RESULTS FROM THE TESTING OF THE SOMERFIELD FUEL SAVING CURVE (FSC) TRAILER

ENVIRONMENTALY FRIENDLY ENGINEERING IN ACTION

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EXECUTIVE SUMMARY

The results of the test to determine the effectiveness of the FSC design indicate clearly that it saves fuel. The average indicated savings across the speed range are:

35 MPH	5.1%
40 MPH	4.0%
45 MPH	5.7%
50 MPH	6.0%
55 MPH	6.1%

Whilst conditions and events conspired to reduce the effect of the FSC the improvements in fuel efficiency should be thought of as conservative.

Trailers such as the ones tested tend to operate at high speed on the motorway as part of a trunking operation and therefore savings should be greater than the overall average savings indicated in this document.

People who were stood beside the number 1 track reported that whichever vehicle was connected to the SFC trailer it seemed to sound quieter.

The FSC improves fuel efficiency, reduces environmental impact and may reduce noise pollution.

INTRODUCTION

This document reports upon a test designed to determine the impact upon fuel consumption of improving the shape of a double deck trailer. Specifically, an innovative redesign of the frontal area by David Batty of Somerfield. This new design also reduced weight by 150 kg. The test was conducted on the high-speed track at the MIRA proving ground on February 25th 2004. The drivers and observers were independent of the trailer designers and builders.

AIM OF THE TEST

The aim of the test is to determine the difference in fuel consumption between a standard double deck trailer used by Somerfield and an almost identical trailer where the only difference is the fuel saving curve (FSC) design at the front of the trailer. The difference will be expressed in percentages of miles per gallon (MPG).

TEST METHODOLGY

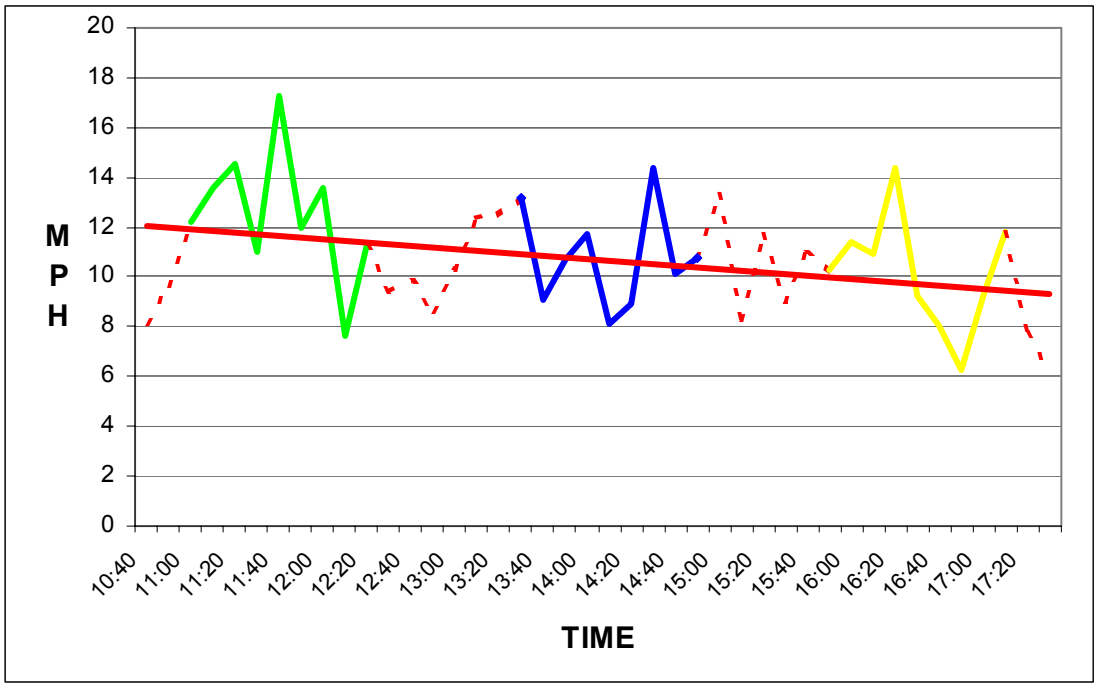
Two Volvo tractor units of identical specification and fitted with on board computers (OBCs) followed a test sequence as described below. The OBCs only show fuel used to one decimal point so the fuel used and resultant calculated savings are sensitive to the rounding of the figures. The data collected from the OBCs' was then analysed to determine if there was a difference between the two trailers and what was the magnitude of the difference. The first vehicle with the registration PO51XHN was designated V1 and the second vehicle PO51XHV was designated V2. The vehicles ran 'back to back' and after the first run swapped trailers. Therefore, the only controllable changeable variable was the trailer. Cruise control was used at all road speeds to reduce any 'order effect' although this should be minimal because both drivers have operated vehicles on the circuit before. The results were analysed to determine the effect the FSC trailer had on each vehicle's fuel consumption. Then the data from each vehicle would be combined under the same conditions to produce a set of overall figures.

OBSERVATIONS

During the first run the vehicle in front V1 appeared to be slowing and because this specific type of test was investigating an aerodynamic effect any problems with road speed would impact upon the results. To prevent this vehicle from causing the second vehicle V2 to baulk it was decided to increase the speeds at which the front vehicle V1 travelled. These also meant the results for vehicle V1 on the first run would be declared void and necessitate an additional run. Ultimately, both vehicles did an extra run.

Wind speed at the test circuit is important when undertaking a test that involves assessing the impact of an aerodynamic intervention. A record of wind speed taken at ten-minute intervals is shown below in Chart 1.

Chart 1 Wind speed during the test at ten minute intervals



The first unbroken line (green) is when the first test run was conducted. The second unbroken line (blue) is when the second test run was conducted and similarly the third unbroken line (yellow) shows the period when the final test was conducted. The unbroken thick red line indicates the overall trend in wind speed during the day. It can also be seen that there was a great deal of volatility within the data. The average wind speed and its standard deviation during the three test runs is shown below in Table 1.

Table 1 Average wind speed and standard deviation

TEST RUN	AVERAGE MPH	ST DEV MPH
1	12.57	2.68
2	10.78	2.06
3	10.17	2.35

Standard deviation is used to indicate the volatility within the data from which the average is derived.

Both of the drivers suggested without prompting that when connected to the trailer with the FSC the engine seemed to be working less. Observers on the track reported that the vehicles when connected to the FSC seemed to be quieter.

RESULTS

The results shown in Table 2 indicate the range of savings generated by V2 during the test under the differing wind conditions. The improvements are shown in both absolute and percentage terms.

Table 2 Results for Vehicle 2

ROAD SPEED	STANDARD		FSC	FSC IMPROVEMENT			
MPH	MPG RUN 1	MPG RUN 2	MPG	MPG RUN 1	% RUN 1	MPG RUN 2	% RUN 1
35	9.08	9.24	9.78	0.70	8%	0.53	6%
40	9.97	9.59	9.97	-	0%	0.38	4%
45	9.24	8.92	9.42	0.17	2%	0.50	6%
50	8.77	8.34	9.08	0.31	4%	0.74	9%
56	7.37	7.94	8.20	0.83	11%	0.26	3%

Whilst a spread of savings ranging from zero to 11% is indicated it must be remembered that the OBCs only produce readings accurate to one decimal point. Combining the first and third runs, which represents data generated by the standard trailer with that of the second run produces the overall savings indicated in Table 3.

Table 3 Vehicle 2 improvements after runs 1 and 2 consolidated

ROAD SPEED MPH	STANDARD MPG	FSC MPG	IMPROVEMENT MPG	IMPROVEMENT %
35	9.16	9.78	0.62	6.7%
40	9.78	9.97	0.19	2.0%
45	9.08	9.42	0.34	3.7%
50	8.55	9.08	0.53	6.3%
56	7.65	8.20	0.55	7.3%

The improvement of 6.7% at 35 MPH seems unusual when compared with the other improvements. Whilst no explanation is offered for this the remaining data follows an expected pattern. It is also noticeable that when testing at the higher speed during run two with the FSC there was greater wind resistance than at the equivalent speeds in runs one and three and this may explain why the results do not mirror the expected pattern.

Table 4 shows difference between the two trailers when connected to vehicle 1. Due to the problems encountered during the first test run and discussed earlier only the data from runs two and three is used in the next piece of analysis with run three being generated when connected to the FSC trailer.

Table 4 Vehicle 1 fuel consumption – runs two and three

ROAD SPEED MPH	STANDARD MPG	FSC MPG	IMPROVEMENT MPG	IMPROVEMENT %
35	9.59	9.78	0.18	1.9%
40	9.78	10.38	0.60	5.8%
45	9.08	9.78	0.70	7.1%
50	8.62	9.08	0.46	5.1%
56	7.70	8.07	0.37	4.5%

The savings whilst impressive do not follow the expected pattern and his may be due to the changes in wind speed and the impact of the rounding of numbers in the OBC.

Having reviewed the data produced by the vehicles independently the final stage is to combine the data from both vehicles under the different conditions. The standard data is generated from runs one and three undertaken by vehicle 2 and run two by vehicle 1. Whilst the FSC data is that generated during run three with vehicle 1 and run two with vehicle two.

Table 5 Combined data from both vehicles under two conditions

ROAD SPEED MPH	STANDARD MPG	FSC MPG	IMPROVEMENT MPG	IMPROVEMENT %
35	9.30	9.78	0.48	5.1%
40	9.78	10.17	0.39	4.0%
45	9.08	9.59	0.51	5.7%
50	8.57	9.08	0.51	6.0%
56	7.67	8.14	0.47	6.1%

The combined data in Table 5 shows with the exception of that produced at 35 MPH an expected continual improvement in MPG. However, savings of the magnitude indicated in this analysis are certainly worthwhile. Modelling an improvement in fuel consumption of 6% as shown in Table 6 for a vehicle travelling 150,000 miles per annum and using a baseline MPG of 8 miles per gallon shows a saving of £3,136 (based upon a price of £0.65 per litre).

Table 6 Potential financial and environmental savings

Miles PA	150,000	150,000
MPG	8.00	8.48
Litres	85,239	80,414
Cost	£ 55,405	£ 52,269
Saving		***£ 3,136***

Additionally, a reduction in production of carbon dioxide of 12.5 tonnes will be achieved.

CONCLUSION

The results clearly show that the trailer with the FSC is more fuel-efficient and will reduce costs and environmental impact. The savings indicated should be considered as conservative because of the wind conditions on the day and the likely operational speed profile of the trailers when they are working in operations. The higher the road speed that the trailers are operated at the greater the savings generated by the FSC.

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