The relationship between vehicle performance and novice driver crash involvement
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Abstract
The aims of this project were (i) to provide contemporary evidence of the relationship between vehicle performance factors and the risk of serious injury crash involvement among young novice drivers in Western Australia, and (ii) to review the current Australian vehicle restriction programs. Data for analysis were n=11,321 vehicles driven by those aged 17+ years involved in serious injury crashes during the period 2001-2008. High performance vehicles driven by those aged 17-19 years accounted for less than 1% of the serious injury crashes investigated, while 7.6% of serious injury crashes involving drivers aged 17-19 years involved a high performance vehicle. The findings of a number analyses provided some evidence, albeit definitive, to suggest that drivers aged 17-19 years have a higher relative rate of crash involvement when driving a high performance vehicle and that six and eight-cylinder vehicles and high performance four-cylinder vehicles have a higher representation in single vehicle crashes compared with two-vehicle crashes. Comparable vehicle restriction schemes for novice drivers currently operate in four Australian jurisdictions (Victoria, New South Wales, Queensland and South Australia). A review of the schemes noted an absence of published empirical evidence to support their introduction and no evaluations to date to determine their impact on the novice driver problem. All jurisdictions expressed the view that the schemes were somewhat difficult to administer and enforce. On the basis of the above findings and others, a number of recommendations were provided to the Road Safety Council, including the rejection of a vehicle restriction scheme for Western Australian novice drivers.

Keywords
Road safety; vehicle performance; young novice drivers; crash risk

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**Technical Supplement**  
*Vehicle performance and crash risk amongst novice drivers in Western Australia.*  
Adelaide: Centre for Automotive Safety Research, The University of Adelaide.
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EXECUTIVE SUMMARY

Introduction
Drivers aged 17-25 years in Australia and across all other highly motorised Western countries are substantially over-represented among drivers killed and seriously injured. In 2010, this age group accounted for 26.2% of all driver deaths in Australia while representing only 15.4% of the population. While this age group is nearly twice as likely as all age drivers to be killed, the risk is greater still for those drivers in the initial period of licensure. Graduated Driver Licensing systems have been implemented across countries such as the USA, New Zealand, the United Kingdom and Australia to control the exposure of novices to factors associated with an increased risk of crashing. Unlike their overseas counterparts however, a number of Australian jurisdictions (e.g., Victoria, New South Wales, Queensland, South Australia) have placed restrictions on the vehicles young novices can drive based on the performance of the vehicle.

Western Australia has for some years debated the need to introduce similar restrictions but has not done so to date because of an absence of strong empirical evidence to support a statistically increased risk of crashing among novices who drive high performance vehicles. A review of the limited number of available studies of the relationship between vehicle performance and driver behaviour and driving outcomes, including a much earlier investigation of the issue in Western Australia published in 2005 by Palamara & Gavin, failed to identify strong and valid findings regarding a consistent, quantifiable influence of vehicle performance on driving outcomes. At best, the published research shows a reasonably consistent theme of drivers of high performance vehicles, including young drivers and males, as being more likely to engage in anti social and risk taking behaviour on the road and of having a higher risk of involvement in a crash. The most recent Australasian research by Keall & Newstead (2012) provides the strongest evidence of this, though it also notes that young drivers in high performance vehicles involved in a crash represent a relatively small proportion of crashes among this age group – a finding similarly noted by Palamara & Gavin (2005). None of the previous investigations have however, addressed the relationship between driver characteristics and vehicle selection and the interaction between these in relation to driving outcomes. Thus, it is not entirely clear whether driving outcomes are directly influenced by vehicle performance per se or whether drivers with certain dispositions or personality traits that dispose them to risk taking seek out certain types of vehicles to express their behavioural style. If so, would restricting high sensation seeking drivers to lower
performance vehicles significantly alter their likelihood of engaging in risky behaviours and becoming involved in a crash?

The aim of this study, commissioned by the Road Safety Council of Western Australia in 2009, was to provide more definitive contemporary Western Australian evidence of the relationship between vehicle performance factors, age of driver, and risk of involvement in a serious injury crash to reconsider the need for a restricted vehicles scheme for novice drivers.

The specific objectives of the research were as follows:

**Objective One**
To investigate the relationship between vehicle performance and serious injury crash involvement among Western Australian drivers (i) aged 17-19 years holding a provisional, restricted ‘C’ class motor car drivers’ licence and (ii) drivers older than 19 years holding a full, unrestricted ‘C’ class motor car drivers’ licence

**Objective Two**
To compared the finding from Objective 1 with the findings of the previous investigation undertaken by Palamara & Gavin (2005).

**Objective Three**
To consider the recent experiences of other Australian jurisdictions with respect to vehicle performance restrictions for novice drivers

**Objective Four**
To provide recommendations to the Road Safety Council of Western Australia regarding the need for vehicle performance restrictions for novice drivers and the form of those restrictions.

**Method**
The research was undertaken by the Curtin-Monash Accident Research Centre (C-MARC) (Curtin University, Western Australia and Monash University, Victoria) in collaboration with the Centre for Automotive Safety Research (CASR). C-MARC was primarily responsible for the management of the project and Objectives Two and Three, while CASR was primarily responsible for Objective One and the production of the technical supplement. Both institutions contributed to Objective Four.

Data for the investigation of the statistical relationship between vehicle performance and crash risk were selected from all police reported serious injury (death or hospitalisation)
crashes occurring during the period 2001-2008, provided by Main Roads Western Australia. To enable the calculation of the rates of crash involvement for drivers by age and vehicle performance, and to investigate the safety and performance characteristics of the fleet of Western Australian vehicles, a sample of 3,750 registered private passenger vehicles was randomly selected from each year of the period 2001 to 2008 (totalling 30,000 vehicles). Vehicle Identification Numbers (VIN) and driver licensing and vehicle ownership information was obtained from the Department of Transport for each crash involved vehicle and driver and each vehicle in the sample of the vehicle fleet. VINs were subsequently forwarded to RL Polk Australia for the retrieval of manufacturer’s information on the performance of the vehicle and its safety features.

After applying the criteria for the inclusion of relevant vehicles and drivers, the final crash dataset consisted of n=11,321 vehicles (post-1990) and actively licensed drivers aged 17+ years (categories into those aged 17-19 years, 20-24 years and 25+ years). The performance of vehicles was based on both the number of cylinders and the power to weight ratio (kilowatt output/kerbside weight x 100kgs) of the vehicle, resulting in the following categories of performance:

- four-cylinder vehicles: PWR ≤59; PWR 60-74; PWR 75-89; PWR ≥90
- six-cylinder vehicles: PWR ≤99; PWR 100-109; PWR ≥110
- eight-cylinder vehicles: PWR ≤109; PWR 110-139; PWR ≥140

Relative rates of crash involvement were calculated for owner-drivers only for the various driver/vehicle groups using the average crash rate for those aged 17-19 years in all four-cylinder vehicles. In addition to this analysis, the proportion of high performance vehicles in single and two car crashes was calculated and followed up with univariate and multivariate modelling of the effect of various driver, vehicle, and crash location factors on the ratio of single vehicle crashes to two car crashes. Finally, a set of time series analyses were undertaken on the 2008 sub-set of the sample of the WA vehicle fleet to document the history and introduction of various vehicle safety technologies and vehicle performance characteristics and the relationship between the two.
Summary of Findings

Objective One

The complete findings from the analysis of serious injury crashes 2001-2008 are reported in the attached technical supplement prepared by Hutchinson and Anderson (2012). The main findings were as follows:

- Vehicle performance was categorised using both the number of cylinders of the crashing vehicle and the power to weight ratio of the vehicle. Vehicles considered to be of ‘higher performance’ were those in the following groups:
  - four-cylinder vehicles with a PWR $\geq 90$kw/tonne;
  - six-cylinder vehicles with a PWR $\geq 110$kw/tonne; and,
  - all eight-cylinder vehicles

- These high performance vehicles accounted for 7.6% of the n=1,285 vehicles crashed by owner and non owner-drivers aged 17-19 years and less than 1% of the n=11,321 owner and non owner-driver vehicles (all ages) involved in a serious injury crash.

- Calculation of the crash rates for owner drivers only showed that in comparison with the crash rate for those aged 17-19 years in all four-cylinder vehicles, a relative higher rate of crashing for 17-19 year olds was observed for those driving:
  - four-cylinder vehicles with a PWR $\geq 90$kw/tonne;
  - six-cylinder vehicles with a PWR $\leq 99$kw/tonne and PWR 100-109 kw/tonne; and,
  - all eight-cylinder vehicles

- Overall, the trend was for the relative rate of crashing to decrease with the age of the owner-driver and to increase with the performance of the vehicle.

- The interpretation and confidence of the observed relative crash rates are constrained by the necessary exclusion for methods reasons of some two-thirds of serious injury crashes involving drivers aged 17-19 years.

- Calculation of the relative numbers of high performance vehicles in single and two car crashes where the driver (of any age) was hospitalised or killed showed an increasing proportion of high performance vehicles in single vehicle crashes, ranging from a low of 24% for four-cylinder vehicles with a PWR 60-74 to a high of 57% for eight-cylinder vehicles with a PWR $\geq 140$kw/tonne. Overall, the trend was for a higher representation of six and eight-cylinder vehicles and high performance four-cylinder vehicles in single vehicle crashes.
Multivariate analysis of the ratio of involvement in single and two car crashes showed statistically significant effects for performance of the vehicle, year of car, age of driver, day of week and hour of day, and location of crash based on speed limit and distance in relation to the Perth metropolitan area. Hutchinson & Anderson (2012) advised that caution must be exercised in the interpretation of these individual findings.

Analysis of the safety features and crash worthiness of vehicles by performance category for a sample of the Western Australian registered fleet, 2008, showed that safety and performance are strongly associated- Electronic Stability Control, side curtain airbags, and a 4 or 5 star ANCAP rating were more common among higher performance vehicles.

**Objective Two**

The methods employed by Palamara and Gavin (2005) differed somewhat to those employed in this study, particularly in relation to the selection and analysis of crash data; the retrieval of vehicle manufacturers’ information to determine the performance characteristics of crashed vehicles, and the classification of the performance of vehicles. Notwithstanding these methodological differences, both studies noted that serious injury crashes involving young novice drivers in high performance vehicles account for a very small proportion of the road crash problem among this age group and more generally. The studies differed however, in relation to the observed statistical relationship between high performance vehicles and the risk of crashing. Palamara and Gavin (2005) found no evidence to support such a relationship, while this study found some evidence and trend of an increased crash risk based on the calculation of relative rates of serious injury crash involvement and the ratio of involvement of high performance vehicles in single vehicle versus two vehicle crashes. Both studies expressed similar concern that restricting young novices from certain high performance vehicles might inadvertently limit their access to vehicles with outstanding or superior technologies to reduce their risk of crash involvement and risk of injury. This study supported the conclusion through an analysis of a sample of Western Australian vehicles registered in 2008, where it was found that higher performance vehicles were also more likely to feature Electronic Stability Control, superior airbag systems, and to have 5-star ANCAP ratings (particularly among four-cylinder vehicles).
Objective Three

Four Australian jurisdictions - Victoria, New South Wales, Queensland, and South Australia - currently operate a restricted vehicles scheme for novice drivers that restrict the driving of:

- all eight-cylinder vehicles;
- some normally aspirated high performance six-cylinder vehicles (at times based on a power to weight ratio limit or kilowatt output that varies across jurisdictions); and,
- turbo charged vehicles unless they are ‘low powered’ or diesel fuelled.

It seemed that the existing Australian vehicle performance restriction schemes were primarily introduced in response to political and community pressure rather than strong existing evidence in support of higher performance vehicles being a significant contributor the crash problem of young novice drivers. Consequently, the operational definitions of a high performance vehicle across the schemes did not necessarily align with a known increased risk of crashing for this driver group. Although there was some consistency across jurisdictions in the broad definition of a ‘high performance’ vehicle, the definition of a high performance normally aspirated six-cylinder vehicle was found to vary somewhat across the jurisdictions and perhaps for this reason there is strong interest, promoted by vehicle manufacturers, in the development of a national standard based on a simplified power to weight ratio of 130kw/tonne tare weight. The administrative efficiency of this definition is seemingly tied to the redevelopment of and access to the National Exchange of Vehicle and Driver Information System (NEVDIS) to enable the ready retrieval by jurisdictions of the required manufacturer’s information on vehicle characteristics (e.g., kilowatt output, tare weight). However, this may not be possible for another two to three years. At present, WA’s TRELIS system provides no useful information to assist with the administration and enforcement of a restricted vehicles program since it does not contain all required information to apply any of the criteria of the existing schemes or the proposed national definition based on a power to weight ratio.

From the discussions with representatives from jurisdictions that operate a restricted vehicle scheme there was reason to conclude:

- the schemes can be difficult to support, defend and promote given the absence of empirical evidence in support of a relationship between vehicle performance and crash risk;
• some schemes have difficulty in informing and advise the motoring public (and police) on permissible and restricted vehicles; for example, lists of vehicles are not readily updated, leaving the onus on the motorist and police to determine if the vehicle is unrestricted or restricted;

• the exemption process can be onerous, resource intensive, and open to abuse, which ultimately undermines the intent and possible effectiveness of the scheme; and,

• that to date, there has been little if any commitment to an evaluation of the effectiveness of the schemes.

Recommendations
Based on the findings of the various project objectives the following recommendations were provided to the Roads Safety Council for consideration.

1. Reject the introduction of a vehicle performance restriction scheme for Western Australian novice drivers.

This study has failed to provide compelling evidence to support the introduction of a vehicle performance restriction scheme; such a scheme is therefore not recommended at this point in time. Notwithstanding the identified methodological problems for the study, there are a number of reasons to reject the introduction of a vehicle restriction scheme:

• crashing high performance vehicles driven by novice drivers do not represent a sizable road safety problem;

• a statistical association between vehicle performance and crash risk for young novice drivers was observed but it was not overwhelming strong or unequivocal;

• no evaluations of the existing Australian vehicle performance restriction schemes have been undertaken; therefore, it is not known whether such schemes effectively reduce novice driver crashes and injury or whether they are cost-effective;

• Western Australia does not presently have, nor is likely to have in the near future, ready access to the vehicle performance information required to administer and enforce a vehicle restriction scheme; and that,
restricting access to some high performance vehicles may inadvertently restrict the access of young novices to vehicles which feature a high level of vehicle safety technology.

2. Progress the introduction of outstanding and empirically supported graduated driver training and licensing initiatives in Western Australia.

Compared with some other Australian and overseas jurisdictions, Western Australia’s existing graduated driver training and licensing system could be strengthened by the adoption of other initiatives related to increased driving experience as a learner and reduced exposure to crash risk factors as a provisional driver. In relation to these issues, government should:

- expedite a thorough reexamination, particularly in relation to access and equity issues, of the current requirement for supervised driving during the learner phase to consider an increase in both the number of required hours and the conditions under which those hours are obtained (e.g., daytime versus nighttime; types of roads); and,
- move to introduce other licensing initiatives such as peer passenger restrictions and restrictions on the use of mobile phones during the provisional period. Both initiatives are likely to reduce the occurrence of distracted driving and possible risk taking when driving in the company of peers.

3. Further investigation and development of a broad platform of initiatives to more broadly target the problem of speeding and reckless driving by young novice drivers.

Whilst it is acknowledged that high performance vehicles have an increased ability to accelerate and maintain higher speeds, speeding and other reckless behaviour among young novice drivers is not confined to those driving high performance vehicles. For this reason then, it is recommended that the government of Western Australia investigate and develop initiatives that target the behaviour of the young novice driver, rather than the vehicle per se, in an effort to reduce speeding and other reckless behaviour across this target population. For example, consideration should be given to:

- the introduction of differential speeding penalties for novice drivers that would effectively result in the suspension of a provisional driver in the first 12 months for a single speeding offence (or at the very least a subsequent offence). Such a
system operates in New South Wales and could be applied here as Western Australia similarly suspends provisional drivers in the first 12 months of licensure upon the loss of four demerit points.

- the imposition of vehicle restrictions on provisional drivers who are caught speeding or engaging in reckless or dangerous driving, including BAC offences, while driving a high performance vehicle;

- the introduction of ‘offence free’ periods as a prerequisite for novice drivers progressing from P1 to P2 stages and from a P2 stage to full licensure; and,

- the development and implementation of a trial education program targeting novice drivers committing any speeding offence, utilising a monitored Intelligent Speed Adaptation (ISA) device fitted to their vehicle.

4. Encourage the purchase of safer vehicles by all young drivers by providing information about safe first car choices and the provision of financial incentives to purchase safer vehicles.

Young novice drivers have a higher risk of crash involvement compared with older and more experienced drivers. For this reason it is important that young drivers have access to vehicles with emerging technologies that will reduce their likelihood of crashing and also provide them with superior protection in the event of a crash. The secondary analysis in this study of a 2008 sample of vehicles registered in Western Australia showed that vehicles with superior safety features such as Electronic Stability Control, side curtain airbags, and even in some cases driver airbags, were far more common in vehicles that might otherwise be classified as high performance from a power to weight ratio point of view, especially among four and six-cylinder vehicles. Indeed, this finding suggests that any possible restriction on the access of novices to higher performance vehicles might, in the shorter term, also inadvertently restrict their access to vehicles with high safety ratings, at least until these technologies filter down over time to be more common among cheaper and lower performance vehicles. In the meantime the government of Western Australia should:

- strongly encourage the purchase of safer vehicles by young novice drivers through an educational campaign on ‘safe first car choice’, along the lines of campaigns undertaken in New South Wales and Victoria; and,
• consider vehicle registration rebates or discounts to young novice drivers who purchase vehicles meeting the ‘safe first car’ criteria.