FLEET FUEL EFFICIENCY: A WIN-WIN OPPORTUNITY

Peter Baas
TERNZ

ABSTRACT

This paper summarizes the findings of New Zealand-based research carried out during 2008 on overcoming the barriers to transport fleets adopting fuel saving measures. This research included: a review of overseas best practice; a fuel efficiency trial involving car, bus and truck fleets; surveys of industry awareness and an analysis of the barriers to adopting fuel saving measures. The trial confirmed overseas experience that has found that fuel savings of 10% or more are achievable through improved fleet management systems, driver training, vehicle maintenance, and other well established practices. However, most fleets do not have the skills or knowledge required to realise these savings resulting in a low level of uptake.

Saving fuel is a win-win opportunity for transport fleets. Saving fuel:

- reduces transport costs, which increases fleet profitability, improves productivity and benefits the economy through lower overseas expenditure in a way that does not affect NZ jobs,
- benefits the environment through less CO_2 and other emissions
- improves road safety because of the synergies between fuel efficiency and road safety measures (reducing speed, anticipating the situation ahead, improving vehicle maintenance etc).
- has very little effect on travel time

INTRODUCTION

There is growing recognition internationally of the potential to improve the 'bottom line' profitability of road transport fleets, reduce emissions and improve safety by encouraging fleets to save fuel (Dept for Transport UK 2009).

International literature reviews undertaken by the author found that significant improvements in fuel efficiency are achievable through relatively simple measures such as: driver training, checking tyre pressures regularly, ensuring vehicles are well maintained, ensuring drivers do not speed, monitoring fuel use and improving logistics. There appears to be industry awareness of the need to improve fuel efficiency but there is a lack of understanding of how this can be achieved (Baas and Latto 2005 (a); Baas, Latto et al. 2005 (b)).

There are a number of factors that affect fuel efficiency:

- Driver behaviour. The difference in fuel consumption between a good and a poor driver can be as much as 35% (OEE Canada 1998). This difference is reportedly due to differences in road speed, gear selection, the engine speeds at which gears are changed, aggressiveness of accelerator and brake pedal use, and the amount of time the driver leaves the truck idling.
- Vehicle speed.

- Air-conditioning. The use of air-conditioning can increase fuel consumption by 3% to 4% (OEE Canada 1998). Open windows also increase fuel use. Maximum use of the cab's air ventilation system should be made (IRTE 2003).
- Aerodynamic losses. At highway speeds over half the energy required to move the vehicle along the road is used in overcoming aerodynamic drag. Reducing aerodynamic drag by 25 % on heavy vehicles results in savings of fuel consumption of 10 to 15 % at highway speeds (Bradely 2000).
- Matching engines and transmissions to the transport task .
- Maintenance. Poorly-tuned engines can use up to 50% more fuel than well-tuned ones. Clogged air filters, for example, increase fuel consumption by up to 10% (OEE Canada 1998).
- Tyres. According to a report in Heavy Duty Trucking (Putz 2003) more than 80% of tyre problems are caused by under-inflation and could be eliminated through better tyre maintenance, especially proper tyre inflation. Under-inflation not only reduces the durability of tyres but also increases rolling resistance. A 15psi drop in a truck's tyre pressure will increase rolling resistance by 6% resulting in increased fuel usage (Winkler and Fancher 2000).

Key methods of saving fuel include:

- Fuel efficient driver training
- Encouraging improvements in fleet management practices that include: fuel monitoring, maintenance management and promoting a fuel saving culture within their organisation. This could be through the development of a package that includes case studies, fuel management guides and other material similar to that produced by the UK Transport Energy Best Practice programme.
- Reduction in trip demand through improve logistics, the use of alternative modes and other measures

Saving fuel will result in financial, environmental and safety benefits but may have a small detrimental effect on travel time. The following estimates are based on a 10% saving.

Financial benefits

Heavy vehicles in New Zealand consume approximately 45PJ of energy per year. Heavy vehicle fleets with more than 10 employees consume approximately 33 PJ/pa of energy or 13% of New Zealand's total liquid fuel consumption per year. Light vehicle fleets operated by enterprises with more than 20 employees consume approximately 18PJ of energy per year or 7% of New Zealand's total oil consumption p.a. The cost of diesel used by heavy vehicle fleets with more than 10 employees is approximately $1billion p.a. based on July 2009 fuel prices.

If half of the heavy vehicle fleets with more than 10 employees achieved a 10% reduction in fuel use, diesel purchases would be reduced by approximately $50million p.a. If half of the light vehicle fleets with more than 20 employees reduced their fuel use by 10%, the reduction in the cost of fuel would be in the order of $25mllion p.a.

The financial incentives for operators are significant. Assuming the cost of diesel is $0.935 after a 10% fleet discount has been applied, a 10% reduction in fuel used would typically save:

- $2,000 p.a. for a 3-axle rigid truck doing metro deliveries averaging 45,000km p.a.
- $15,000 p.a. for a typical double-shifted B-train averaging 290,000 km p.a.

For a typical heavy vehicle operator, a 10% saving in fuel costs would have resulted in a 55% increase in bottom line profit in September 2008 when the fleet discounted price of diesel was $1.439 per litre. This was based on the National Road Carriers Inc cost model data, the Waikato University Operator Comparison report and the RTF/Deloitte index. The effect on profit has reduced somewhat since then because of the drop in oil prices. However the benefits of saving fuel are still considerable.

In the UK, the government has funded safe and fuel efficient driver training for over 12% of the fleets with more than 15 vehicles. A formal review of their training scheme (SAFED) found that there was an average fuel saving of over 9% soon after the training and a sustainable long term fuel saving of approximately 5% (Department for Transport 2004; Lawson, Michaelis et al. 2008). Further savings of over 5% were obtained through relatively simple measures such as checking tyre pressures, reducing idling, improving vehicle maintenance, improving route selection and logistics, improving vehicle selection and other measures such as better vehicle aerodynamics and management practices..

Environmental benefits

Transport is responsible for 20% of New Zealand's greenhouse gas emissions and transport emissions have increased by 70% since 1990 (Ministry for the Environment, 2009). The OECD and International Transport Forum Joint Transport Research Centre has found that, assuming a business-as-usual scenario, CO_2 global emissions from transport are likely to grow by 120% by 2050 if action is not taken (JTRC 2008). This assumes that sufficient energy supplies will be available to meet demand without major increases in fuel price.

While major reductions in emissions will require technological solutions and changes in travel demand and freight logistics, a 10% fuel saving through fuel efficiency measures is still worth having, especially as it can be implemented straight away and produce economic benefits at the same time. If half of the heavy vehicle fleets with more than 10 vehicles reduced their fuel use by 10%, CO_2e emissions would reduce by approximately 115,000 tonne p.a. (enviroIndex). A similar saving by half of the light vehicle fleet with more than 20 vehicles would reduce CO_2e emissions by approximately 60,000 tonnes p.a.

Safety benefits

Virtually no research has been undertaken on the inter-relation between safety and fuel efficiency. However, many of the techniques used to improve both are the same: managing speed, anticipating the situation ahead, reducing aggressive driving behaviours, checking tyre pressures, vehicle maintenance and reducing travel.

As mentioned above, a reduction in average speed of 8km/h can result in a fuel saving of 10% to 15%. (Archer, Fotheringham et al. 2008) noted that the relationship between speed and accident outcome severity is well established with reductions in speed of approximately 5 percent resulting in a reduction in fatalities of as much as 20 percent.

(AMR Interactive 2006) found that fleet managers can have a major influence on speed behaviour. "Pressure to meet deadlines" was by far the most common reason given in their survey on why truck drivers speed in Australia. As many as 20% of the drivers reported that they were speeding on at least half of their trips even though the vehicle was supposed to be speed limited. Only half of the drivers reported that their company promoted a "do not speed" policy. Many drivers believed that it was more important to keep their manager happy than to obey the law.

Fleet management practices can have a major influence on safety. The Trucksafe and National Heavy Vehicle Accreditation (NHVA) schemes in Australia are formal means of recognising operators who have good safety and other (e.g. mass) management systems in place. In order to become accredited operators need to demonstrate, through independent audits, that they have effective management systems. (Baas and Taramoeroa 2008) determined the safety benefits of accreditation by comparing Police reported crash rates over a 3 year period of accredited and non-accredited vehicles in Victoria, Queensland and NSW. Approximately half of the 48,000 articulated heavy vehicles registered in these States belonged to operators who were accredited to Trucksafe or NHVAS. It was found that vehicles belonging to operators accredited to TruckSafe or NHVAS were, on average, significantly safer than vehicles that were not accredited. The calculated difference in average crash rates was substantial with vehicles accredited to the schemes having between ½ and ¾ fewer crashes on average than non-accredited vehicles. The analysis also found that operators improved through the process of becoming accredited with reductions on crash rates of approximately 50 percent in the 2 years after accreditation compared to the 2 years before.

Effect on travel time

A general and often misleading assumption made by drivers is that speeding and driving more aggressively will result in a substantial reduction in their travel time. An independent review of the UK SAFED programme in 2004 (Department of Transport UK 2004) noted that:

> *One of the main barriers to SAFED training was the perception that driving fuel efficiently meant that journey times would be lengthened. There is now evidence from the training to show that this is not the case. Driving times are broadly comparable over the same distance using SAFED techniques and not using them. This combined with the cost savings identified have helped in getting training widely accepted within the industry.*

Fuel efficient driving promotes compliance with the speed limit. Even if drivers decided on their on volition to drive more slowly than the speed limit, the effect on travel time is relatively small. A review of the literature undertaken by (Archer, Fotheringham et al. 2008) found that small reductions in posted speed limits had a relatively minor impact on travel times at an individual level. This is because mean speeds are always lower than posted speeds because of delays due to other traffic, slowing down for curves and intersections etc. Many drivers have experienced aggressive drivers passing them at speed only to be a few cars ahead 15 minutes later. A large nationwide linehaul truck operator has found that the average trip speed is about 65km/hr for truck-trailer combinations traveling between Auckland and Wellington on SH1 (unpublished company manual).

(Haworth, Ungers et al. 2001) found that lowering urban speed limits on local streets, collector roads and arterials would result in an estimated increase in travel time of 9 seconds per trip per head of population assuming a 5km/hr reduction in average travel speed.

(RACV 2000) (cited in (Archer, Fotheringham et al. 2008) found that there was only a 5 minute difference in travel time between aggressive driving and smooth driving but a 30 percent difference in fuel consumption for a 61km journey on Melbourne roads. There was a 30% difference in fuel consumption between the two driving styles in a large passenger car. The large car driven smoothly used less fuel than a small car driven aggressively.

There is general agreement in the literature that there is significant benefit to society from driving less aggressively and slower. However the safety benefits to society are often outweighed by the increases in travel time using current cost benefit analyses. This is because small increments in travel time are added together. An important issue of debate is whether individuals spending a minute or two longer getting to their destination should offset safety and fuel efficiency gains when deciding on government priorities.

PURPOSE OF THE STUDY

This paper summarises the findings of a fleet fuel efficiency trial undertaken by TERNZ for the NZ Ministry of Transport in 2008. The purpose of the trial was to undertake an initial evaluation of a number of fuel saving options suitable for promoting fleet fuel efficiency in New Zealand. The trial focused on heavy and light vehicle fleets (10 or more vehicles in the heavy vehicle fleets and 20 or more vehicles in the light vehicle fleets). Fleets were chosen, rather than individual motorists because it is more effective to work with groups of drivers in the form of companies and enterprises.

METHOD

Three interventions were trialed:

1. The UK “Safe and Fuel Efficient Driving” (SAFED) training), which was developed as part of the UK Department for Transport Freight Best Practice initiative (http://www.safed.org.uk/). The driver training included an initial assessment drive, a theory session and an instructional drive. Fuel use, gear changes and driver performance data were recorded to show the driver what they can achieve by driving more fuel efficiently and how.

2. The Green Torque fuel efficient driver training package, which was developed by DECA for the trial (www.deca.co.nz). It included a theory session followed by an instructional drive and was based on similar training provided by DECA in Australia.

3. An information toolkit that was constructed by the Ministry of Transport from material in the UK Freight Best Practice, Canadian Fleetsmart programmes and other sources. The toolkit included written advice, a tyre pressure gauge and a CD with copies of material from the UK Freight Best Practice and the Canadian Fleetsmart programmes, short instructional videos and background reports. The toolkit was presented to drivers and managers through a 45 minute on-site PowerPoint presentation.

Table 1 shows the types of fleets and the interventions administered to each of them.

	Light vehicles	**Heavy vehicles**	**Buses and Coaches**
SAFED		• Rural general freight • Tipper truck fleet	• Tour coach
DECA Green Torque		• Urban general freight • Refrigerated linehaul	• Urban bus
Toolkit	• Company cars	• Dangerous Goods and linehaul	• School bus

Table 1: Types of fleets involved in the trial

Drivers were asked to complete a fuel log every time they refuelled the vehicle. Distance travelled, date, driver name and other information were recorded. Fleet interviews were undertaken 2 to 4 weeks before the interventions were administered, the training was observed, and final interviews were undertaken about one month later.

RESULTS

Time constraints meant that only limited before and after fuel usage data could be collected. Despite that limitation, the trial did provided a good qualitative understanding of the options available for promoting fuel efficiency. Both the SAFED and DECA training were well received and both short term and medium term improvements in fuel efficiency and safe driving practices (managing speed, anticipating the situations ahead etc) were observed. The number of gear changes typically reduced by 40 to 60 percent and greater use was made of engine brakes. SAFED was a more refined training package than DECA Green Torque, which is not surprising given the considerable investment the UK government has made in its development and that it has now been used to train large numbers of drivers in the UK while the DECA package was developed especially for the trial.

The toolkit resulted in most drivers improving their fuel efficiency, with one driver improving by 30 percent. At the other end of the scale, one driver did not complete the fuel log properly and admitted that he liked large cars and driving aggressively. From a driver behaviour perspective, the toolkit was not as effective as the SAFED or Green Torque training packages but was more effective in encouraging fleets to reduce engine idling, improving maintenance, checking tyre pressures etc. In many ways the toolkit and driver training are complementary.

While all fleets are keen to save fuel, feedback from the trial and the subsequent consultation meetings was that many fleet operators do not know what to do and are too busy dealing with day-to-day problems. There is very little fuel efficiency driver training being undertaken at present, few fleets analyse their fuel use (they keep fuel card records but data on the distance travelled is often missing or unreliable) and there is very little New Zealand specific information available.

The trial did show that with the right motivation, significant savings could be made. This was illustrated by the experience of one of the trial participants, Alexander Petroleum of Christchurch. Over a 3 year period they have reduced their fuel consumption by 18 percent on a distance travelled basis. They have halved the number of safety-related incidents and have reduced the number of times their vehicles exceed 90km/h by 99% (the maximum speed limit for these vehicles is 90km/hr). Their new target is to increase their fuel savings to over 20%. They have achieved this by taking a holistic approach that included improvements in company management, driver behaviour and education, journey planning and vehicle selection and maintenance.

CONCLUSIONS AND DISCUSSION

The trial confirmed overseas experience that suggests that savings of over 10% are achievable by light and heavy vehicle fleets through driver training, vehicle maintenance and other well established practices but fleet management commitment is required.

Fleet commitment can be encouraged by:

- Promoting fuel efficiency. This can be achieved through funding of advisory services, promotion activities, research dissemination and other means.
- Undertaking fuel efficiency audits that provide guidance on the implementation of fuel saving measures. EECA already undertakes audits of this nature, however the uptake has been very limited.
- Providing incentives and other forms of encouragement to operators who can demonstrate that they have met certain minimum standards.

If half of the heavy vehicle fleets with more than 10 employees and half of the light vehicle fleets with more than 20 employees reduced their fuel use by 10%, there would be:

- A reduction in diesel and petrol purchases of approximately $75million p.a.
- A substantial increase in heavy vehicle operator profitability
- A relatively minor increase in travel time
- A reduction in CO_2e emissions of approximately 175,000 tonnes p.a.
- A reduction in crashes over 50% by those who made the commitment to save fuel and improve safety

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