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The safety of vehicles imported from right-hand-drive vehicle configuration countries when operated in a left-hand-drive vehicle environment

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ABSTRACT

Vehicles over 15 years of age imported into Canada are exempt from complying with Canadian Motor Vehicle Safety Standards (CMVSS) applicable to their years of production. This has led to a developing market for older imported vehicles in British Columbia (BC). But while mechanical inspections are carried out on such vehicles before they can be registered in BC, vehicles from countries that drive on the left side of the road (such as Japan) retain their right-hand-drive (RHD) control configuration.

The concern with these vehicles is two-fold: first, does the RHD configuration lead to increased risk of crash involvement; and second, are these vehicles inferior in comparison to built-for-Canada vehicles of a similar age, with respect to occupant protection potential?

In this study three separate methodologies were utilized in approaching these concerns: a relative crash culpability analysis where RHD and left-hand-drive (LHD) crash rates were compared for the same group of drivers; a survival analysis where time-to-first-crash was compared between RHD and LHD drivers: and a multiple regression model where RHD vehicle driver risk was compared to that of a similarly constituted comparison group of LHD vehicle drivers.

The results of all three analyses were consistent. RHD vehicles had a significantly greater risk of at-fault crash involvement over that of similar LHD vehicles. However, crashes involving RHD vehicles were no more severe than those involving LHD vehicles only.

1. Introduction

Currently, Transport Canada applies a 15-year import rule for vehicles coming into Canada from other countries in respect to the need to meet Canadian Motor Vehicle Safety Standards (CMVSS) requirements for their year of manufacture. Prior to 2005 relatively few imported vehicles fell under this classification but recently the number of Japanese imports beyond 15 years of age has been climbing noticeably. This appears to be due to the increasing regulatory and economic burden for Japanese drivers associated with licensing such older vehicles combined with a ready market in BC for relatively low-cost transportation.

The potential problem associated with this situation is two-fold. First, since the Japanese imports are right-hand-drive (RHD) vehicles designed to be operated on the left side of the road, there are possible ergonomic and visibility issues for drivers in a right-side travel environment. This could lead to a higher probability of crash involvement especially in the early period of vehicle use. Second, there is no guarantee that these vehicles meet all the major Canadian safety standards appropriate to their model year and thus occupants, if involved in a crash, could be at greater than desirable risk of injury. Some safety-related modifications to imported RHD vehicles are required in BC – such as headlight replacement to correct aiming – but other design components may not necessarily conform to applicable standards.

The driver-related issue is one that is relatively easy to understand and has at least some recognition in the literature. While no studies could be found that specifically dealt with the safety of RHD vehicles in a LHD environment, there were a few that examined the situation with respect to driver unfamiliarity with local road travel conventions. For example, Dobson et al. (2004) found no greater risk associated with drivers born outside Australia (left-side driving convention) when compared to those native to the country but did find a greater risk for immigrant pedestrians. On the other hand, in driving simulator tests Jeon et al. (2004) found that Korean drivers not accustomed to RHD performed worse in a left-side road convention (simulated environment around Yokohama, Japan) than did native Japanese drivers. The former demonstrated more lane position adjustments and less visual searching when negotiating turns across traffic lanes and, overall, exhibited twice the level of mental workload that characterized the latter.

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Commercial goods movement within the European Union has given rise to situations where British heavy goods vehicles (RHD-HGVs) regularly operate on the Continent and Continental LHD-HGVs operate in Britain. The impact of the latter situation can be assessed from reported UK crash statistics (Transport Statistics, 2006) which clearly point to an increased risk of turning and weaving collision involvements for LHD vehicles in the RHD environment. Foreign LHD-HGVs in 2005 were over 4.5 times more likely to be involved in crashes while turning, overtaking or lane-changing (537 out of 1031 total collisions) than were domestic RHD-HGVs (2340 out of 12,120). And almost all (99%) of RHD-HGV side-swipe crashes involved lane changes to the right compared to 52% for LHD-HGVs. While at least some of these differences could be due to unfamiliarity with UK driving conditions, the authors of the statistical report expressed their belief that they were "a consequence of the reduced direct field of view for drivers of left hand drive HGVs to the side and rear on the right (passenger) side of the vehicle" (p. 38).

RHD countries such as Australia and New Zealand that are not part of a larger transportation system such as the European Union, generally require imported LHD vehicles to be converted to RHD unless specifically exempted under fairly restrictive criteria (Land Transport NZ, 2005; Government of South Australia, 2000).

In terms of visibility for the driver, it is self-evident that LHD vehicles are designed with right-hand traffic operation in mind and vice-versa for RHD. So some difficulties in mixing design and operating criteria can be expected. The "blind spot" over a driver's left shoulder is sometimes mentioned by owners of RHD vehicles operating in a right-side roadway environment (The Daily News, Nanaimo, 2007). Unfamiliarity with control positioning – such as manual gear shift – may cause some temporary adjustment problems for drivers that could be manifested in an early spike of crash involvement risk.

The likelihood that visibility for vehicle drivers affects merging or lane-changing crash risk was addressed by Sivak et al. (2006, 2007). In North America, the critical merge or lane-change direction is to the driver's left. This represents merging into the traffic stream after parallel parking, merging onto freeways and changing to the fast lane on multi-lane facilities. Sivak et al. (2006, 2007) found that the position of the 'A' and 'B' pillars relative to the driver's forward line of sight affected the risk of having a lane-changing crash – the greater the angle to the 'A' pillar and the smaller the angle to the 'B' pillar, the greater was the ratio of lane-change-to-total crashes. The researchers used a variety of North American, Japanese and European makes/models, all with a LHD format. Taking the average 'A' and 'B' pillar measurements from their study and shifting the driver seating position from LHD to RHD has the effect of increasing the relevant average 'A' pillar angle from 24.9° to 51.5° and decreasing the 'B' pillar angle from 122.5° to 101.3°. The net effect is a reduction in the unobstructed left-side visual field between 'A' and 'C' pillars of some 40%. Based on the results of Sivak et al. (2006, 2007) this would be expected to result in a substantial increase in lane-change risk.

With respect to injury potential, very little objective information seems to exist. Lecuyer and Chouinard (2006) discussed the greater proportion of fatalities and serious injuries in crashes involving older vehicles and the greater likelihood of collisions due to mechanical failure. But these findings are generalized to all vehicles and do not specifically relate to older imports which have presumably undergone some level of safety inspection prior to resale. Thokore et al. (2001) have suggested that blunt trauma injuries associated with RHD vehicle interior design (controls, etc.) tend to be more localized on the right side of a driver's body where internal injuries are apparently more difficult to detect, but this alone does not necessarily imply significantly greater overall casualty risk.

It would certainly seem logical in light of the recent US government study on the effectiveness of vehicle safety standards since 1960 (NHTSA, 2004; Farmer and Lund, 2006) that an influx of older vehicles into the fleet mix would tend to increase overall injury risk but in Canada one important historical mitigating factor has been the use of active occupant restraints. If lap/shoulder belts are available for most occupant positions in the imported vehicles then the safety decrement due to less-developed other design factors may be less of an issue – still present but masked.

In summary, while there are cogent reasons to suspect that the introduction of older RHD vehicles into a right-side traffic environment may be problematic, there is not sufficient evidence in the literature upon which to base a reliable conclusion. And much of what there is confounds driving environment unfamiliarity with opposite side control placement – a situation that does not apply to most BC operators of RHD vehicles. Thus, a specific crash risk study comparing RHD imports to other vehicles in BC using Insurance Corporation of BC (ICBC) crash–claim data was indicated.

2. Study design

In September 2006, ICBC began identifying imported vehicles greater than 15 years of age. During the 7-month period up to the end of March, 2007 there were 1083 such vehicles of which 578 represented passenger vehicles with active policies. In order to obtain a larger sample which would be required in order to assess crash rates of probable RHD vehicles, the ICBC policy/vehicle records were searched to identify BC-assigned vehicle identification numbers (VINs) for vehicles of model year (MY) 1986–1992. All vehicles imported into BC from abroad are issued new VINs which begin with the character string "2BG". These VINs are also issued for various "home-made" specialty vehicles such as kit-cars and so the list resulting from the search had to be reduced to include only recognizable Japanese and British makes of passenger vehicles which should be RHD. Then this reduced list was further restricted by eliminating those for which no policy existed or for which the first policy was earlier than 2001 (1986 + 15) or less than 15 years before the vehicle model year.

The design of this study included three separate methodologies to assess RHD vehicle risk. The use of different methodologies – a technique known as triangulation – can strengthen the conclusions of the study especially where no perfect link between driver and vehicle is available. The methodologies included: (1) a relative crash culpability comparison for drivers of RHD vs. LHD vehicles; (2) survival analysis to determine if an increased risk was associated with the early driving periods for RHD vs. LHD vehicles; and (3) Poisson regression analysis to compare RHD driver risk to a LHD driver control group. In addition to estimation of vehicle crash involvement risk, comparison of crash severity for RHD and LHD vehicles was undertaken as part of the first and third methodologies.

2.1. Relative crash culpability ratio

A procedure was designed in which RHD operators could be compared within their own group in terms of crash experience both with RHD and conventional LHD vehicles and which should largely remove the effect of driver differences. This was accomplished by identifying all drivers involved in crashes while operating the RHD vehicles since January 1, 2001 and then examining all other crashes in which those same drivers had been involved while operating an LHD vehicle during the same period. For 1986 MY vehicles, January 2001 was the earliest date when they could have been 15+ years old.