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Trial Program on Aerodynamic Fairings

The analysis and conclusions contained in this case study are those of the authors alone and do not necessarily represent the point of view of the Government of Canada.

Organization

Freight Wing

Major Findings

Aerodynamic trailer fairings can reduce truck fuel consumption by 6.4%, saving up to 339 litres of fuel and 925 fewer kilograms of greenhouse gas per month/per trailer.

Project Timeline

August 2006 to February 2007

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Please note that some figures such as cost savings on fuel are based on data from the period that this project took place.

Introduction

Transport produces about a quarter Canada's greenhouse gas (GHG) emissions, with freight responsible for about 44% of that amount. Transport Canada's Freight Sustainability Development Program (FSDP) helps the freight sector reduce fuel consumption and the related GHGs and air pollutants. Freight Wing received FSDP funding to look at how much fuel could be saved by using aerodynamic fairings on long-haul transport trucks.

Most long-haul transport trucks have a poor aerodynamic design that produces a lot of drag, which, at highway speeds, requires 50% more fuel to overcome. Streamlining the box-shaped semi-trailers cuts aerodynamic drag and reduces the amount of fuel they need, especially at highway speeds. Fairings below the sides of the trailer ensure fewer crosswinds and a smoother airflow under the truck. Both methods reduce air turbulence and reduce drag. With less drag, the truck can maintain a given speed with less energy, which saves fuel and produces less GHGs.

Project Description

Three truck companies took part in the Freight Wing Fleet Trial Program, using two kinds of fairings and trailer-skirts to cut drag on different fleets of trucks.

The three Canadian trucking companies taking part in the testing were:

1. Bison Transport
2. Cascades Transport
3. Robert Transport

Two kinds of fairing were used.

1. **The Freight Wing Belly Fairing** features identical wind deflectors that attach to the bottom of the underside of the trailer, beside the sidewalls. This:
 - Stops wind from hitting the rear wheels
 - Smooths airflow around the sides
 - Traps the draft created by the tractor underneath the trailer.
2. **The Freight Wing "Low Rider" Fairing** is similar, but also features a curved front panel and flexible plastic extension on its lower edge to maximise aerodynamic benefits.

Fifty-seven trucks were fitted with the fairings and tested. The Bison truck-trailers traveled a longer distance than those of the other two companies and probably ran into more windy weather. This factor would impact the results.

Project Goals and Objectives

The National Research Council tested both designs in its wind tunnel before the project, with positive results (published in SAE paper 06CV-222). The project goal was to measure how much fuel the fairings would save over a given distance in real operating conditions.

Three companies, providing 57 trailers, cooperated in this study:

- Robert Transport installed and tested the Low Rider on 51 trucks.
- Bison Transport installed and tested the Belly Fairing on one truck.
- Cascades Transport installed and tested the Belly Fairing on five trucks.

Project Methodology

Robert Transport studied fuel economy using a TMC type IV standardized fuel economy test procedure at the PMG technologies test track. Bison Transport studied the fuel use of two identical tractors with identical weight of cargo, between Calgary and Winnipeg: one trailer with fairings, one without. At one point, operators exchanged trailers so that each truck pulled its partner's trailer. Researchers measured fuel use frequently. Cascades Transport outfitted five similar trailers with fairings. Drivers recorded cargo weight, distance traveled and fuel used. Researchers then compared fuel use with that of other Cascade trucks that had traveled the same route.

Results

Fleets reported savings averaging 6.4% without any problems in running the trucks, or with the fairings. Researchers estimated that burning one litre of fuel produced 2.73 kg of GHGs and used an average cost of one dollar a litre throughout the test period. For the 57 trucks used, each month the fleets saved 7,134 litres, \$7,134 in fuel costs, and cut GHGs by 19,475 kg. For the three months of testing, trucks saved 21,401 litres of fuel, reducing fuel costs by \$21,401 and created 58,426 fewer kg of GHGs. Of the three companies participating in the study, Bison saved the most fuel per trailer, despite reporting the lowest fuel savings percentage (5%), because of the longer distance its trucks traveled. If all trucks traveled this same distance, fuel savings in general could have been even better.

Researchers then projected annual GHG reductions and financial savings for the 57 truck-trailers used. Results showed that these trucks could save 77,768 litres of fuel, \$77,768 in fuel costs and produce 212,307 fewer kg of GHGs a year. And over ten years, the typical life span of a trailer, the project could save 777,683 litres of fuel and produce 2,123,074 fewer kg of GHGs.

Operation and Implementation Costs

Return on investment for the three trucking companies varied because of a broad range of operating

characteristics, such as the average distance traveled by test trailers. The retail cost of the standard Belly Fairing at the time of the project was \$1,825 and the Low Rider fairing was \$2,450. Given retail costs and fuel savings, return on investment was calculated at 1.2 to 2.2 years with a fuel cost of \$1/litre.

Table: Estimated Trailer Life (10 year) Fuel and GHG Savings

	Bison	Cascades	Robert	Totals
Fuel savings per fleet trailer (litre)	15,537	8,245	14,136	N/A
Total project fuel savings (litre)	15,537	41,223	720,923	777,683
GHG savings per fleet trailer	42,415	22,508	38,591	N/A
Total project GHG savings	42,415	112,539	1,968,120	2,123,074

This table shows that over its lifetime, each trailer could save up to 15,537 litres of fuel and produce 42,415 fewer kg of GHG emissions.

Table: Estimated Fleet Savings

	Bison	Cascades	Robert	Totals
Annual fleet fuel savings (litre)	3,573,444	431,193	4,312,815	8,317,452
Annual fleet GHG savings (kg)	9,755,502	1,177,156	11,773,986	22,706,644
Annual fleet \$ savings	\$3,573,444	\$431,193	\$4,312,815	\$8,317,452

In this table, annual savings are multiplied by the number of trailers in each fleet, showing how much fleets could save if all trucks were fitted with fairings. Together, these three fleets could save 8,317,452 litres of fuel, \$8,317,452 of fuel costs and produce 22,700,544 fewer kg of GHGs each year.

Conclusion

When beginning the study, researchers expected less than the actual 6.4% fuel savings. Test results showed savings of up to 339 litres of fuel and 925 fewer kg of GHGs per trailer, per month. During the three-month project, trucks saved approximately 21,401 litres of fuel and produced 48,426 fewer kg of GHG. Given the average price of fuel at \$1 for each litre of fuel, fleets saved \$21,401 of fuel costs.

The data and feedback from fleet partners showed that the fairings worked well and saved fuel costs. The fuel savings generated an estimated return on investment for the test fleets of 1.2 to 2.2 years. That is, if truckers bought fairings at retail prices, the investment paid itself in less than 100,000 miles (161,000 km.). As well, there were no problems with durability or accidental damage of the fairings. Indeed, drivers preferred the improved truck performance with the aerodynamic fairings.

Additional Information

[Freight Wing](#)

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