



TRIAL SUMMARY

This trial sought to quantify the fuel efficiency benefit of an aftermarket device fitted to trailers to reduce aerodynamic drag. The trial was conducted for one B-double running a highway linehaul application between Sydney and the NSW North Coast.	Fuel benefit (L/100 km)	GHG benefit (g CO₂-e/km)	Economic benefit (\$/100 km)
	inconclusive	inconclusive	inconclusive

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 an aerodynamic device trial conducted under the program in 2014.

1 TRAILER AERODYNAMIC DEVICE

Aerodynamic drag is created as air resists the movement of a vehicle. The vehicle engine must work harder to overcome this resistance and hence consumes more fuel.

Particularly at high speeds, aerodynamic drag can be a significant consumer of energy for a heavy vehicle. One-third to one-half of the fuel consumed by articulated trucks in highway linehaul applications can be attributed to overcoming aerodynamic drag.

Vehicle manufacturers have progressively improved the aerodynamic efficiency of prime movers. The integration of truck and trailer, however, offers three main areas for aerodynamic improvement: the gap between cab and trailer, the gap between trailer and road, and the rear of the trailer.

The device tested in this trial fits to the rear of the trailer.

The literature suggests that aerodynamic devices can achieve fuel savings of 2–3% individually and up to 15–20% in combination (IEA 2012, DoI 2012, CWR 2012, USEPA 2012). But the benefits in Australia may vary, and depend on the device, the vehicle configuration and the vehicle duty cycle.

2 TRIAL OBJECTIVE

This trial assessed the economic and environmental performance of an aftermarket aerodynamic device in a B-double configuration. The device was trialled fitted to the rear of both trailers in a B-double configuration, and also to the second trailer only. A diagram of the device is shown in Figure 1.

3 METHODOLOGY

DATA COLLECTION

The trial involved an in-field assessment of one prime mover operating an interstate linehaul route on the east coast of NSW over a 17-week period between June and September 2014. The differences in fuel efficiency were quantified by recording performance of the prime mover with and without the device fitted to the two trailers.

The prime mover makes the same trip from Sydney to Macksville (roughly 5.5 hours), and back, several times a week, with the same driver. At Macksville, trailers were swapped (as a set) with other trailers heading south from Brisbane. Other trips made by the prime mover during the trial period were excluded from analysis.

Swapping trailer sets between modified trailers and standard trailers allowed the capture of baseline data and trial data over the same period. The consistent nature of the linehaul trips – between the same origin and destination, at roughly the same time of day, with the same driver, and carrying similar loads – ensured that the duty cycle was similar when driving with and without the aerodynamic device fitted. Data loggers verified that the vehicle was undertaking similar work with both trailer sets, allowing a comparison of fuel consumption.

The trip data collected by the loggers included:

- **TRIP LENGTH:** measured in time (hh:mm) and distance (km)
- **TRIP IDLE TIME:** time spent at idle
- **TRIP ENGINE RUN TIME:** time spent with engine running
- **ENGINE LOAD:** percentage theoretical maximum loading (%)
- **FUEL CONSUMPTION:** total fuel consumed (L)
- **TRIP ORIGIN/DESTINATION:** from GPS data
- **DRIVER LOG BOOK:** recording trailer used.

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

DATA ANALYSIS

The first stage of the analysis involved examining vehicle trip data to isolate trips on the selected linehaul route. Trip destination and trip length data were used to isolate the linehaul trips, and northbound and southbound trips were separated. Driver logs were then used to identify

the trips which used the trailer set fitted with the aerodynamic device.

Once the six datasets were collected (i.e. northbound and southbound trips, with one device on the rear trailer, with the device fitted to both trailers, and the control without the aerodynamic device), secondary analysis was completed to validate that the fuel consumption results with and without the aerodynamic device could be compared fairly. This was achieved by comparing three duty cycle descriptors (average engine load, engine run time and idle time) for the truck when pulling trailer combinations with and without the device.

As shown in Figure 2, a comparison of the engine load profiles with and without the aerodynamic device on northbound and southbound routes showed good correlation.

Although there were some differences between duty cycles on the northbound and southbound routes, there were no major differences in duty cycle with and without the trial device.

Accordingly, it was concluded that the truck had been operated in a similar manner throughout the trial period and that direct comparison of fuel efficiency was valid.

4 RESULTS

Comparison of fuel efficiency results for the southbound route showed a small fuel efficiency improvement (less than 3.9%) when using one aerodynamic device, but no difference in fuel efficiency with two devices installed (compared to baseline data).

However, the northbound route did not show a fuel efficiency benefit from using the device – indeed the device appeared to show the opposite on northbound journeys than it did southbound. Further investigation revealed that different types of freight were carried north and south, with the northbound trailers full but carrying lighter product (by up to 30% at times). This would explain the better average efficiency when heading north.

Figure 3 shows the average fuel efficiency of trips in the six datasets examined. Error bars have been added at 1 standard deviation either side of this average to show the variation in the trip fuel efficiencies measured.

5 CONCLUSION

In this trial the device was fitted to the rear trailer, and to both trailers in a B-double configuration. The results of the trial indicate that this device may provide a fuel efficiency benefit in this application, but the overall size of the benefit was inconclusive. In particular, the reason for the discrepancy between northbound and southbound trips could not be isolated but may be due to differences in payload.

A longer period of data collection, on a range of vehicles and trips, would improve the level of confidence in the result. Fitting the device on a single trailer (rather than a B-double), where the supplier claims to have seen better results, could improve the overall understanding of the potential benefit.

REFERENCES

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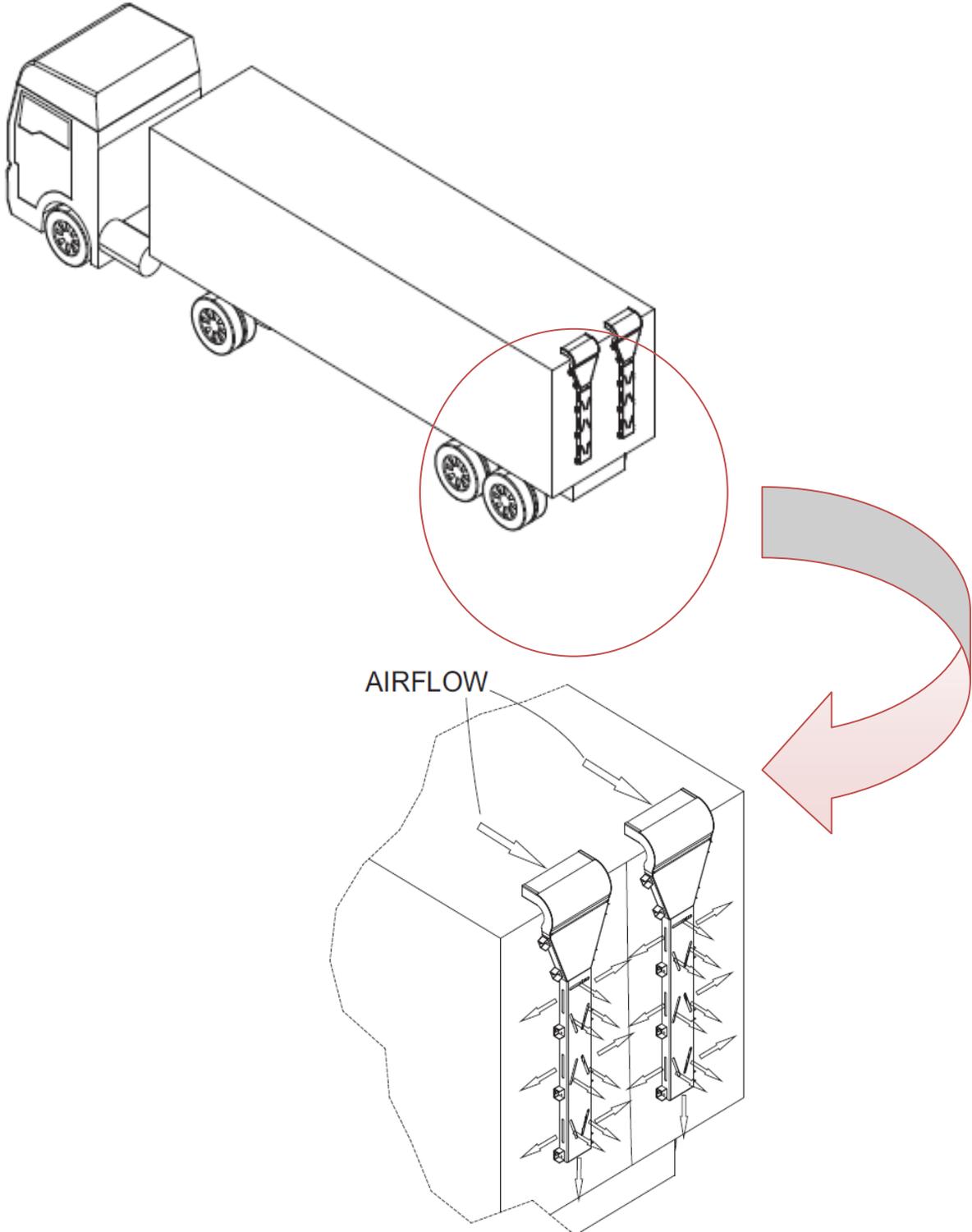


Figure 1
Diagrammatic representation of the trialled aerodynamic device

Figure 2
Comparison of vehicle average engine load for trial and control trailers on northbound and southbound trips

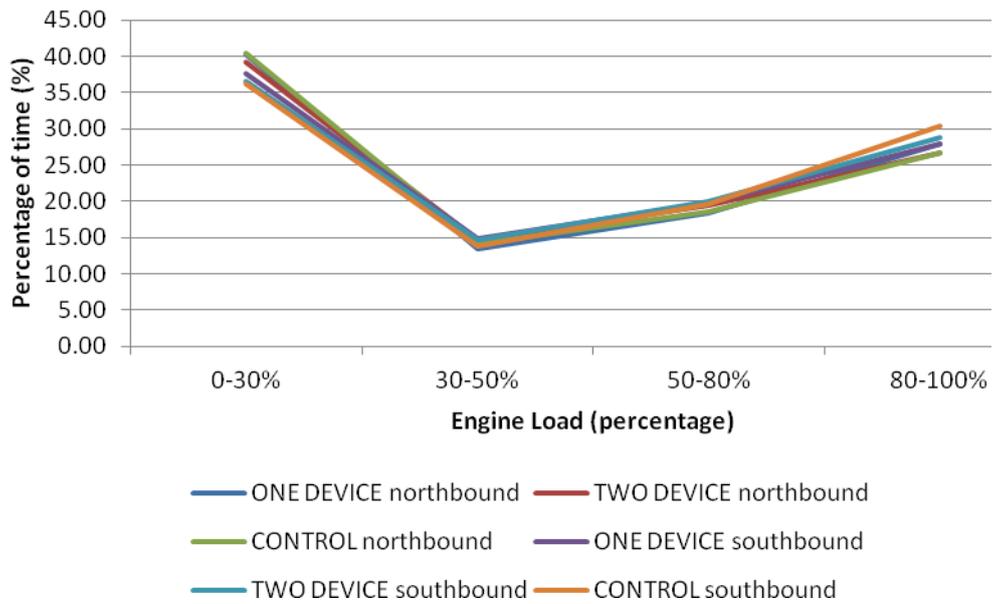


Figure 3
Comparison of vehicle fuel efficiency for trial and control trailers on northbound and southbound trips

