Devices to help drivers control their speed

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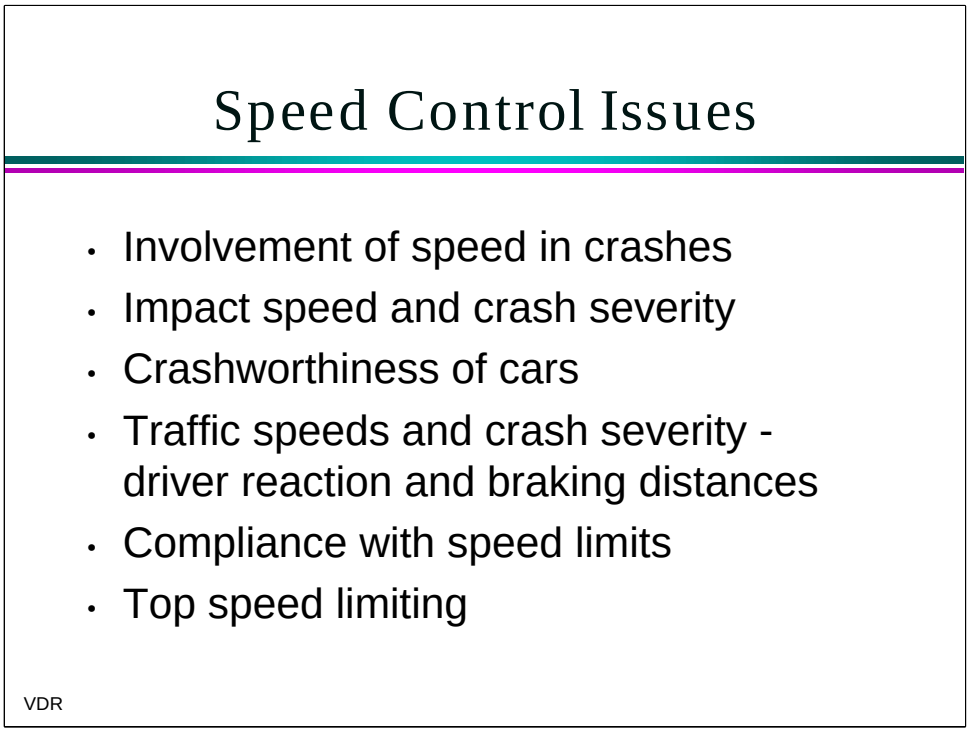
First some brief background. During 1996 I carried out a major review of speed control devices for the NSW RTA. The results of that study have not yet been released but some of the findings have already been incorporated in the NSW Speed Management Strategy. Also during 1996 I commenced assessing the results of crash barrier tests by the Australian New Car Assessment Program. These two projects have given me a good appreciation of the role of speed in crash severity. Also I should inform you that I have recently assisted the RTA in its prepared of a submission to Staysafe on this subject.



The issues that I will address today are:

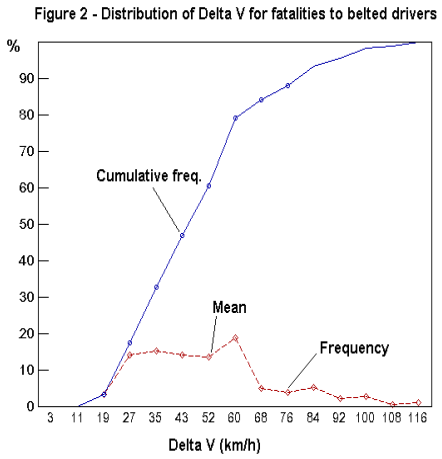
- Involvement of speed in crashes
- Impact speed and crash severity
- Crashworthiness of cars
- Traffic speeds and crash severity - driver reaction and braking distances
- Compliance with speed limits
- Top speed limiting

Speed and Crashes

The NSW road accident statistics for 1996 state that 38% of all fatal accidents were speed related. In other words, 38% of all fatal crashes could have been avoided or made less severe if the vehicle had been travelling at a more appropriate speed for the circumstances.

When we think of speed-related accidents we usually think of high-speed crashes. In fact most fatal accidents occur at impact speeds well under 70km/h.

Impact Speeds & Fatalities



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• Half of all fatalities to seat-belted drivers in car to car frontal crashes occur at 50km/h or less. Airbags increase this to about 60km/h.
• Half of all fatal intrusive side impacts occur at 30km/h or less
• About half of all fatal pedestrian impacts occur at 25km/h or less

The Speeding Problem is NOT confined to grossly excessive speeds - there is a lot to gain from improved compliance with speed limits

This graph is based on fatalities to *seat-belted drivers* in car to car crashes in the USA between 1982 and 1991 (not unlike the current Australian vehicle fleet!). It shows the distribution of fatalities by impact speed (or more correctly the change in velocity or “delta V”).

Half of all fatalities to seat-belted drivers occurred at impact speeds of less than 50km/h.

5% of reported crashes were fatal at an impact speed of 50km/h. Athough this risk seems low the total number of reported crashes at or below this speed is large and this outweighs the higher risk crashes at greater speeds. This suggests that measures which address impact speeds in the range 30 to 50km/h are just as important as those which address higher speeds.

Recent data from the US suggest that airbags have shifted the curve to the right but half of all fatalities are still occurring at under 60km/h. In any case it will be many years before a significant proportion of Australian cars have airbags.

On the other hand, for vulnerable road users such as pedestrians and cyclists, and for side impacts into cars, the curve is shifted well to the left.

NCAP 64km / h Offset Crash

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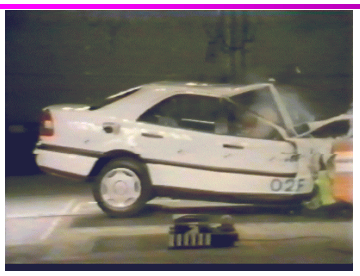
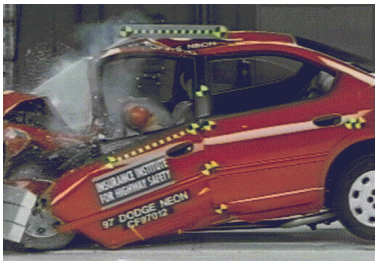
Crash tests by the Australian New Car Assessment Program clearly show that an impact at 64km/h is a very severe crash. The crash test simulates an offset head-on crash between similar vehicles each travelling at about 60km/h.

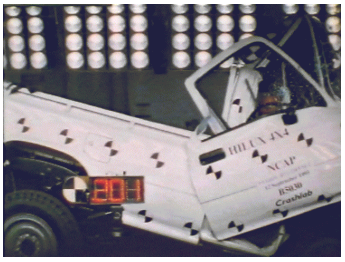
These pictures show a range of vehicles, some with longstanding safety reputations, at the peak of the 64km/h offset crash test.

While advanced features such as airbags can have a significant influence on the many crashes that occur at or below the NCAP test speed it is likely that other factors, such as structural failure will influence the outcome of higher speed crashes.

NCAP 64km/h Offset Crash







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These and other crash tests suggest that, at impact speeds of around 70km/h, a vehicle reaches physical limits to its ability to protect front seat occupants.

One aim of speed management measures is to reduce impact speeds (preferably to zero - that is, no impact).

Speed and Crashworthiness

QuickTime™ and a YUV420 codec decompressor are needed to see this picture.

Travel Speed & Driver Injury

50m hazard distance, alert driver

Travel Speed km/h	Impact Speed km/h	Prob. of Fatality (%)	Prob. of Sev Inj/Fatal.(%)
50	0	0	0
60	19	0	1
70	47	3	13
80	65	16	34
90	80	32	54
100	95	46	70

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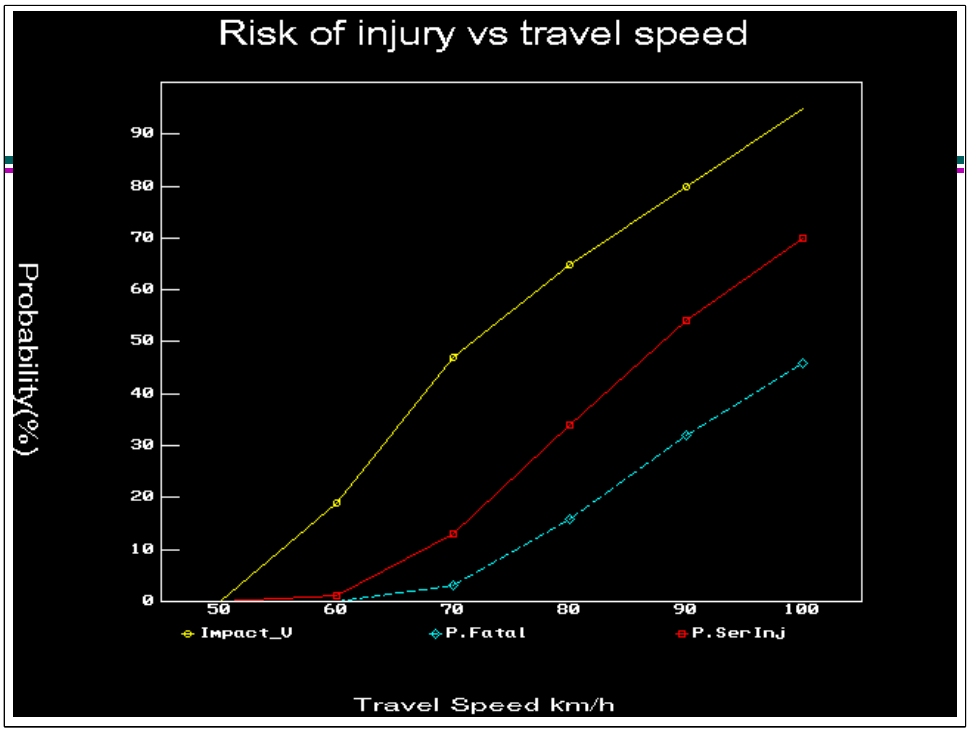
Stopping distances are not often appreciated by motorists. When travelling at 60km/h an alert motorist will typically travel 25m between the time that an object becomes visible (but not necessarily seen) and the time when their foot hits the brake pedal. We tend to only think of stopping distance after our foot hits the pedal!

For a given set of road conditions the impact speed depends on the initial travel speed. Using typical driving conditions it can be shown that the probability of a *driver fatality* is highly sensitive to the initial travel speed of the vehicle. The table shows the result of this analysis for a typical residential road where the distance to the hazard is 50m (alert reaction time of 1.5s, heavy braking). Again the probabilities are for seat-belted drivers.



The results are plotted on this graph.

This analysis supports Swedish research which suggests a fourth power relationship between mean traffic speed and the proportion of fatal crashes. A 3% reduction in mean traffic speeds can produce a 12% reduction in fatal crashes. For example, it is estimated that measures which reduced mean traffic speeds by just 2km/h in urban areas and 3km/h in rural areas would have saved 71 fatal crashes, 342 serious crashes and 1191 other injury crashes in NSW during 1994.

The analysis is also in agreement with a recently published study by Jack McLean from Adelaide University. That study found that risk of involvement in a casualty crash doubles with each 5km/h increase in travelling speed.

The message here for road safety professionals is that for every road situation there is an optimum maximum traffic speed. Above this optimum speed the risk of a serious crash rises exponentionally (see red curve). It is therefore very important that the speed limit is set according to the actual conditions. Motorists can be quite mistaken about perceived “safe” speeds therefore I believe that speed limits should not be set according to percentile traffic speeds.

Compliance with Speed Limits
"Intelligent Speed Adaptation" (ISA)

- These days cars are smoother and quieter - it is easy for speed to creep up
- Possible that unintentional speeding makes up a large proportion of the speeding problem
- Drivers could do with some technical assistance in keeping to the speed limit
- Trials of automatic speed limiters/alarms have been underway for 6 years - including the TAC Safe-Car in Melbourne (uses throttle pedal feedback).
- Now easy to do with GPS equipment in cars.

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The previous analysis also shows the importance of compliance with speed limits - in urban areas the risk of involvement in a casualty crash doubles for each 5km/h increase in speed above the speed limit. Travelling at 70km/h in a 60 zone has 4 times the risk of travelling at 60km/h.

Compliance with speed limits should not be considered solely an enforcement issue:

- These days cars are smoother and quieter - it is easy for speed to creep up
- It is possible that unintentional speeding makes up a large proportion of the speeding problem
- Drivers could do with some technical assistance in keeping to the speed limit
- Trials of automatic speed limiters/alarms are underway in Europe and in Australia. GPS technology has made the task much simpler. One GPS navigation system supplier told me that clients often ask whether the system will tell them the local speed limit.
- However, there is an urgent need to set standards on speed limit information contained in digital maps. For example they need temporal information such as school zones.

Top Speed Limiters

- Engine power drops off above a preset speed
- Many engine management chips already have a top speed setting (but typically well in excess of 200km/h)
- *Very* low cost to set at a realistic value. My analysis suggests 120km/h would be appropriate.
- Potential optional item when ordering a new vehicle (can Government fleets take the lead here?)
- Strong deterrent to theft, car-jacking and joy-riding.

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Top speed limiting is a controversial issue, particularly if it is forced on motorists but this need not be the case. Voluntary speed limiting looks very promising.

- Most speed limiters function by reducing engine power above a preset speed. Below this speed the vehicle has the exactly same performance as an unlimited vehicle.
- Many engine management chips already have a top speed setting (but typically well in excess of 200km/h)
- *Very* low cost to set at a realistic value
- There is a unique opportunity to make top speed limiting an optional item when ordering a new vehicle
- Governments could take the lead here when specifying fleet requirements - an Occupational Health and Safety issue.
- In addition it would be a very effective deterrent against theft and joy-riding. The SMH recently reported that car-jacking and theft of keys was increasing as a way of overcoming immobiliser systems.

Hurdles

- Public acceptance that "low speed" impacts can be fatal
- Selling the concept that ISA can help with speed limit compliance
- Getting speed limit information included with digital maps (and dealing with exceptions)
- Selling the concept that top speed limiting will not affect day-to-day performance and it will be a strong theft deterrent

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- National "policy" opposes vehicle regulations that are not globally harmonised
- Northern Territory has no maximum speed limit - NT drivers are likely to oppose maximum speed limiting. One solution would be to provide for *owners* to temporarily over-ride a top speed limit by entering a PIN
- Vehicles are marketed as powerful machines - manufacturers are likely to strongly oppose any efforts introduce or encourage speed control devices. Consumer (fleet buyer?) demand may be the best way to quickly introduce the technology. A place for ANCAP?

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Thank you