Safety
ALLOCATING RATINGS TO THE NZ FLEET
NZ fleet is unusual (only 12% are <6 years old)
Secondary safety has improved with time

Figure 14: Crashworthiness by year of manufacture (with 95% confidence limits)
Market group secondary safety has improved...
Challenges – NZ fleet

- There are almost 3 million licensed light passenger vehicles
- There were 86,317 unique make/model combinations (including typos on the register) for licensed light passenger vehicles in 2014
- Imported used vehicles make up 51% of licensed fleet (2012 data)
## Actual example of vehicles on register

<table>
<thead>
<tr>
<th>make</th>
<th>model</th>
<th>manufacture year</th>
<th>modelh</th>
<th>market group</th>
<th>VIN</th>
<th>IMPORT STATUS</th>
<th>method</th>
<th>TSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>MITSUBISHI</td>
<td>L300</td>
<td>1994</td>
<td>I23 C</td>
<td>People Mover</td>
<td>*****</td>
<td>RE-REG</td>
<td>1</td>
<td>0.049</td>
</tr>
<tr>
<td>MITSUBISHI</td>
<td>CHARIOT</td>
<td>1988</td>
<td>I10 A</td>
<td>People Mover</td>
<td>*****</td>
<td>RE-REG</td>
<td>1</td>
<td>0.044</td>
</tr>
<tr>
<td>AUSTIN</td>
<td>COOPER</td>
<td>1966</td>
<td>LEY Z</td>
<td></td>
<td>*****</td>
<td>RE-REG</td>
<td>3</td>
<td>0.053</td>
</tr>
<tr>
<td>MAZDA</td>
<td>323</td>
<td>1994</td>
<td>M99 Z</td>
<td>Small</td>
<td>*****</td>
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<td>2</td>
<td>0.040</td>
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<tr>
<td>MAZDA</td>
<td>MX5</td>
<td>1993</td>
<td>M11 A</td>
<td>Small</td>
<td>*****</td>
<td>RE-REG</td>
<td>1</td>
<td>0.047</td>
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<tr>
<td>MAZDA</td>
<td>626</td>
<td>1994</td>
<td>M02 E</td>
<td>Medium</td>
<td>*****</td>
<td>RE-REG</td>
<td>1</td>
<td>0.040</td>
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<tr>
<td>TOYOTA</td>
<td>LANDCRUISER</td>
<td>1992</td>
<td>T20 B</td>
<td>SUV Large</td>
<td>*****</td>
<td>USED</td>
<td>1</td>
<td>0.048</td>
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<tr>
<td>SUBARU</td>
<td>LEGACY</td>
<td>1989</td>
<td>SU2 A</td>
<td>Medium</td>
<td>*****</td>
<td>USED</td>
<td>1</td>
<td>0.043</td>
</tr>
<tr>
<td>HONDA</td>
<td>ASCOT</td>
<td>1990</td>
<td>O99 Z</td>
<td>Small</td>
<td>*****</td>
<td>USED</td>
<td>2</td>
<td>0.043</td>
</tr>
<tr>
<td>HONDA</td>
<td>INTEGRA</td>
<td>1986</td>
<td>O5 A</td>
<td>Small</td>
<td>*****</td>
<td>RE-REG</td>
<td>1</td>
<td>0.050</td>
</tr>
<tr>
<td>NISSAN</td>
<td>SKYLINE</td>
<td>1986</td>
<td>N04 Z</td>
<td>Large</td>
<td>*****</td>
<td>RE-REG</td>
<td>1</td>
<td>0.049</td>
</tr>
<tr>
<td>TOYOTA</td>
<td>CROWN</td>
<td>1990</td>
<td>T07 C</td>
<td>Large</td>
<td>*****</td>
<td>USED</td>
<td>1</td>
<td>0.033</td>
</tr>
<tr>
<td>DAIHATSU</td>
<td>MIRA</td>
<td>1995</td>
<td>D3 Z</td>
<td>Light</td>
<td>*****</td>
<td>NEW</td>
<td>1</td>
<td>0.078</td>
</tr>
<tr>
<td>SUZUKI</td>
<td>SWIFT</td>
<td>1995</td>
<td>SZ01C</td>
<td>Light</td>
<td>*****</td>
<td>NEW</td>
<td>1</td>
<td>0.052</td>
</tr>
<tr>
<td>TOYOTA</td>
<td>CELICA</td>
<td>1987</td>
<td>T06 B</td>
<td>Medium</td>
<td>*****</td>
<td>RE-REG</td>
<td>1</td>
<td>0.047</td>
</tr>
<tr>
<td>TOYOTA</td>
<td>BLIZZARD</td>
<td>1987</td>
<td>T16 B</td>
<td>Ute</td>
<td>*****</td>
<td>RE-REG</td>
<td>1</td>
<td>0.052</td>
</tr>
<tr>
<td>SUBARU</td>
<td>VIVIO</td>
<td>1995</td>
<td>SU99Z</td>
<td>Light</td>
<td>*****</td>
<td>NEW</td>
<td>2</td>
<td>0.043</td>
</tr>
<tr>
<td>TOYOTA</td>
<td>COROLLA</td>
<td>1985</td>
<td>T99 Z</td>
<td>Light</td>
<td>*****</td>
<td>RE-REG</td>
<td>2</td>
<td>0.057</td>
</tr>
<tr>
<td>BMW</td>
<td>325I</td>
<td>1994</td>
<td>BM3 B</td>
<td>Medium</td>
<td>*****</td>
<td>RE-REG</td>
<td>1</td>
<td>0.038</td>
</tr>
</tbody>
</table>
Hierarchy of methods

A hierarchical order to apply a TSSI to every vehicle (with most precise estimates listed first) is:

1. by make/model/year of manufacture
2. by market group (e.g., small car; compact SUV) and year of manufacture
3. by year of manufacture alone

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
<th>% of fleet beginning 2014</th>
<th>Exclude year of manuf 2011-13</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Model id</td>
<td>71.4%</td>
<td>71.2%</td>
</tr>
<tr>
<td>2</td>
<td>Market group and year</td>
<td>23.6%</td>
<td>24.0%</td>
</tr>
<tr>
<td>3</td>
<td>Year only</td>
<td>5.0%</td>
<td>4.8%</td>
</tr>
</tbody>
</table>
Limitations of the ratings

- There need to be enough data for a rating to be made
- This means that recent model vehicles cannot be rated yet
- To ensure a reasonable level of accuracy:
  - the width of the 90% two-sided confidence interval needs to be less than 2.00%, and
  - the ratio of the confidence interval width to the rating score (coefficient of variation) needs to be less than 1.6
- For crashworthiness, only injuries to the driver are assessed (not passengers). This is because of limitations in crash data (we often don’t know whether a passenger is in a crashed vehicle unless they are injured). It is reasonable to assume that passenger injury outcomes will approximately mirror those of the driver.
- Mean NZ occupancy (per kilometre driven, NZTS 2011) was 1.56
PRESENTATION OF THE RATINGS
VEHICLE CRASHWORTHINESS RATINGS AND CRASHWORTHINESS BY YEAR OF VEHICLE MANUFACTURE:

VICTORIA AND NSW CRASHES DURING 1987-95
2011: Crashworthiness + Total Secondary Safety Best Picks

### Buyer’s Guide to Used Car Safety Ratings 2011

**Small Cars**

<table>
<thead>
<tr>
<th>Year</th>
<th>Make</th>
<th>Safety Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>Toyota Corolla</td>
<td>5 stars</td>
</tr>
<tr>
<td>2011</td>
<td>Ford Focus</td>
<td>4 stars</td>
</tr>
<tr>
<td>2011</td>
<td>Mazda 3</td>
<td>4 stars</td>
</tr>
</tbody>
</table>

**Light Cars**

<table>
<thead>
<tr>
<th>Year</th>
<th>Make</th>
<th>Safety Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>Honda Civic</td>
<td>5 stars</td>
</tr>
<tr>
<td>2011</td>
<td>Nissan Versa</td>
<td>4 stars</td>
</tr>
<tr>
<td>2011</td>
<td>Hyundai Accent</td>
<td>3 stars</td>
</tr>
</tbody>
</table>

**Commercial Vehicles - Vans**

<table>
<thead>
<tr>
<th>Year</th>
<th>Make</th>
<th>Safety Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>Ford Transit</td>
<td>4 stars</td>
</tr>
<tr>
<td>2011</td>
<td>Chevrolet Express</td>
<td>3 stars</td>
</tr>
<tr>
<td>2011</td>
<td>Mercedes-Benz Sprinter</td>
<td>5 stars</td>
</tr>
</tbody>
</table>

**Commercial Vehicles - Utes**

<table>
<thead>
<tr>
<th>Year</th>
<th>Make</th>
<th>Safety Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>Isuzu D-Max</td>
<td>4 stars</td>
</tr>
<tr>
<td>2011</td>
<td>Holden Colorado</td>
<td>3 stars</td>
</tr>
<tr>
<td>2011</td>
<td>Toyota Hilux</td>
<td>5 stars</td>
</tr>
</tbody>
</table>
Vehicle Safety Research Group: The Broader Research Programme
Crash fleets by crashworthiness quintile: Region
Safe Vehicle Choices: Crash fleets by crashworthiness quintile: Age

![Graph showing the relationship between crash fleets and Vehicle CWR quintile by age categories.](image-url)
Safe Vehicle Choices: Crash fleets by crashworthiness quintile: Gender

![Graph showing the relationship between vehicle crashworthiness quintile and % crash fleet for males and females.](image-url)
Older Driver Vehicle Choice

- Older drivers tend to drive vehicles which were purchased new or only a few years old and they retain the vehicles for long periods, possibly until they no longer wish to drive anymore.
  
  - to prevent missing critical technology, it is vital that older drivers buy the safest vehicle with the most advanced relevant safety technology. The features contained in their purchase need to be relevant for years to come.

- Choosing the vehicle with the best possible crashworthiness can reduce injury risk by up to 80% but a minimum of 30% on average

- Forward collision avoidance technology with automatic braking across all speeds was identified as the optional advanced safety technology which best matched the crash types and driving behaviour of older drivers. It was found to be associated with expected injury crash reductions for older drivers of about 10-23%. Curtain airbags and ESC also important.
ANCAP results to predict crashworthiness
(charge of fatal or serious injury in a crash)

- ANCAP crash test results conducted from 1997 to 2007
- 69 cars were able to also have crashworthiness ratings estimated
- Problems with this sort of exercise include:
  - ANCAP safety ratings should not generally be compared across vehicle categories, particularly if there is a large mass difference
  - ANCAP ratings protocols change over time to reflect increased safety levels, so comparing ratings across time periods can be problematic
  - The crashworthiness ratings (from the Used Car Safety Ratings) are based on crash data, so have statistical uncertainty
Relationship Between ANCAP & Real World Crash Outcomes
4WD Rollover Risk by Age and Gender of Driver

- 4WDs 8x more likely to rollover in speed zones 80km/h & above
- Rollovers more common for young drivers & older females
Crash Risk Reduction related to ESC: Injury Crashes

Adjusted Effectiveness (%)

-100
-80
-60
-40
-20
0
20
40
60
80
100

Crash Type

ALL VEHICLES

SUVS

CARS

All Crashes
SVA only
MVA only
Effectiveness of Side Airbag Systems

- Use of Police recorded injury outcome alone is insufficient to evaluate side airbag effectiveness
- Linked data with validated injury outcome by body region produces much more stable analysis
- **Combination** torso and head protecting airbags are highly effective in reducing risk of injury
  - 50% reduction in odds of injury overall
  - 60% reduction in odds of injury to head, face, neck & chest
  - 53% reduction in odds of injury to head, face & neck
- **Torso-only** protecting airbags are less effective
  - No statistically significant injury effects
Crash Risk and Vehicle Colour

Crash Risk Risk Relative to White

Relative Risk

Colour

MONASH University
Accident Research Centre
Relative injury rate of high powered vehicle vs non-high powered

![Bar graph showing relative injury rates across different age groups.](image-url)
High Powered Vehicle Restrictions: Policy Implications

- Half of the injuries from young people’s high performance vehicle crashes could be prevented, given optimistic assumptions.
- But high performance vehicles are rare (1%-4% of young driver crash fleet).
- Only 0.4%-1.8% injuries arising from crashes involving young drivers could be prevented.
- Regulations are expensive to establish and police. There appear to be only very modest potential safety gains compared to the effort.
Pedestrian Injury Risk: Odds of Death or Serious Injury (REF=Large)

All Body Regions

Market Group

SUVM  SUVL  SUVC  SL  S  PM  M  CV  CU

Odds

95.6%  8.2%  1.4%  -13.2%  -6.2%  25.6%  -1.5%  31.6%  53.2%

MONASH University
Accident Research Centre

A centre within the Monash University Injury Research Institute
Vehicle Roadworthiness Inspections: Relative crash involvement rate

![Graph showing the relationship between vehicle age and crash risk relative to age 10. The graph indicates an increasing trend with vehicle age.]
Vehicle Roadworthiness Inspections: Relative rate of faults found

![Graph showing the relative rate of vehicle faults found over vehicle age. The x-axis represents vehicle age, and the y-axis represents the number of faults per inspection. The graph shows a linear increase in faults with increasing vehicle age.]
Vehicle Roadworthiness Inspections: Estimated safety effect of 6-monthly vs. annual inspections

- 8% reduction in risk (95% CI 15%-0.4%)
- 13.5% reduction in numbers of faults (with 95% CI 12.8%-14.2%)
- BUT the regime is expensive, and the safety benefits do not justify the costs
Mean Total Safety Index in 2014 fleet by vehicle year of manufacture

Year of manufacture

Total Safety Index

0 0.01 0.02 0.03 0.04 0.05 0.06


New

Used
Real cost of purchasing vehicles (CPI for vehicles divided by CPI overall)
Safety effects of used imported vehicles in NZ

- The real cost of purchasing motor vehicles has fallen considerably, approximately halving in the past 30 years.
- This implies that the used importation programme *should* have improved safety considerably by decreasing the real costs of safer vehicles.
- However, rather than choosing to improve the quality of the vehicles they drive, New Zealanders consumers have preferred to spend their money on other things.
- Perhaps because of the glut of older used imported vehicles, driving such vehicles has become normalised in a way that might not have happened in the absence of the programme.
-Purely from a vehicle safety perspective, the used importation programme has provided vehicles that are marginally safer for a given year of manufacture.
- Yet the New Zealand fleet has got older on average, with consequent poorer fleet safety than a younger fleet.
Current Research Focus

- Continued updates of the UCSRs
- Effects of future fleet changes and vehicle safety technology on pedestrian related road trauma
- Past and future improvement in the safety of the vehicle fleet and the role of future technologies
- Establishing a vehicle crash risk ratings system
- Heavy vehicle crashes and future benefits of emerging technology
Peer review in international journals

Projecting Effects of Improvements in Passive Safety of the New Zealand Light Vehicle Fleet

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Objectives. In the year 2000, as part of the process for setting New Zealand road safety targets, a project was completed to estimate the reduction in social cost of 15.5 percent associated with improvements in crashworthiness, which is a measure of how well a vehicle can protect its occupants in a crash. The objectives of this paper are to describe a method for projecting changes in casualty rates associated with passive safety features and to apply this methodology to a new prediction.

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Development of a method to rate the primary safety of vehicles using linked New Zealand crash and vehicle licensing data

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Evaluation of electronic stability control effectiveness in Australasia

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ABSTRACT
Electronic stability control (ESC) is an in-vehicle technology aimed at improving primary safety by assisting drivers to maintain control under a variety of challenging conditions. This paper provides an overview of the effectiveness of ESC, focusing on Australasia, and draws conclusions about its potential benefits for road users.

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An evaluation of costs and benefits of a vehicle periodic inspection scheme with six-monthly inspections compared to annual inspections

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Abstract
Although previous research suggests that safety benefits accrue from
grammies, little consideration has been given to whether the benefits
considerable costs of such schemes. Methodological barriers in methodology
all safety benefits of periodic vehicle inspection schemes, including this

Are SUVs dangerous vehicles?

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Abstract
This study was a population cohort study of all licensed passenger vehicles in New Zealand in the years 2005–2006. The objective of the study was to evaluate the effect on road safety of sports utility vehicles (SUVs) compared to other passenger vehicle types. Statistical models were fitted to the population of 2,996,000 vehicles of which 17,245 were involved in an injury crash. Controlling for distance driven, vehicle and owner characteristics, SUVs were found to be relatively safe vehicles in terms of injury crash involvement and in terms of the injury rate of their own occupants at the time of injury. This result contrasts with previous research on SUV safety clearly shows them to be a road safety concern, but only

The potential effectiveness of young driver high-performance vehicle restrictions as used in Australia

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Abstract
Young drivers persistently have higher crash rates despite various countermeasures targeting factors and exposures. A potentially high risk situation for novice drivers may feasibly include high performance vehicles; which are subject to restrictions for probationary and restricted

four Australian States. High performance vehicles are capable of high levels of acceleration,
Passenger vehicle safety in Australasia for different driver groups

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\begin{abstract}
Vehicle fleets in Australia and New Zealand are composed of varying proportions of different makes and models of passenger cars. Here we consider crashworthiness, accident risk, and driver performance according to vehicle type. Accident analyses of fleet data are used to inform the design of safer vehicles.
\end{abstract}

Rating the overall secondary safety of vehicles from real world crash data: The Australian and New Zealand Total Secondary Safety Index

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\begin{abstract}
Various systems for rating secondary safety of particular makes and models of vehicles have been developed internationally. These measures generally evaluate crashworthiness (the ability of the vehicle to protect its own occupants in the event of a crash) separately from aggressivity (the harm a vehicle is liable to impose on other road users into which it crashes). This paper describes an approach using Australian and New Zealand crash data to rate the overall secondary safety of vehicles.
\end{abstract}