Case Study

LIFT AXLES

TRIAL SUMMARY

This trial sought to quantify the fuel efficiency benefits of using lift axles on truck trailers (single). The trial was conducted for a mixed linehaul in the Greater Sydney metropolitan area of New South Wales and a summary of the results is provided in this table.

Fuel benefit (L/100 km)	GHG benefit (g/km CO_2-e)	Economic benefit ($/100 km)
0.823↑	22.20↑	1.15↑

↑performance better than conventional vehicle

The *Green Truck Partnership* is designed to be a forum for the objective evaluation of the merits of clean vehicle technologies and fuels by heavy vehicle operators. This report discusses the results of a lift axle technology trial conducted under the program in 2010.

1 LIFT AXLE TECHNOLOGIES

Truck trailers may be fitted with dual or triple axles in order to support heavier loads. However, when the truck trailer is unloaded or lightly loaded there is an opportunity to lift one of the axles from the road, resulting in a reduction in rolling resistance and a potential reduction in fuel consumption.

The primary motivations for heavy vehicle operators choosing to fit lift axles are reduced tyre wear and maintenance. However, the extent of the fuel efficiency benefit derived has not yet been assessed in an Australian context.

2 TRIAL OBJECTIVE

This trial sought to assess the fuel efficiency improvements in a mixed urban and linehaul operation when using lift axle technologies relative to conventional axle operation.

3 METHODOLOGY

DATA COLLECTION

This trial involved measurement of the fuel consumption of a single vehicle operating with a full load in the outbound direction and no load on the return journey. The vehicle was a prime mover with a single trailer.

Under typical operation, the return routes would involve the lifting of axles due to the lighter load. For the purposes of the trial, the baseline assessment was conducted by disabling the lift axle technology in order to emulate conventional vehicle design. Data was collected for a two-week period to establish the baseline fuel consumption.

Following collection of the necessary baseline data, the lift axle was reactivated and fuel efficiency data was collected over a four-week period with the lift axles operating on the return journey.

During the trial period, data loggers were used to collect drive cycle data relating to the operation of the trial vehicles to ensure validity of the before and after comparison.

Data collected by the loggers included:

- **FUEL CONSUMPTION**: daily fuel consumption.
- **FUEL ECONOMY**: daily fuel economy (km/L).
- **DISTANCE**: kilometres travelled.
- **IDLE TIME**: time spent at idle.
- **ENGINE LOAD**: percentage of time spent at a given engine load.
- **AVERAGE SPEED**: average speed (km/h).
- **STOPS**: number of stops per kilometre travelled.

Other datasets were collected but were not relevant to this particular trial.

DATA ANALYSIS

The data was subsequently analysed on an average basis over the baseline and technology trial periods, and any recorded periods that did not reflect the typical duty cycle (such as days with less than 50 km travelled) were removed from the dataset. The baseline data was then compared with the trial data. The resulting findings are discussed in Section 4.

4 RESULTS

Figure 1 displays the average fuel efficiency of the truck running without the use of lift axles (baseline) and the same truck running with the use of lift axles (trial). The results indicate that the use of lift axles provided a 1.8% improvement in fuel efficiency.

Given the marginal benefit demonstrated, the engine load profiles of both the trial and baseline test periods were compared with a view to determining if duty cycle variance was likely to be responsible for any fuel efficiency differences.

The results of this comparison are shown in Figure 2, which shows the comparative engine load profiles for the baseline and trial periods. As indicated, there is very little variation between the two periods, suggesting a similar duty cycle and comparable data.

Figure 3 provides an additional duty cycle comparator in average speed. The trial and baseline periods share like speed profiles, indicating comparable duty cycles.

5 CONCLUSION

The trial sought to investigate the potential for a fuel economy benefit to be realised with the use of lift axles when unloaded. Traditionally, lift axles have been implemented as a means of reducing tyre wear – a significant contributor to maintenance costs; however, the trial sought to determine if this benefit extended to a reduction in fuel consumption.

Data from the six-week assessment period suggests that a marginal reduction in fuel consumption may be achieved with the use of lift axles. A 1.8% improvement in fuel economy was recorded over the trial period.

The subsequent assessment of engine loads over the baseline and trial periods suggests that external factors such as duty cycle and driver behaviour are unlikely to have contributed significantly to the observed variation in fuel consumption. As a consequence, the fuel efficiency benefit observed under this trial is likely to be directly attributable to the operation of the lift axles.

Axle in raised position

Figure 1
Average drive fuel economy of lift axle vs. conventional trailer

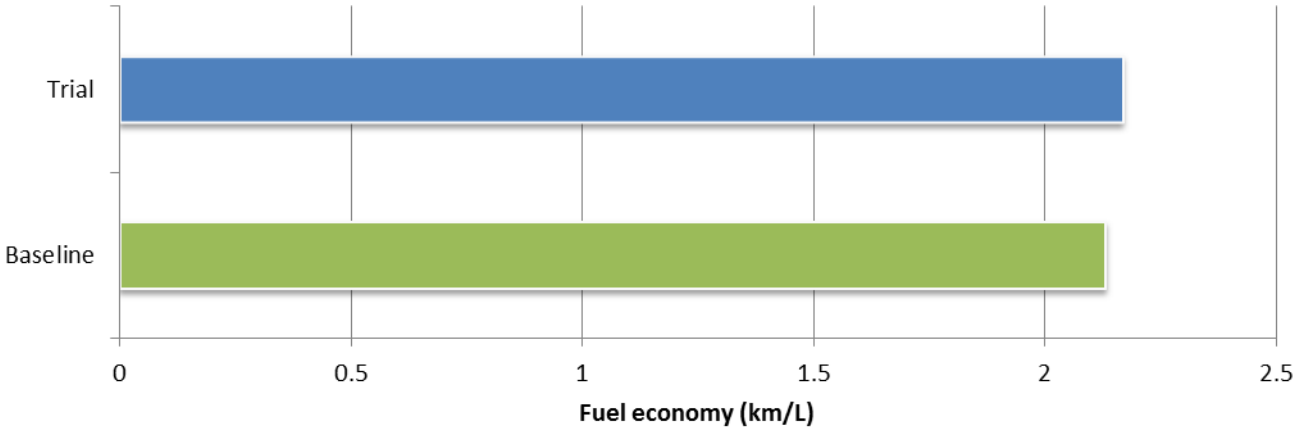

Figure 2
Comparison of baseline and trial period engine loads

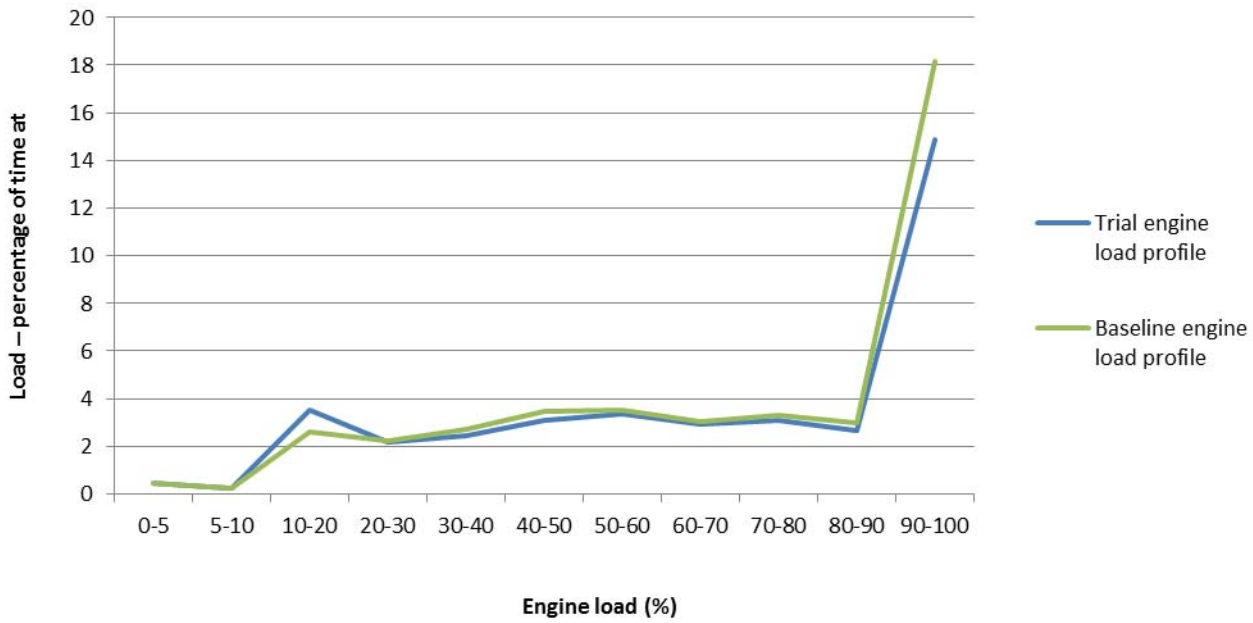

Figure 3
Comparison of baseline and trial period average speeds