

An evaluation of the roadworthiness of Victorian buses

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Abstract

As part of a project investigating the relationship between bus roadworthiness and safety outcomes, this study examined annual inspection results to identify the incidence and characteristics of mechanical failures. The findings showed that about one in five buses had issues that may have compromised safety, with Body & Chassis and Steering & Suspension comprising the highest incidence of defects. Registered buses were much less roadworthy than accredited ones. Vehicle age was found to be an important influential factor, with the effect varying across operation type. The implications of the findings in enhancing bus roadworthiness and safety were discussed.

Background

During the past three years in Victoria, there have been about 100 mechanical failure-induced incidents, including bus fire, brake failure, wheel dislodgment, etc., bringing about not only injuries and property loss, but also concerns about the roadworthiness of the Victorian bus fleet. Victorian buses, like those in other Australian states, are mandated to undergo safety inspections at least on an annual basis. This paper aims to achieve a comprehensive understanding of the roadworthy characteristics of Victorian buses by examining the annual inspection results.

Method

Annual inspection results of Victorian buses for the period from 1 Jul 2014 to 30 Jun 2017 were examined. Each observation assessed operational, vehicle characteristics, the inspection result (pass or fail) for each of the fourteen vehicle components and overall roadworthiness. Only first inspections were included to ensure accuracy (Peck, Scott Matthews, Fischbeck, & Hendrickson, 2015) and the finalised dataset comprised 21,675 observations involving 9,265 vehicles.

Results

Table 1 illustrates overall roadworthiness and the contribution that each component made to bus unroadworthiness with the similarities and differences between accredited and registered buses being outlined.

During the three years, nearly one-quarter (22.6%) of buses failed their first inspections, among which about four fifths (81.0%=18.3%/22.6%) failed on at least one safety critical component (as defined by Transport Safety Victoria), implying that about one in five buses was operating with issues that might compromise safety.

A further distinction was made between accredited (vehicles with more than 12 seats (driver included) and providing commercial/local service) and registered (vehicles with between 10 and 12 seats or not providing commercial/local service) buses and there was an obvious contrast with the latter being more than twice more likely to fail the annual inspection than the former.

Among safety critical components, Body & Chassis and Steering & Suspension were most defective for both while registered buses had a much higher failure rate on Wheels & Tyres and Seats & Seatbelts.

Table 1. Inspection failure rate* by operation type and vehicle component

		Overall	Accredited	Registered
	Failure rate**	22.6	15.7	38.7
Roadworthiness	Fail with at least one safety critical component**	18.3	13.7	29.0
	<u>Body Chassis</u>	7.3	<u>5.3</u>	<u>12.2</u>
	<u>Steering Suspension</u>	6.2	<u>5.6</u>	<u>7.5</u>
Components of high safety risk (safety critical)	Engine Driveline	4.5	3.9	5.9
	<u>Seats & Seatbelts</u>	5.1	<u>2.5</u>	<u>10.9</u>
	<u>Wheels Tyres</u>	3.0	<u>1.4</u>	<u>6.8</u>
	Brakes	3.7	3.1	4.9
	Brake performance	1.9	1.4	3.0
Components of medium safety risk	Lamps, signals, reflectors	6.6	4.9	10.5
	Windscreen Windows	2.0	1.5	3.0
	Windscreen Wipers Washers	2.1	1.1	4.4
	Parking brake	1.1	0.5	2.5
Components of low safety risk	Exhaust emission controls	1.5	1.2	2.1
	Other items	8.9	4.2	19.7
	Modifications	0.6	0.1	1.8

*All failure rates in the table were calculated based on the formula: number of inspections that fail the item/ number of inspections.

**The sum of the failure rates of 14 components don't add up to the failure rate at the top and that of seven components of high safety risk don't add up to the top second because a vehicle may fail multiple components.

Figure 1 demonstrates how inspection failure rates changed with vehicle age for accredited and registered buses, highlighting the different patterns of the two operation types. Generalised estimation equations confirmed that there was a significant effect of vehicle age on inspection outcome ($p < 0.001$). For accredited vehicles, the failure rate increased gradually before vehicle reached 30, with vehicles over 30 years having a substantially higher failure rate than newer vehicles. However, for registered vehicles, there was a gap between vehicles younger and older than 10 years, with the roadworthy condition of vehicles older than 10 years deteriorating significantly.

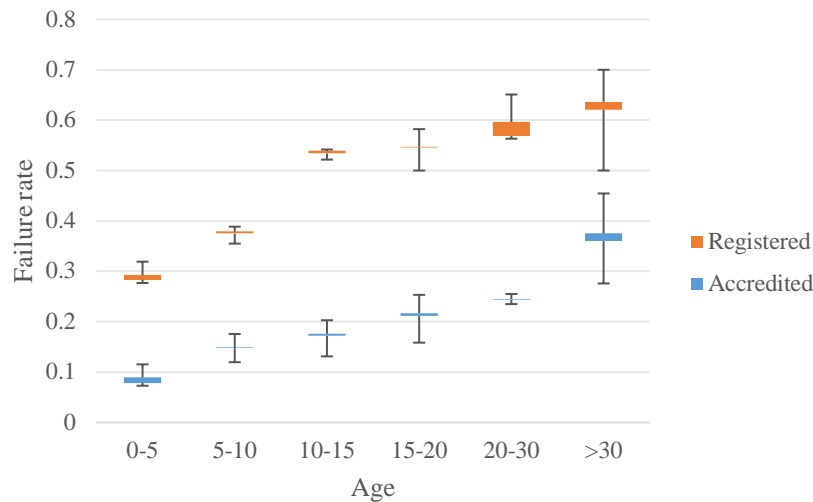


Figure 1. Failure rate by vehicle age and operation type (the values making the bars are min, mean, median and max failure rate over the three-year period)

Conclusions

This study illustrates the roadworthy characteristics of Victorian buses, identifies the influential factors of roadworthiness and revealed issues in need of urgent improvement, including rectifying the operation of registered buses, examining the maintenance of Body & Chassis and Steering & Suspension and targeting registered buses over 10 years and accredited buses over 30 years. In combination with a future case control study which compares the roadworthy characteristics of buses with and without mechanical failure-induced incidents, this study will provide safety regulators with opportunities to enhance bus roadworthiness and public safety.

References

- Peck, D., Scott Matthews, H., Fischbeck, P., & Hendrickson, C. T. (2015). Failure rates and data driven policies for vehicle safety inspections in Pennsylvania. *Transportation Research Part A: Policy and Practice*, 78, 252-265. doi: <http://dx.doi.org/10.1016/j.tra.2015.05.013>