Engineers Australia Report

A quantitative investigation into consistent differences in reliability of motorised vehicles produced in different countries

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Scope of the research

It has been suspected for quite some time that there can be significant quality differences between cars of the same brand produced in different countries. To confirm or deny this suspicion, we have investigated average failure rates for cars produced in various countries. The investigation was based on the EA-DR18 database of car failures.

Outcomes

The outcomes of our research are summarised in Table 1. The normalised average failure rates given are defined as

$$NAF(j)=\frac{1}{N_j}\sum_i \frac{FR(i,j)}{FR(i)}$$

where

- NAF(j) is the normalised average failure rate for country j
- N_j is the number of car brands with manufacturing plants in country j
- the sum ranges over the N_j car brands produced in country j
- FR(i) is the average number of failures per 100.000 km driven of a car of brand i, produced anywhere in the world
- FR(i,j) is the average number of failures per 100.000 km driven of a car of brand i, produced in country j.

Table 1: Normalised failure rates per country

Country	Normalised average failure rate (NAF)
Australia	0.9
Canada	1.0
France	1.0
Germany	0.8
Indonesia	1.3
United States	1.1
Sweden	1.0

Discussion

The database used in this investigation contains data on failures occurring in cars of different brands, from different countries. The goal of this project was to determine if there are differences in reliability between cars produced in different countries, not between cars of different brands. A complication is that while many car manufacturers have production plants in different countries, the distribution of plants in a single country between the various car brands is different for every country. For example, Germany has a high proportion of BMW, Volkswagen and Mercedes plants, Peugeot and Renault are more common in France, and most plants in Australia are Haldon.

For this reason, the numbers given in Table 1 are *normalised* failure rates. This means that the effects of quality difference between different car brands have been corrected for. The numbers given in Table 1 therefore reflect the effect of the location of a car manufacturing plant on the quality of the cars produced, regardless of the car brand. We conjecture that the differences are due to the available infrastructure, quality of the raw materials available, and local regulations.