



## How much petrol does your car use?

Many conscientious motorists keep a log-book in which they record the number of kilometres their pride and joy has covered since the last fill-up. They can then work out litres per 100 km, and boast to friends how their machines achieved extraordinarily low fuel consumption on that recent long-distance trip.

Actually, that vehicle log is not a bad idea. Mr Ros Trayford, an engineer with the CSIRO Division of Building, Construction, and Engineering, recommends it. Keeping an eye on your car's performance this way, he explains, allows you to tell immediately when a tune-up is needed.

Mr Trayford is a keen believer in the value of vehicle logs. Not only does he keep one himself, but last year he and four collaborators published a study in which 704 car log-books were analysed statistically. Some revealing facts emerged from the data.

The results confirmed conventional wisdom regarding the fuel penalties of big cars, automatic transmissions, and air-conditioning. Surprisingly, they also cast aspersions on the competence of the do-it-yourself mechanic — cars serviced at home consumed 9% more petrol than those sent to commercial garages. On a consumption

rate of 13 L per 100 km, over a year the home mechanic could end up paying an \$80 fuel penalty — enough for a good electronic tune-up!

And the figures say that the highway consumption figures published by manufacturers (and compiled each year by the Department of Primary Industries and Energy) are likely to be optimistic. You will probably need to add an extra one-third to get a more realistic figure.

The study was conducted between 1984 and 1986 by the Light Vehicle Energy Consumption Committee of the Society of Automotive Engineers—Australasia. The Committee comprises Mr Trayford, Dr Harry Watson of the Department of Mechanical and Industrial Engineering at Melbourne University, Mr John Mole of Ford, Mr Mike Mowle of the New South Wales Pollution Control Commission, Mr John Ward of the National Roads and Motorists Association (NRMA), and Mr Ian McFarlane of Shell.

The work was sponsored by the National Energy Research, Development and Demonstration Council. The NRMA was contracted to acquire the data and do the initial analysis. Ms Yan Lui of Melbourne University

performed much of the remaining statistical analysis.

Each of 704 car-owners — randomly selected members of motoring organisations — filled in logs covering four tank-fulls of normal operation. Each also supplied details of his or her car and its operation.

A vital part of the work was checking the accuracy of this method. Forty of the vehicles were fitted with calibrated fuel-flow meters — and the results essentially matched the recorded fuel consumption. The 40 were also run on a dynamometer according to the standard city and highway drive cycles; results closely matched the figures published by manufacturers, which are derived in the same way. These are the figures published by the Department of Primary Industries and Energy in their annual fuel-consumption guide.

Yet a clear disparity became evident between the dynamometer figures and those returned from the log-books.

Fuel consumption was, on average, 35% higher in highway use than on the dynamometer-run highway drive cycle; for the city drive cycle, the average difference between real city and suburban motoring and the test results was smaller —

on-the-road consumption was about 16% higher. Obviously, the test cycles do not match our usual driving.

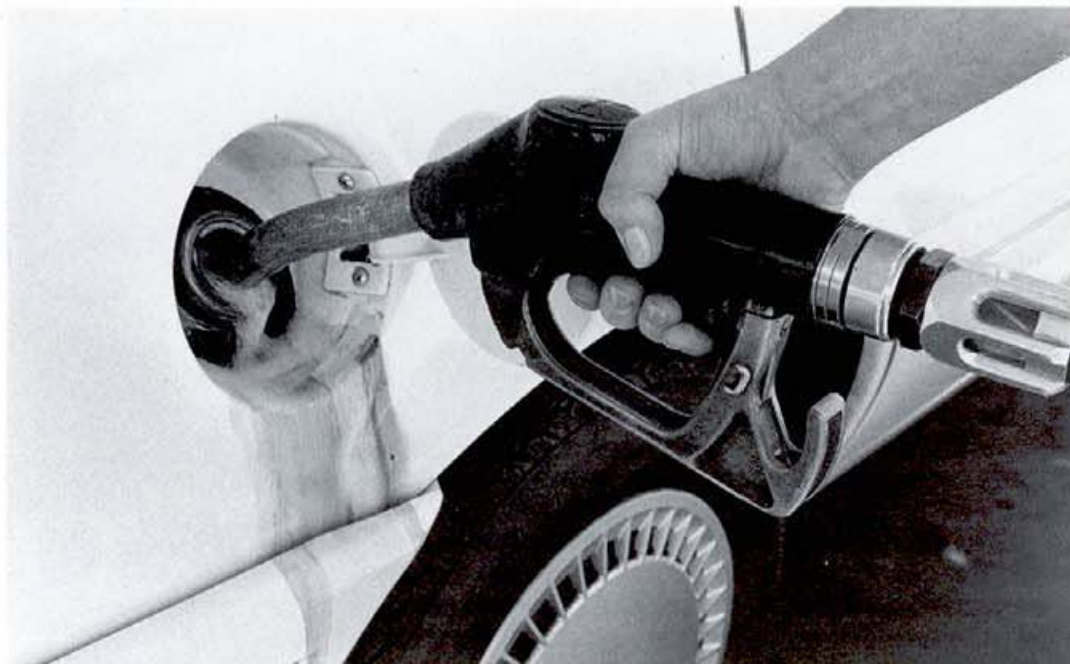
Nevertheless, motorists should understand that the real value of the guide figures is that they compare vehicles on the same basis — better fuel economy on the test will invariably mean better fuel economy on the road.

Variations in driving styles can account for bigger differences than test methods can. Some careful drivers used 10% less fuel than the guidelines indicate, whereas other 'lead-footed' ones used 60% more.

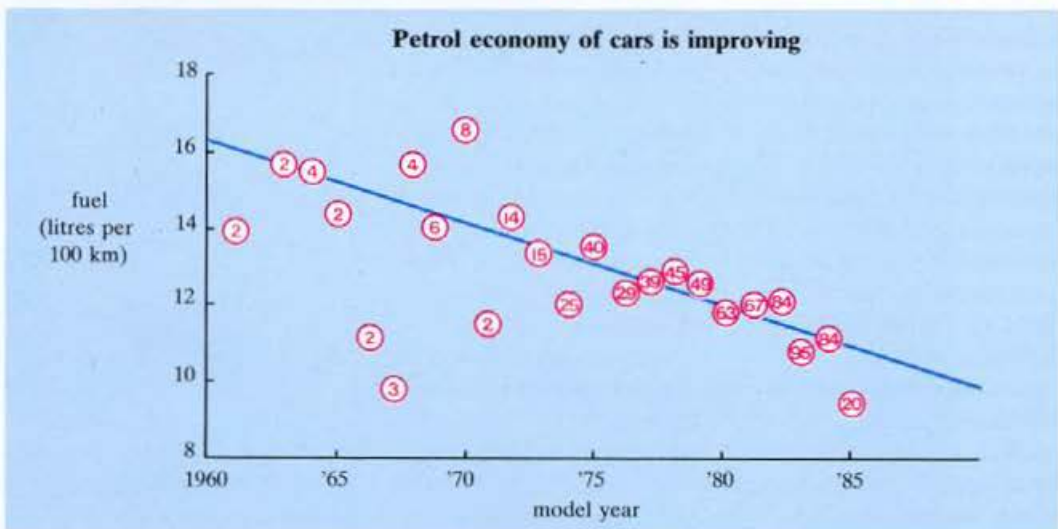
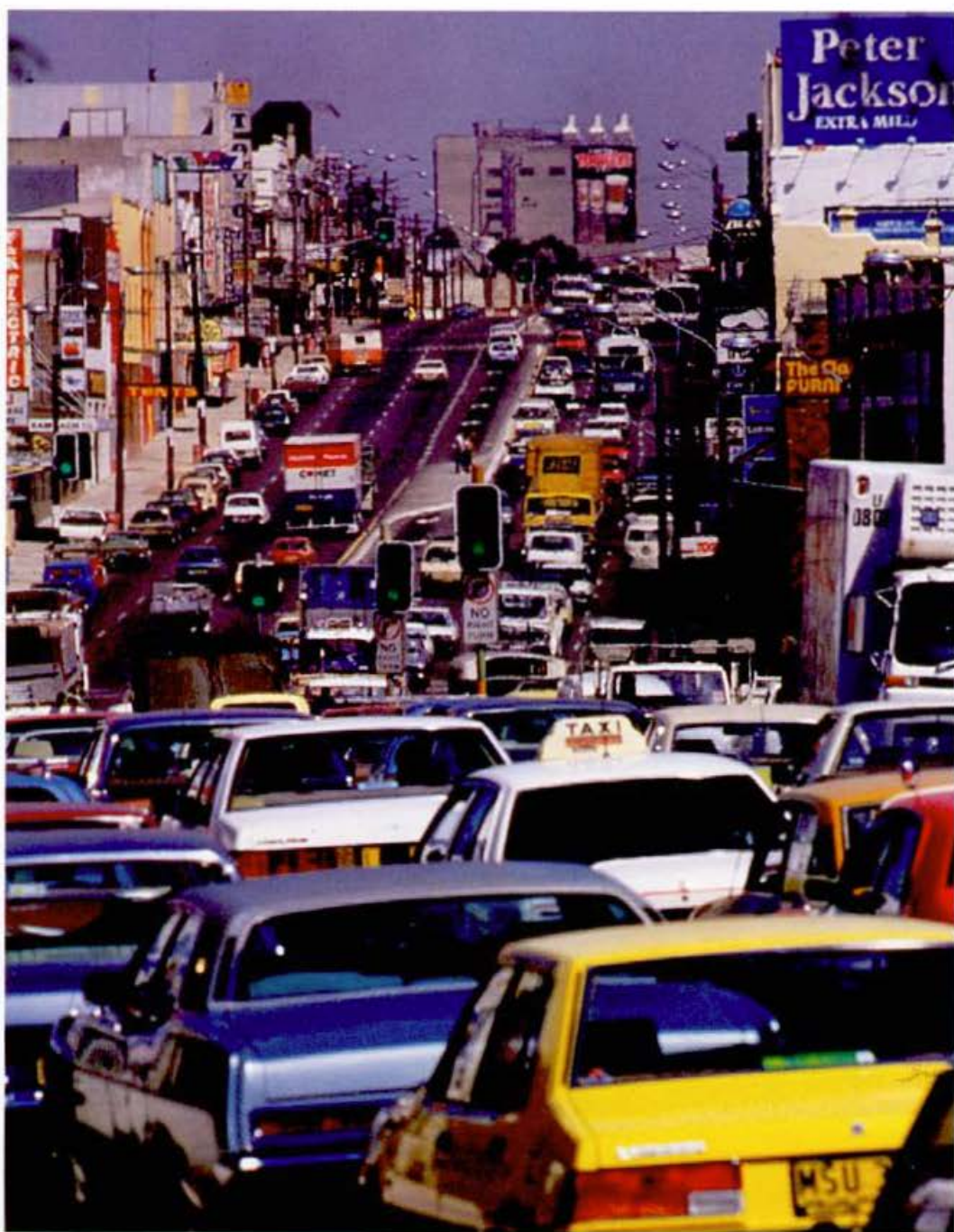
Further analysis of the survey data showed up the following key factors.

**MODEL/YEAR.** When the sample cars were separated into age groups, the newer ones showed a clear trend towards better fuel consumption. The trend is shown in the graph on page 28. More fuel-efficient engines are part of the explanation, but a move towards smaller cars also figures strongly.

**SIZE OF CAR.** As you would expect, the bigger the car, the more petrol was consumed. The smallest vehicles, with a mass close to 700 kg, returned the lowest consumption







When data from the car survey were separated according to model year, they showed that the fuel economy of the Australian car fleet is tending to improve. Better engine efficiency and smaller cars both contribute. The circled figures show the number of cars of each vintage.

figures — a miserly 6.5 L per 100 km. By comparison, 2-tonne 'tanks' consumed 18 L per 100 km.

**TRANSMISSION.** Cars with automatic transmission used 15% more petrol than manuals in city driving, and 11% more on the highway.

Engine size plays an interesting role here. For city driving, automatics with 1.3-L engines drew a 20% fuel penalty, whereas automatics with 4.1-L engines gave the same economy as manuals. This suggests that small automatics are relatively inefficient in city conditions. In highway driving, automatics incurred a constant 10% fuel penalty irrespective of engine size.

We can expect the difference between automatics and manuals to diminish as manufacturers offer more 4-speed automatic transmissions with torque-converter lock-up. This will eliminate slip in the transmission while cruising, and if it's available in the lower gears it can provide savings around town as well.

**AIR-CONDITIONING.** Cars fitted with air-conditioners consumed 13% more fuel than those without. The units appeared to penalise manuals more than automatics (in percentage terms), but in each case they introduced an additional fuel consumption of 1.5 L per 100 km.

The data didn't show how much the facility was used, but some follow-up tests at Melbourne University revealed that a vehicle is likely to be 22% harder on fuel when the air-conditioner is operating than when it's not.

*Andrew Bell*

Factors influencing petrol consumption — a survey of the Australian passenger car fleet. Y. Liu, I. McFarlane, J. Mole, H. Watson, and R. Trayford. *SAE-A Journal*, Jan/Feb 1988, 27-33.