Case Study

AUTOMATIC TYRE INFLATION MANAGEMENT

TRIAL SUMMARY

This trial sought to quantify the fuel efficiency benefits of an automatic central tyre inflation system. The trial was conducted with two cement tankers running regional linehaul applications in NSW.

Fuel benefit (L/100 km)	GHG benefit (g CO_2-e/km)	Economic benefit ($/100 km)
0.19% ↑ (saving 0.23 L/100 km)	0.19% ↑ (saving 3 g CO_2-e/km)	0.19% ↑ (saving $0.15/100 km)

↑ performance better than conventional vehicle
↓ performance worse 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 used by heavy vehicle operators. This report discusses the results of an automatic tyre inflation management trial conducted under the program in 2013.

1 AUTOMATIC TYRE INFLATION MANAGEMENT

Under-inflated tyres increase rolling resistance, which can not only reduce fuel economy, but can also wear out tyres and reduce vehicle safety through poor handling. Maintaining correct tyre pressures and monitoring for uneven tyre wear (which can be caused by poor wheel alignment) can help to ensure optimum vehicle performance.

Central tyre inflation (CTI) systems offer one solution to managing tyre pressure, by automatically maintaining tyre pressures within a pre-determined range. Commonly used in off-road vehicle applications, CTI systems are primarily installed for their safety benefit (e.g. reducing tyre blow-out) and extending tyre life.

Using CTI systems to manage tyre pressure not only reduces the number of manual tyre pressure checks, but also allows tyre pressure to efficiently correspond to a variety of road terrains.

Overseas studies have shown that tyre inflation management can produce fuel savings of 1–4% and can increase tyre life by up to 10%. Results from previous (manual) tyre inflation trials under the *Green Truck Partnership* did not support this finding, but were deemed to be inconclusive.

2 TRIAL OBJECTIVE

The objective of this trial was to assess the economic and environmental performance of automatic central tyre inflation in B-double regional linehaul applications.

3 METHODOLOGY

DATA COLLECTION

This trial involved an in-field assessment of two cement tankers operating regional linehaul routes in NSW. The vehicles operated over an average of 12 week between February 2013 and May 2013.

Both trial vehicles underwent a monitoring period of 6 weeks with the CTI system turned on. This was followed by a 6-week period with the CTI system turned off.

In order to ensure that the operation of each vehicle was directly comparable before and after the intervention, data loggers were fitted to each vehicle to capture key descriptors of vehicle operation

Specifically, information was collected in relation to:

- **AVERAGE SPEED**: average speed (km/h).
- **IDLE TIME**: time spent at idle.
- **PTO**: time spent using power-take-off.
- **STOPPING INTENSITY**: number of stops per kilometre travelled.
- **FUEL CONSUMPTION**: total fuel consumed (L).

DATA ANALYSIS

The first stage of the analysis involved validating that the fuel consumption results could be compared before and after the trial. This was done by comparing four duty cycle descriptors (average engine load, average speed, idle time and PTO time) for each truck during both phases of the trial.

As shown in Figure 1, a comparison of the speed profiles for both vehicles (with and without the CTI units turned on) revealed a strong level of correlation. A comparison of the engine load profiles for both vehicles also shows a strong correlation between the baseline and trial periods for each trial vehicle (Figure 2).

Comparisons for idle time and PTO time for both vehicles are displayed in Figures 3 and 4. Both vehicles showed higher average idle and PTO times for the trial period when the CTI units were turned on, and lower average times for the period when the CTI units were turned off.

In summary, comparison of the duty cycles indicated that operation of the vehicles when fitted with and without CTI systems was very similar, with the exception of slight differences in idle time.

Following data validation, the fuel consumption of the two trial vehicles was compared. The results are summarised in Section 4.

4 RESULTS

A summary of the results for each of the trial vehicles when using automatic tyre inflation is provided in Table 1.

Comparison of the fuel consumption data revealed that when using a CTI system changes in fuel efficiency ranged from a 1.22% fuel use reduction in Truck 2, to a 0.84% fuel use increase in Truck 1.

Of the two trial vehicles, Truck 2 provided a stronger argument in support of CTI producing fuel savings, despite more idling and more PTO use during the CTI period.

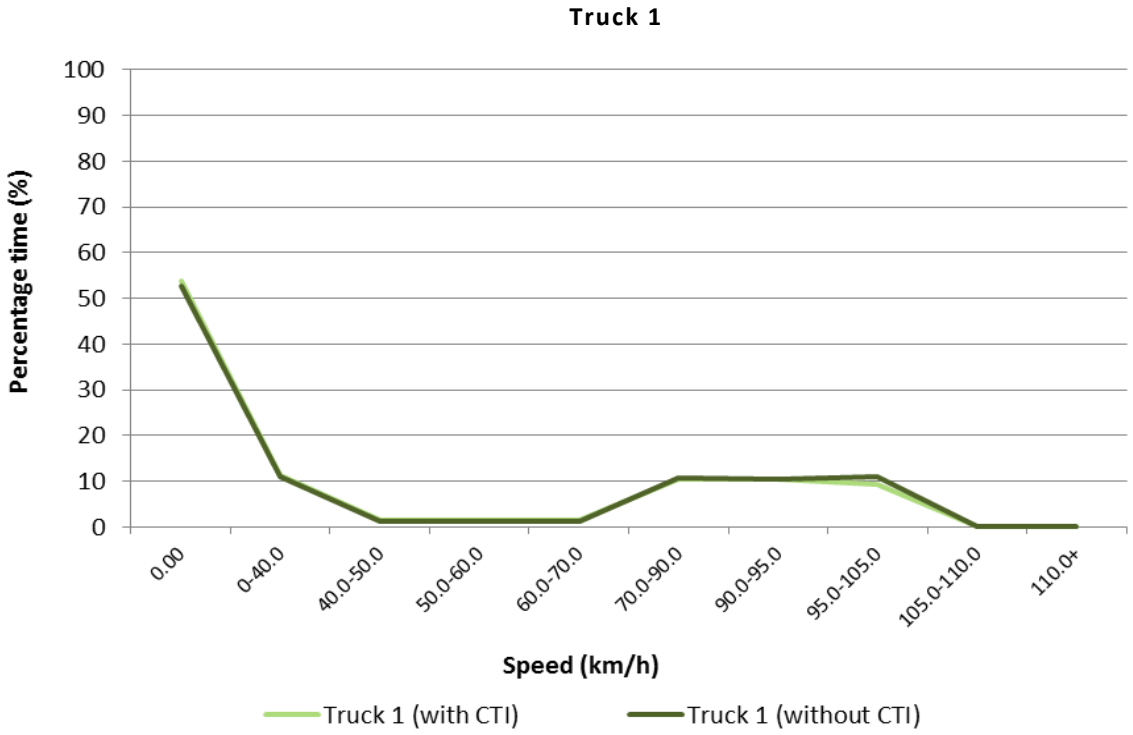
Combined, the average fuel efficiency benefit was 0.19% (Figure 5). Analysis of the GHG performance (Figure 6) mirrors the fuel trend: GHG emissions generated by the trial vehicles were, on average, 0.19% lower than before the monitoring intervention.

5 CONCLUSION

Contrary to anecdotal evidence and the results of overseas studies, this trial showed a negligible impact on fuel consumption for both trial vehicles. Overall, the average result was inconclusive (showing a small average benefit of 0.19% with the CTI fitted in a linehaul application).

Taking into account the duty cycle penalty (idling, PTO) the benefit for truck 2 was considered promising. However, the result was not conclusive given the background variability in fuel use data.

Figure 1
Comparison of average vehicle speed across the trial period



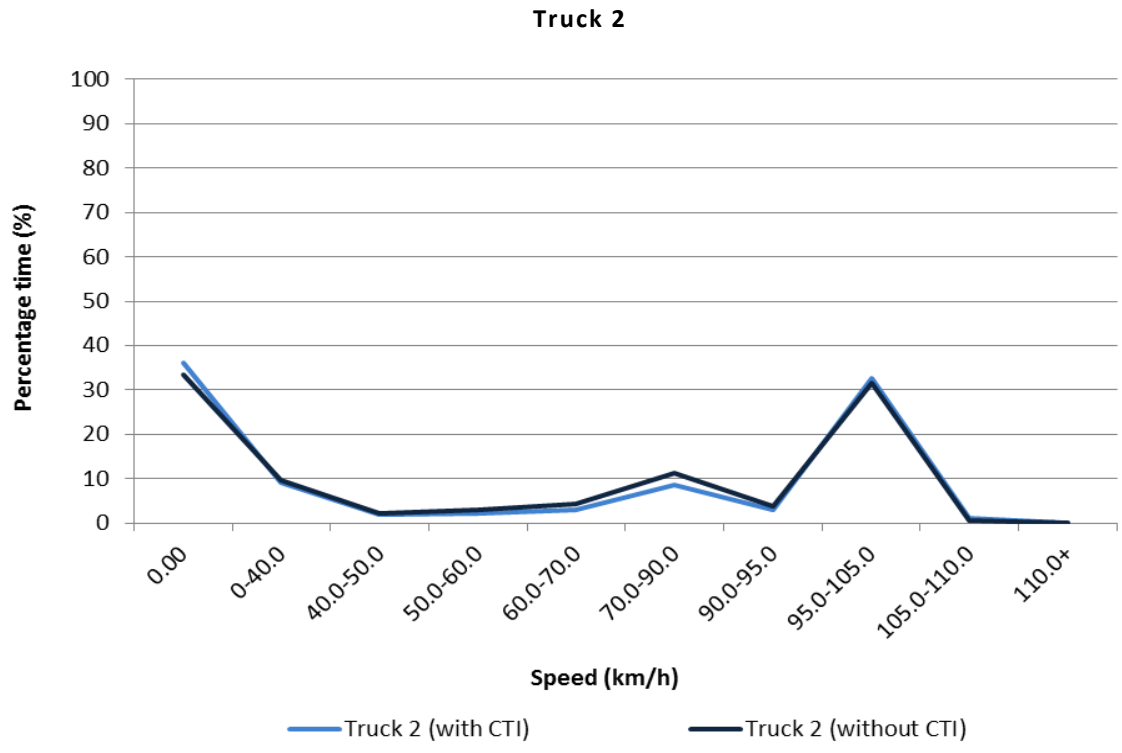
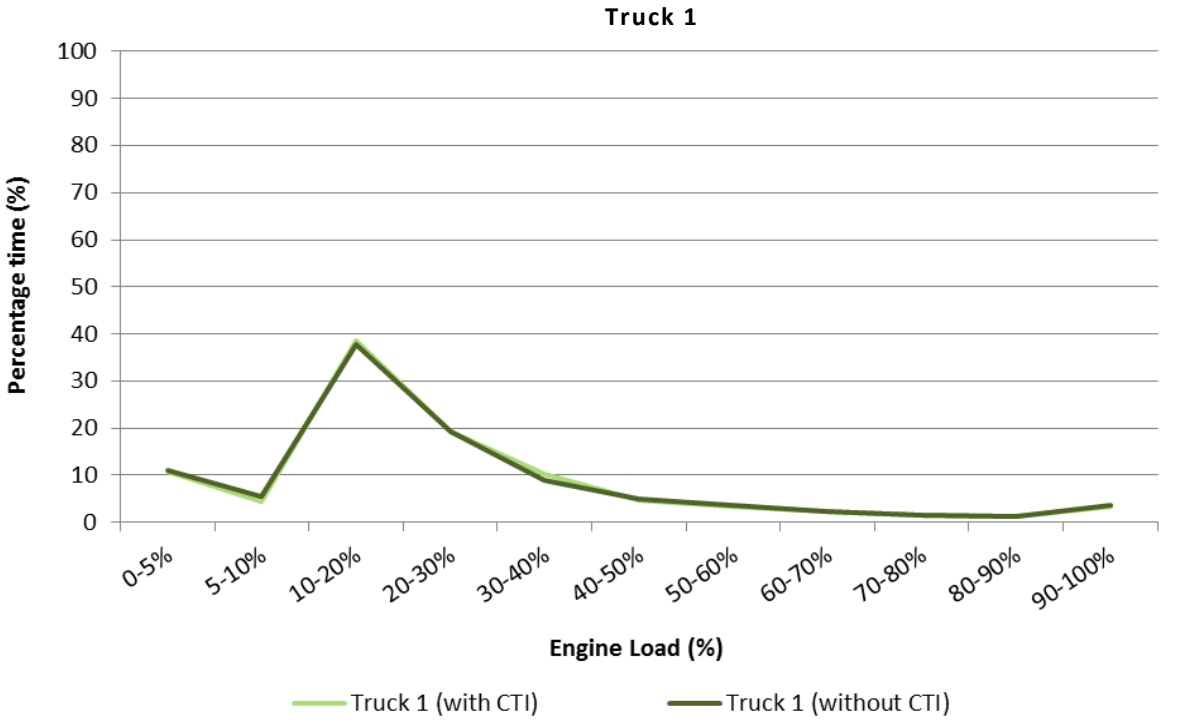


Figure 2
Comparison of average vehicle engine load across the trial period



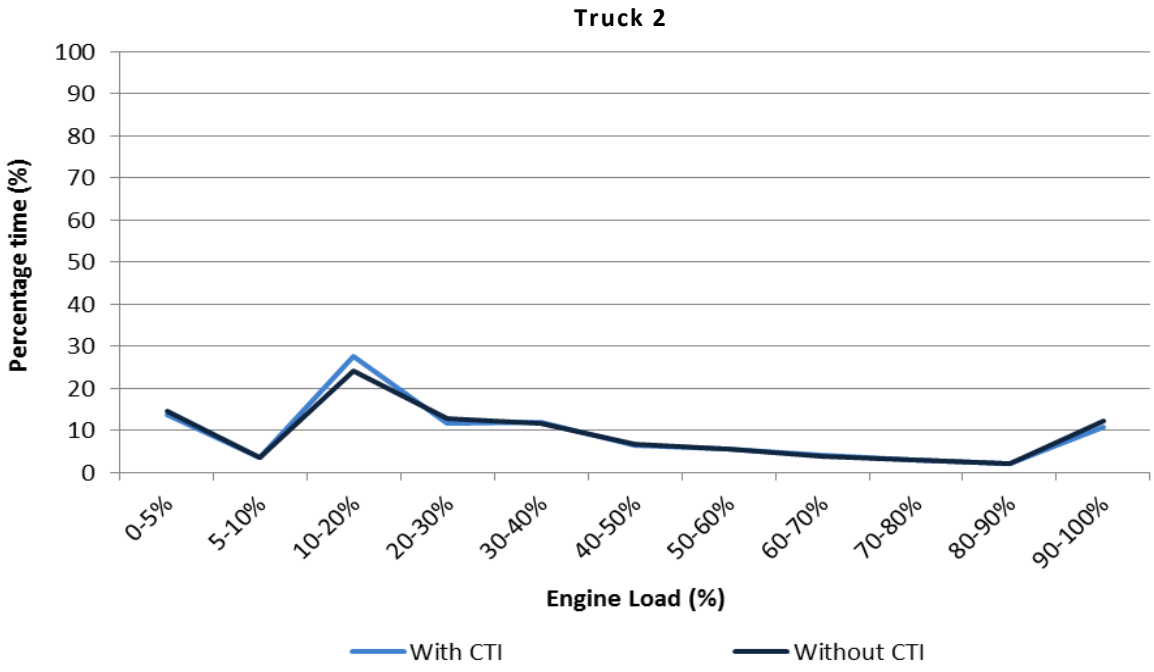


Figure 3
Comparison of average vehicle idle time across the trial period

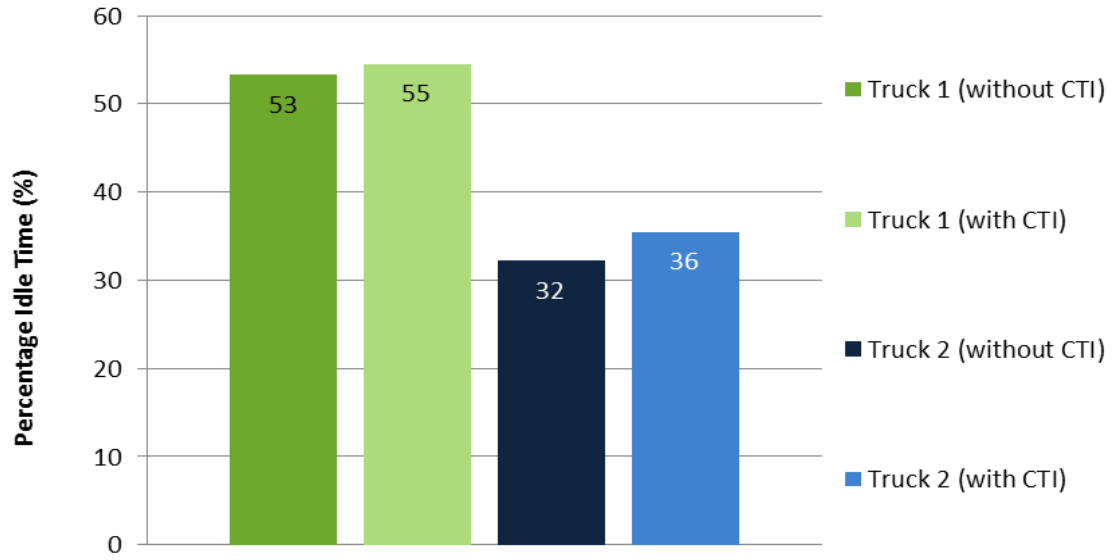


Figure 4
Comparison of average vehicle PTO time across the trial period

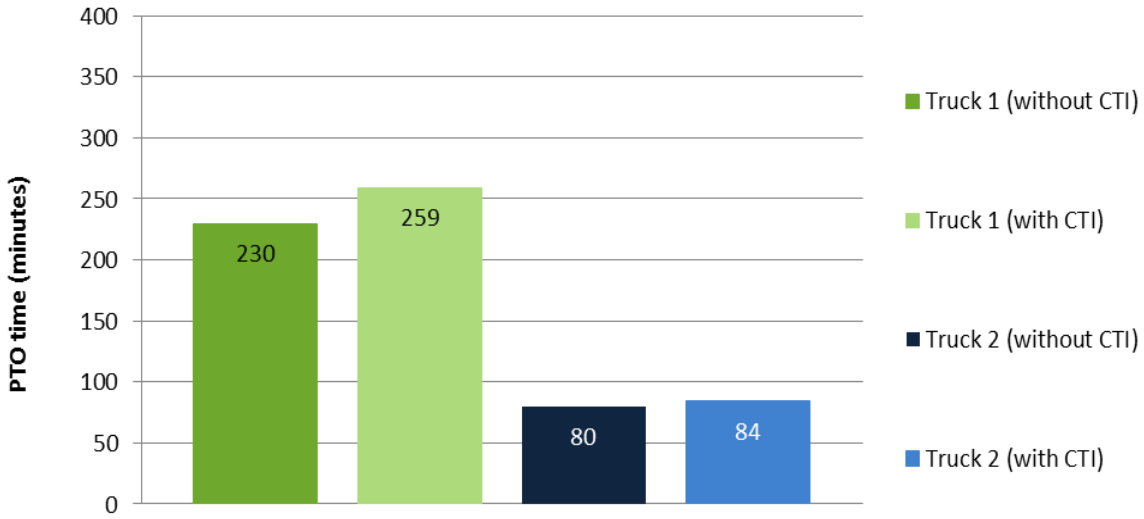


Figure 5
Comparison of average vehicle fuel consumption across trial period

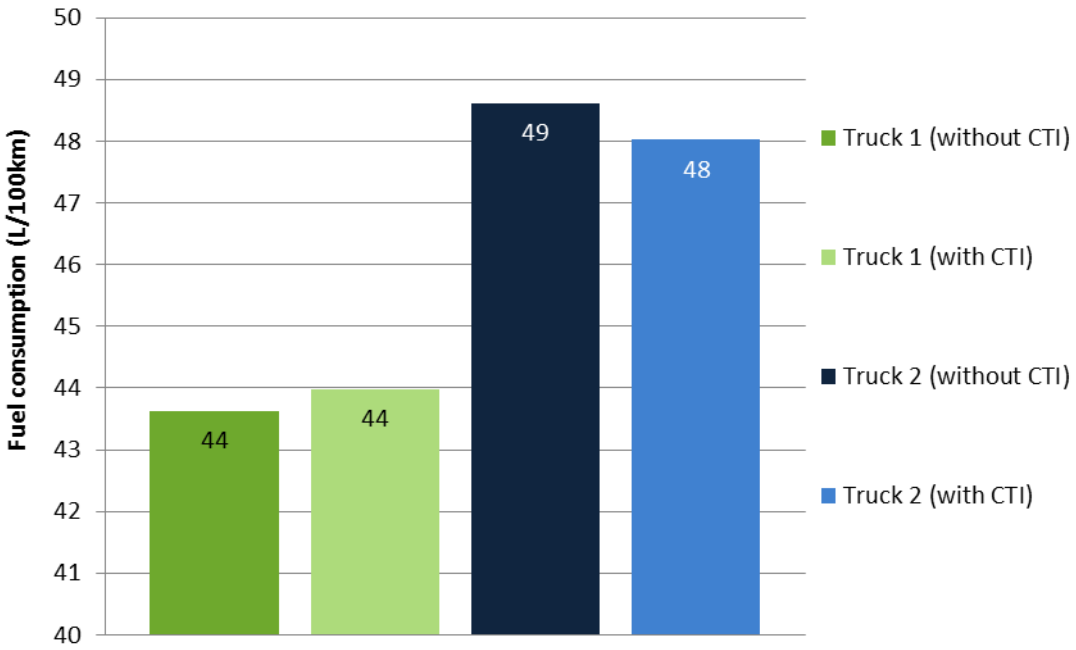


Figure 6
Comparison of average vehicle GHG emissions across the trial period

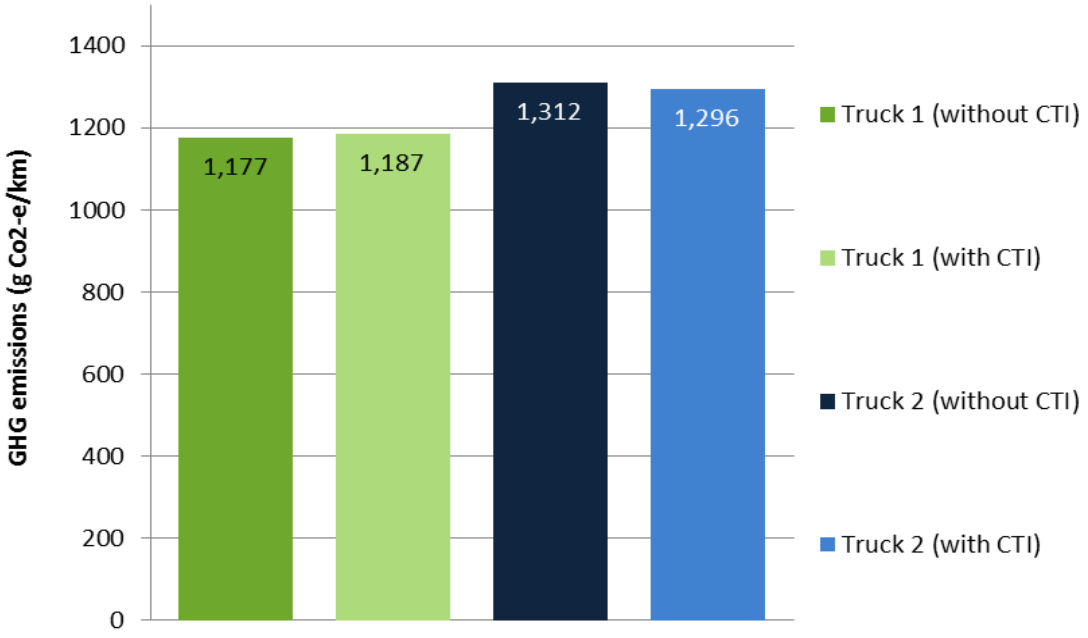


Table 1 Vehicle performance with automatic central tyre inflation (CTI) system

Driver	Vehicle type	Fuel saving (L/100 km)	Relative fuel saving (%)	GHG benefit (g CO_2-e/km)	Economic benefit ($/100 km)
Truck 1	Concrete tanker	–0.36	–0.84	–9.79	–0.51
Truck 2	Concrete tanker	0.59	1.22	15.79	0.82