# © Copyright Statement


# AWP CONTRACTORS
# CATERPILLAR 785B &777C HAUL TRUCK
# FUEL EFFICIENCY TRIALS

March, 1996

*Report prepared by:*

Fuel Technology Pty Ltd
72 Adelaide Street
(PO Box 1271)
FREMANTLE WA 6160

Tel (09) 335 6899
Fax (09) 430 5403

ACN 063 561 151

# CONTENTS



## Appendices

*EXECUTIVE SUMMARY*

Fuel Technology Pty Ltd manufacture and supply a combustion catalyst known as FTC, which, when dosed in liquid hydrocarbon fuels, improves combustion to provide measurable efficiency gains.

In conjunction with AWP Contractors, Fuel Technology developed a controlled engineering base test procedure to evaluate the effectiveness of FTC in an actual operating environment.

Using a set of flow measuring transducers and the vehicle fitted load monitor, the absolute mass of fuel consumed against work done was recorded and used to calculate the dump truck operating efficiency in kilograms of fuel consumed per tonnes of ore moved. Tests were conducted on a Caterpillar 785B and 777C dump truck operating from AWP's Keringal and Orient Well contract mine sites respectively.

Performed on a back to back, untreated-treated basis, the tests **resulted in an efficiency gain of 6% in the 785B and 8.4% in the 777C dump trucks**. The results were proved to be significant by student t-Test at a 99% confidence level.

## *INTRODUCTION*

Since incorporation in 1982 Fuel Technology Pty Ltd has been supplying a ferrous iron based organo-metallic combustion catalyst, FTC, to the mining industry to provide improved fuel efficiency and maintenance.

In conjunction with AWP Contractors, Fuel Technology have been engaged in a series of static fuel consumption tests using the AS2077-1982 Carbon Balance test procedure. Initiated at Binduli and then following on to the Fortnum operations, the purpose of the tests were to determine the benefit provide by FTC to improve fuel consumption in the mobile mining fleet.

The static tests demonstrated a fuel consumption improvement in the range of 6% to 8% and a reduction of 15% to 23% in exhaust particulates.

With the acquisition of flow measurement equipment, which could be retro-fitted to the vehicle for the trial, a controlled test was devised (Haul truck Volumetric Fuel Measurement Procedure) which could be used to evaluate FTC in an actual operational environment. The objective of the test was to measure the absolute amount of fuel consumed against work done over a set circuit.

Using the Haul truck Volumetric Fuel Measurement Procedure a series of two trials were conducted on a Caterpillar 785B and 777C dump truck at AWP's Keringal and Orient Well contract mine sites.

This report provides a detailed description of the test procedure and the results of the two trials.

## *TEST PROCEDURE*

The basis of the Haul Truck Volumetric Fuel Measurement test is to measure the absolute amount of fuel consumed against the work done.

A start point at a given distance from base of pit ramp and a finish point at the top of waste dump were marked with sighting posts.

Flow transducers fitted with thermocouple probes were connected to the dump truck's fuel tank outlet and inlet pipework (*Photograph No. 1*).

These transducers, calibrated to $\pm$ 0.25% by a NATA Certified Laboratory, were then coupled to a Minitrol totaliser mounted in the cab (*Photograph No. 2*).

Because the temperature of engine return fuel is considerably higher than inlet fuel together with the fact that the fuel temperature continues to rise during the working cycle resulting in density variations, the fuel temperatures at each flow transducer was measured via a Fluke digital dual readout thermometer also mounted in the cab.

Prior to the test commencing a fuel sample was drawn from the test truck and density measured at observed temperature. Density was then corrected to industry standard of 15°C using the Institute of Petroleum Density Correction Table, Volume VIII, Table 53B.

Following loading of the dump truck for each cycle and allowing the load monitor to register, load in kilograms (kg) was recorded. Upon arrival at pit ramp marker the test truck stopped and the Minitrol totaliser and stop watch were zeroed. At signal "*GO*" the driver accelerated and the test engineer activated the stop watch and Minitrol totaliser.

To avoid any driver variables the test truck was driven at full throttle over the test circuit. The first section of test circuit being the pit haul ramp allowed the test truck to automatically change from first to second gear only. The run from top of pit haul ramp to top of waste dump allowed gear changes through to fourth gear. Fuel temperatures were recorded and upon arrival at the waste dump marker the stop watch and Minitrol unit readings recorded.

Tests were conducted throughout the day on all available runs.

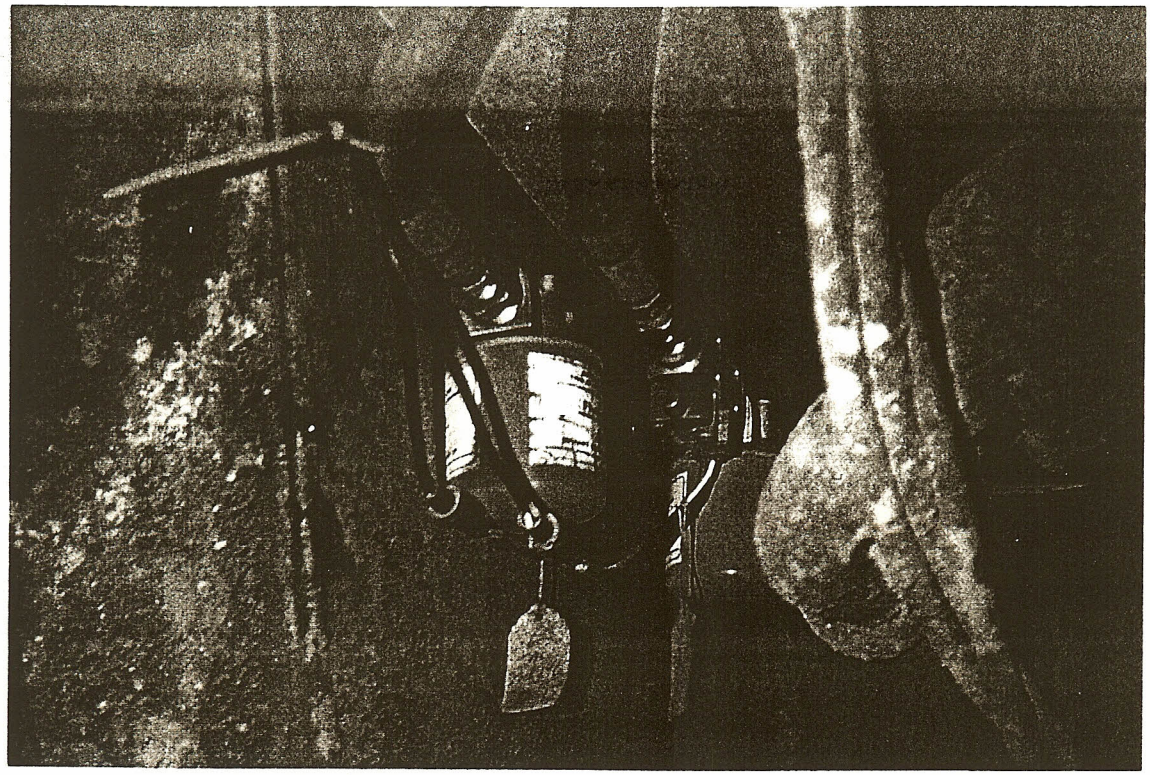


Photo 1. Flowscan transducers fitted adjacent to fuel tank. Measuring flow to and return from engine.

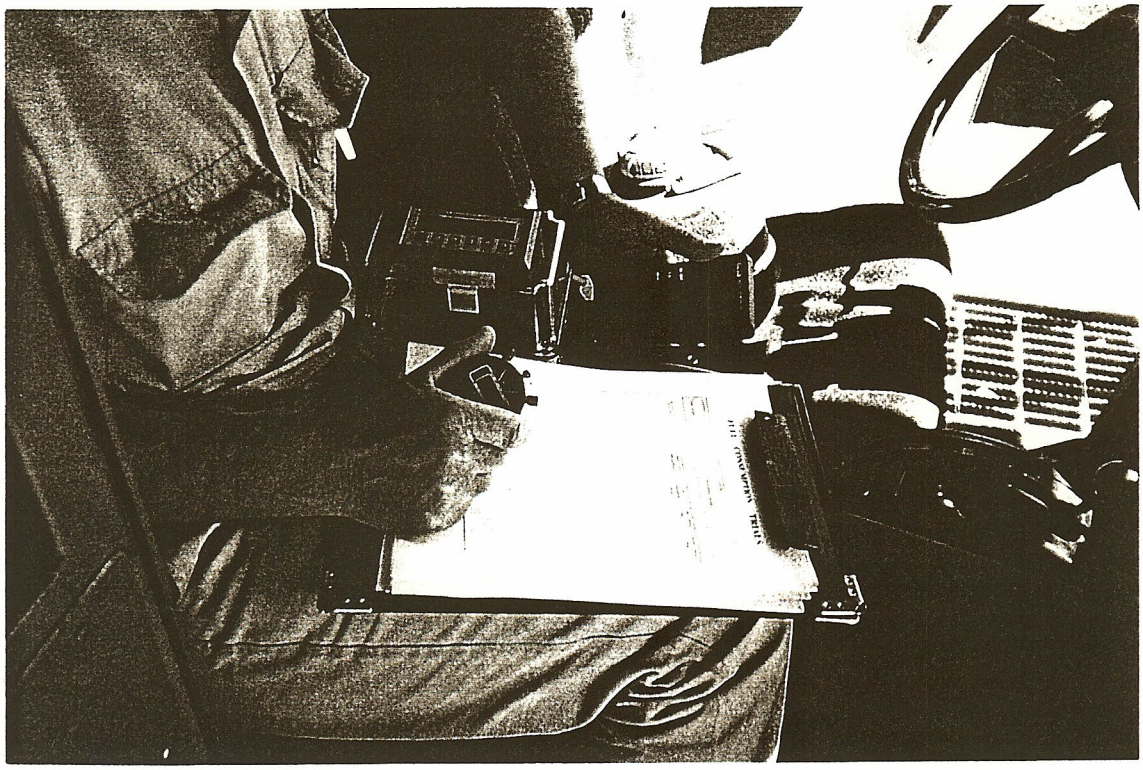


Photo 2. Data recording equipment set up in driver's cab. Minitrol volume recorder, digital thermometer, stop watch and data work sheets.

## *TEST RESULTS*
## *CATERPILLAR 785B DUMP TRUCK: KERINGAL MINE SITE*

FTC-1 treated and untreated fuel consumption has been calculated in kilograms from the litres consumed, corrected for fuel temperatures and density. Kilograms of fuel per tonne of ore moved has then been calculated and the arithmetic mean determined.

**UNTREATED**

| Run No | Time | Load kg | Haul Time | Fuel Litres | | Litres | Fuel Temp | | Density | | Fuel kg | | Fuel kg | Fuel kg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Mins | In | Out | Consumed | In | Out | In | Out | In | Out | Consumed | Per Tonne |
| 1 | 7.10 | 122000 | 3.80 | 57.14 | 46.49 | 10.65 | 47.3 | 58.3 | 0.821 | 0.813 | 46.912 | 37.796 | 9.116 | 0.0747 |
| 2 | 7.25 | 128000 | 3.85 | 58.02 | 47.23 | 10.79 | 47.8 | 58.7 | 0.821 | 0.813 | 47.634 | 38.398 | 9.236 | 0.0722 |
| 3 | 7.35 | 144000 | 4.12 | 63.08 | 51.38 | 11.7 | 48.3 | 60 | 0.820 | 0.812 | 51.726 | 41.721 | 10.005 | 0.0695 |
| 4 | 7.50 | 143000 | 4.10 | 63.11 | 51.40 | 11.71 | 49 | 60.8 | 0.820 | 0.812 | 51.750 | 41.737 | 10.013 | 0.0700 |
| 5 | 8.00 | 132000 | 4.02 | 61.83 | 50.57 | 11.26 | 49.8 | 61.6 | 0.819 | 0.811 | 50.639 | 41.012 | 9.626 | 0.0729 |
| 6 | 8.15 | 121000 | 4.00 | 61.65 | 50.47 | 11.18 | 50.4 | 61.5 | 0.819 | 0.811 | 50.491 | 40.931 | 9.560 | 0.0790 |
| 7 | 8.30 | 138000 | 4.07 | 62.52 | 50.73 | 11.79 | 51 | 62.6 | 0.818 | 0.810 | 51.141 | 41.091 | 10.050 | 0.0728 |
| 8 | 8.45 | 126000 | 3.90 | 60.11 | 48.87 | 11.24 | 51.8 | 62.5 | 0.818 | 0.81 | 49.170 | 39.585 | 9.585 | 0.0761 |
| 9 | 9.10 | 141000 | 4.05 | 62.45 | 50.36 | 12.09 | 52.6 | 61.4 | 0.817 | 0.811 | 51.022 | 40.842 | 10.180 | 0.0722 |
| 10 | 9.25 | 144000 | 4.33 | 66.35 | 53.93 | 12.42 | 53.2 | 63.4 | 0.817 | 0.81 | 54.208 | 43.683 | 10.525 | 0.0731 |
| 11 | 9.40 | 133000 | 4.03 | 62.83 | 51.28 | 11.55 | 53.8 | 64.9 | 0.816 | 0.809 | 51.269 | 41.486 | 9.784 | 0.0736 |
| 12 | 9.55 | 143000 | 4.10 | 62.96 | 51.42 | 11.54 | 54.5 | 65.3 | 0.816 | 0.808 | 51.375 | 41.547 | 9.828 | 0.0687 |
| 13 | 10.10 | 132000 | 4.03 | 62 | 50.65 | 11.35 | 55.3 | 65.3 | 0.815 | 0.808 | 50.530 | 40.925 | 9.605 | 0.0728 |
| 14 | 10.25 | 152000 | 4.30 | 65.61 | 53.18 | 12.43 | 56.1 | 65.7 | 0.815 | 0.807 | 53.472 | 42.916 | 10.556 | 0.0694 |
| 15 | 10.40 | 163000 | 4.50 | 68.87 | 55.28 | 13.59 | 56.8 | 66.7 | 0.814 | 0.807 | 56.060 | 44.611 | 11.449 | 0.0702 |
| 16 | 10.55 | 141000 | 4.03 | 61.99 | 49.75 | 12.24 | 57.5 | 67.5 | 0.813 | 0.807 | 50.398 | 40.148 | 10.250 | 0.0727 |
| 17 | 11.10 | 171000 | 4.60 | 70.26 | 55.56 | 14.7 | 58.2 | 68.2 | 0.813 | 0.806 | 57.121 | 44.781 | 12.340 | 0.0722 |
| 18 | 11.25 | 161000 | 4.40 | 67.24 | 53.13 | 14.11 | 58.8 | 69 | 0.813 | 0.805 | 54.666 | 42.770 | 11.896 | 0.0739 |
| 19 | 11.40 | 143000 | 4.22 | 64.51 | 50.96 | 13.55 | 59.5 | 69.7 | 0.812 | 0.805 | 52.382 | 41.023 | 11.359 | 0.0794 |
| 20 | 11.50 | 127000 | 3.93 | 60.64 | 48.18 | 12.46 | 60.3 | 70.4 | 0.812 | 0.805 | 49.240 | 38.785 | 10.455 | 0.0823 |
| 21 | 12.05 | 138000 | 4.12 | 63.82 | 50.10 | 13.72 | 61 | 70.6 | 0.811 | 0.805 | 51.758 | 40.331 | 11.428 | 0.0828 |
| 22 | 12.20 | 157000 | 4.40 | 67.43 | 52.28 | 15.15 | 61.5 | 70.4 | 0.811 | 0.805 | 54.686 | 42.085 | 12.600 | 0.0803 |
| 23 | 12.35 | 166000 | 4.57 | 69.79 | 53.72 | 16.07 | 62.1 | 70.2 | 0.811 | 0.805 | 56.600 | 43.245 | 13.355 | 0.0805 |
| 24 | 12.50 | 160000 | 4.48 | 68.36 | 52.33 | 16.03 | 62.5 | 71.4 | 0.81 | 0.804 | 55.372 | 42.073 | 13.298 | 0.0831 |
| | | | | | | | | | | | | | | |
| Mean | | 142750 | 4.16 | | | 12.64 | | | | | | | 10.671 | 0.0748 |
| Std Dev | | 14292.75 | 0.2301 | | | 1.6065 | | | | | | | 1.2536 | 0.0045 |
| C.V | | 10.0% | 5.5% | | | 12.7% | | | | | | | 11.7% | 6.1% |

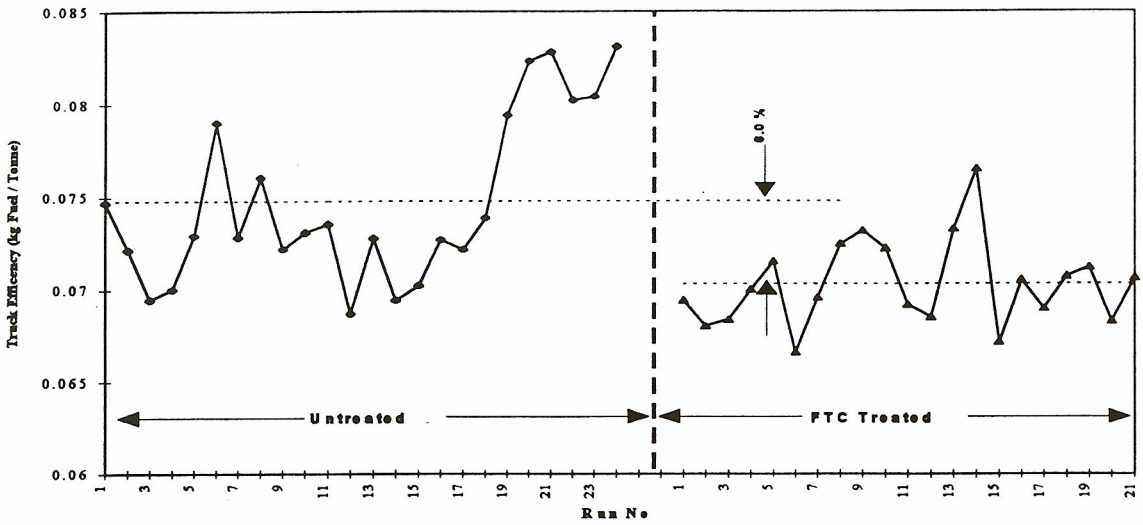
**TREATED**

| Run No | Time | Load kg | Haul Time | Fuel Litres | | Litres | Fuel Temp | | Density | | Fuel kg | | Fuel kg | Fuel kg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Mins | In | Out | Consumed | In | Out | In | Out | In | Out | Consumed | Per Tonne |
| 1 | 07.15 | 132000 | 3.93 | 59.7 | 49.49 | 10.21 | 29.7 | 47.6 | 0.836 | 0.824 | 49.921 | 40.755 | 9.166 | 0.0694 |
| 2 | 08.00 | 150000 | 4.23 | 64.72 | 53.2 | 11.52 | 34.6 | 50.8 | 0.833 | 0.821 | 53.892 | 43.688 | 10.205 | 0.0680 |
| 3 | 08.10 | 132000 | 3.83 | 57.63 | 47.42 | 10.21 | 36 | 52 | 0.832 | 0.820 | 47.931 | 38.903 | 9.028 | 0.0684 |
| 4 | 08.25 | 131000 | 3.82 | 58.2 | 47.79 | 10.41 | 37.2 | 52.5 | 0.831 | 0.820 | 48.358 | 39.188 | 9.171 | 0.0700 |
| 5 | 08.40 | 136000 | 4.00 | 61.14 | 50.00 | 11.14 | 38.4 | 51.9 | 0.830 | 0.820 | 50.746 | 41.020 | 9.726 | 0.0715 |
| 6 | 08.55 | 153000 | 4.15 | 63.19 | 51.52 | 11.67 | 39.5 | 53.3 | 0.829 | 0.819 | 52.403 | 42.215 | 10.188 | 0.0666 |
| 7 | 09.10 | 122000 | 3.52 | 52.18 | 42.43 | 9.75 | 40.5 | 54.2 | 0.829 | 0.819 | 43.231 | 34.742 | 8.489 | 0.0696 |
| 8 | 09.20 | 130000 | 3.88 | 59.44 | 48.64 | 10.8 | 41.3 | 55.1 | 0.828 | 0.818 | 49.216 | 39.797 | 9.419 | 0.0725 |
| 9 | 09.35 | 124000 | 3.78 | 57.21 | 46.78 | 10.43 | 42 | 55.3 | 0.828 | 0.818 | 47.341 | 38.266 | 9.075 | 0.0732 |
| 10 | 09.50 | 129000 | 3.85 | 57.96 | 47.20 | 10.76 | 43 | 55.4 | 0.827 | 0.818 | 47.921 | 38.605 | 9.316 | 0.0722 |
| 11 | 10.05 | 143000 | 4.02 | 61.37 | 49.96 | 11.41 | 43.6 | 56.9 | 0.826 | 0.817 | 50.710 | 40.812 | 9.898 | 0.0692 |
| 12 | 10.15 | 144000 | 4.10 | 62.63 | 51.24 | 11.39 | 44.9 | 57.7 | 0.825 | 0.816 | 51.695 | 41.827 | 9.868 | 0.0685 |
| 13 | 10.35 | 125000 | 3.82 | 58.32 | 47.69 | 10.63 | 45.6 | 57.1 | 0.825 | 0.817 | 48.108 | 38.948 | 9.160 | 0.0733 |
| 14 | 10.45 | 124000 | 3.97 | 60.78 | 49.79 | 10.99 | 46.4 | 58.7 | 0.824 | 0.816 | 50.101 | 40.609 | 9.492 | 0.0766 |
| 15 | 11.00 | 153000 | 4.28 | 65.06 | 53.14 | 11.92 | 47.2 | 59.1 | 0.824 | 0.815 | 53.596 | 43.325 | 10.271 | 0.0671 |
| 16 | 11.15 | 132000 | 3.93 | 60.1 | 49.28 | 10.82 | 48.1 | 59.6 | 0.823 | 0.815 | 49.468 | 40.158 | 9.310 | 0.0705 |
| 17 | 11.25 | 134000 | 3.98 | 60.73 | 50.00 | 10.73 | 48.9 | 60.7 | 0.823 | 0.814 | 49.956 | 40.710 | 9.246 | 0.0690 |
| 18 | 11.55 | 131000 | 3.97 | 60.57 | 49.79 | 10.78 | 50.2 | 61.8 | 0.822 | 0.813 | 49.764 | 40.499 | 9.265 | 0.0707 |
| 19 | 12.30 | 130000 | 3.90 | 59.62 | 48.73 | 10.89 | 52.1 | 61.3 | 0.820 | 0.814 | 48.906 | 39.652 | 9.255 | 0.0712 |
| 20 | 12.40 | 123000 | 3.77 | 55.85 | 46.04 | 9.81 | 52.8 | 63.8 | 0.820 | 0.812 | 45.786 | 37.384 | 8.401 | 0.0683 |
| 21 | 12.55 | 133000 | 3.88 | 59.39 | 48.38 | 11.01 | 53.4 | 64.2 | 0.819 | 0.812 | 48.664 | 39.270 | 9.394 | 0.0706 |
| | | | | | | | | | | | | | | |
| Mean | | 133857 | 3.93 | | | 10.82 | | | | | | | 9.397 | 0.0703 |
| Std Dev | | 9477.794 | 0.1690 | | | 0.5721 | | | | | | | 0.4961 | 0.0024 |
| C.V | | 7.1% | 4.3% | | | 5.3% | | | | | | | 5.3% | 3.4% |

| % CHANGE: Treated-Baseline | Load kg | Haul Time Mins | | Litres Consumed | | Fuel kg Consumed | Fuel kg Per Tonne |
|---|---|---|---|---|---|---|---|
| Baseline | -6.23% | -5.54% | | -14.36% | | -11.93% | -6.0% |

Graph 1 plots the truck's fuel efficiency over each test phase.

*GRAPH 1*

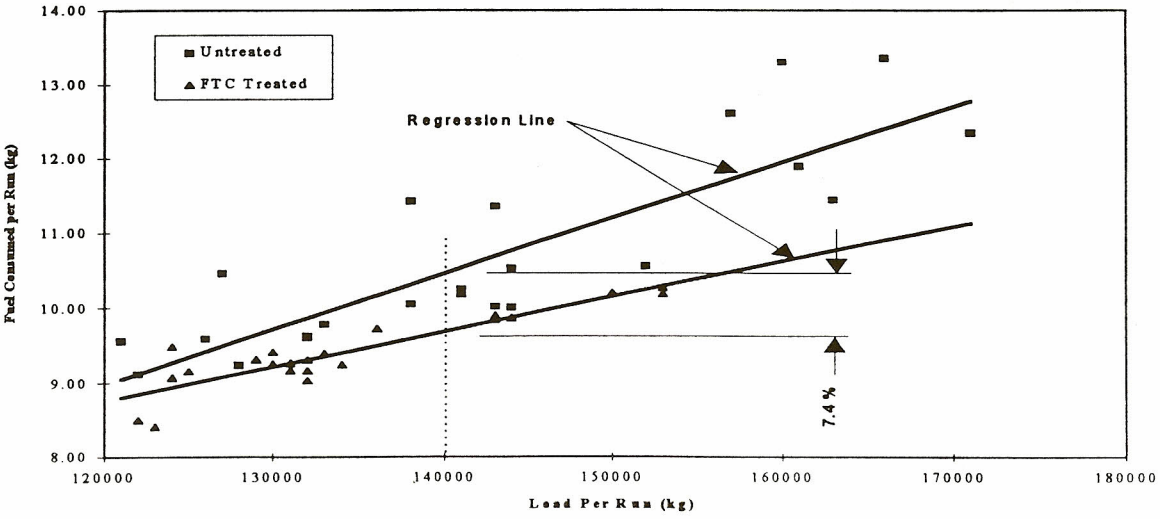



*FUEL EFFICIENCY CHANGE*

| | Kg/Tonne |
|---|---|
| Untreated | 0.0748 |
| FTC-1 Treated | 0.0703 |
| **% CHANGE** | **- 6%** |

A direct comparison of fuel consumption rates at identical payloads can be made using regression analysis as shown in graph 2.

*GRAPH 2*



To prove the statistical significance of the difference in means between baseline and treated test a Students t-test was performed.

*Formula:*

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{(n_1 - 1) S_1^2 + (n_2 - 1) S_2^2}{(n_1 - n_2 - 2)} \left( \frac{1 + 1}{n_1 + n_2} \right)}}$$

*Hypothesis:*

$H_0 : U_1 - U_2 = 0$

$H_1 : U_1 - U_2 \neq 0$

*where:-*

| **Baseline** | **Treated** |
|---|---|
| $\bar{x}_1 = 0.0748$ | $\bar{x}_2 = 0.0703$ |
| $n_1 = 24$ | $n_2 = 21$ |
| $S_1 = 0.004529067$ | $S_2 = 0.002357465$ |

| | | |
|---|---|---|
| Confidence Level | = | 99% |
| $\alpha$ | = | 0.005 |
| degrees of freedom | = | 43 |
| Critical t value | = | 2.58 |
| t | = | 4.09 |

Since 4.09 is outside the range +/- 2.58 we reject $H_0$ and accept $H_1$ and conclude that the difference between truck efficiency means is significant at a 99% confidence level.

T-test spreadsheet is included in the appendices.

## *TEST RESULTS*
## *CATERPILLAR 777C DUMP TRUCK: ORIENT WELL MINE SITE*

FTC-1 treated and untreated fuel consumption has been calculated in kilograms from the litres consumed, corrected for fuel temperatures and density. Kilograms of fuel per tonne of ore moved has then been calculated and the arithmetic mean determined.

TREATED

| Run No | Time | Load Kg | Haul Time | Fuel Litres | | Litres Consumed | Fuel Temperature | | Temperature Corrected Density | | Fuel Kg | | kg Fuel Consumed | kg Fuel / Tonne |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | | Kg | Min / Sec | A | B | | A | B | A | B | A | B | Kg A-B | |
| 1 | 7.20 | 71000 | 1.09 | 15.17 | 13.37 | 1.80 | 27.60 | 49.80 | 0.837 | 0.821 | 12.700 | 10.982 | 1.718 | 0.0242 |
| 2 | 7.30 | 81000 | 1.10 | 15.23 | 13.34 | 1.89 | 27.60 | 50.20 | 0.837 | 0.821 | 12.751 | 10.952 | 1.798 | 0.0222 |
| 3 | 7.45 | 83000 | 1.12 | 15.80 | 13.98 | 1.82 | 26.00 | 50.10 | 0.838 | 0.821 | 13.240 | 11.480 | 1.760 | 0.0212 |
| 4 | 8.00 | 89000 | 1.15 | 16.38 | 14.57 | 1.81 | 25.60 | 50.90 | 0.838 | 0.821 | 13.730 | 11.955 | 1.775 | 0.0199 |
| 5 | 8.10 | 83000 | 1.14 | 16.23 | 14.43 | 1.80 | 27.40 | 51.60 | 0.837 | 0.820 | 13.581 | 11.833 | 1.749 | 0.0211 |
| 6 | 8.20 | 93000 | 1.15 | 16.32 | 14.56 | 1.76 | 26.60 | 51.90 | 0.837 | 0.820 | 13.666 | 11.936 | 1.730 | 0.0186 |
| 7 | 8.35 | 87000 | 1.15 | 16.35 | 14.52 | 1.83 | 28.10 | 52.40 | 0.837 | 0.820 | 13.677 | 11.899 | 1.778 | 0.0204 |
| 8 | 8.45 | 74000 | 1.10 | 15.22 | 13.41 | 1.81 | 32.00 | 53.10 | 0.834 | 0.819 | 12.690 | 10.985 | 1.705 | 0.0230 |
| 9 | 9.05 | 92000 | 1.15 | 16.44 | 14.56 | 1.88 | 27.20 | 53.10 | 0.837 | 0.819 | 13.760 | 11.928 | 1.833 | 0.0199 |
| 10 | 9.15 | 92000 | 1.15 | 16.41 | 14.54 | 1.87 | 27.20 | 53.60 | 0.837 | 0.819 | 13.735 | 11.905 | 1.830 | 0.0199 |
| 11 | 9.30 | 78000 | 1.11 | 15.38 | 13.60 | 1.78 | 31.60 | 54.10 | 0.834 | 0.819 | 12.827 | 11.132 | 1.695 | 0.0217 |
| 12 | 9.40 | 80000 | 1.10 | 15.14 | 13.33 | 1.81 | 31.20 | 54.60 | 0.834 | 0.818 | 12.630 | 10.907 | 1.723 | 0.0215 |
| 13 | 10.00 | 67000 | 1.08 | 14.97 | 13.22 | 1.75 | 35.70 | 55.40 | 0.832 | 0.817 | 12.455 | 10.806 | 1.649 | 0.0246 |
| 14 | 10.10 | 73000 | 1.11 | 15.64 | 13.92 | 1.72 | 36.70 | 55.70 | 0.831 | 0.817 | 12.989 | 11.375 | 1.614 | 0.0221 |
| 15 | 10.25 | 74000 | 1.10 | 15.30 | 13.41 | 1.89 | 31.10 | 55.90 | 0.833 | 0.817 | 12.751 | 10.957 | 1.794 | 0.0242 |
| 16 | 10.35 | 83000 | 1.14 | 16.23 | 14.32 | 1.91 | 35.60 | 56.20 | 0.831 | 0.817 | 13.490 | 11.698 | 1.792 | 0.0216 |
| 17 | 10.45 | 84000 | 1.12 | 15.58 | 13.62 | 1.96 | 34.70 | 56.20 | 0.832 | 0.817 | 12.961 | 11.126 | 1.835 | 0.0218 |
| 18 | 10.55 | 79000 | 1.11 | 15.47 | 13.53 | 1.94 | 32.70 | 56.50 | 0.833 | 0.817 | 12.890 | 11.051 | 1.838 | 0.0233 |
| 19 | 10.05 | 83000 | 1.12 | 15.55 | 13.61 | 1.94 | 38.20 | 57.10 | 0.830 | 0.816 | 12.899 | 11.110 | 1.789 | 0.0216 |
| 20 | 11.30 | 84000 | 1.11 | 15.34 | 13.37 | 1.97 | 33.80 | 57.90 | 0.833 | 0.816 | 12.771 | 10.909 | 1.862 | 0.0222 |
| | | | | | | | | | | | | | | |
| Mean | | 81500 | 1.12 | | | 1.85 | | | | | | | 1.763 | 0.0218 |
| Std Dev | | 7207.452 | 0.0227 | | | 0.0731 | | | | | | | 0.0658 | 0.00158 |
| C.V. | | 8.8% | 2.0% | | | 4.0% | | | | | | | 3.7% | 7.2% |

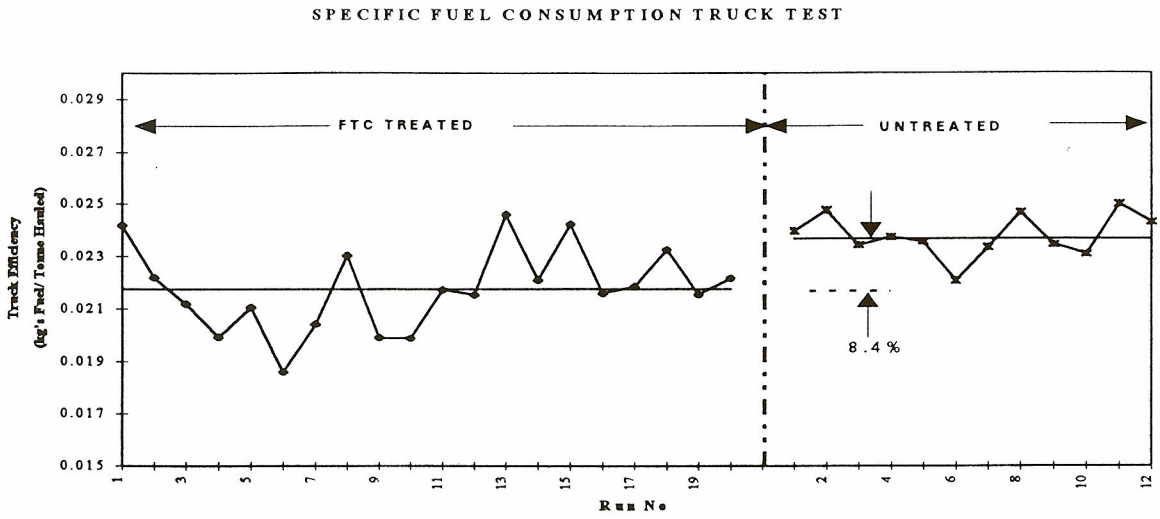
UNTREATED

| Run No | Time | Load Kg | Haul Time | Fuel Litres | | Litres Consumed | Fuel Temperature | | Temperature Corrected Density | | Fuel Kg | | Fuel Consumed | kg Fuel / Tonne |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | | Kg | Min / Sec | A | B | | A | B | A | B | A | B | Kg A-B | |
| 1 | 3.00 | 92000 | 1.13 | 16.88 | 14.37 | 2.51 | 36.6 | 50.3 | 0.822 | 0.812 | 13.88 | 11.67 | 2.207 | 0.0240 |
| 2 | 3.10 | 85000 | 1.12 | 16.84 | 14.41 | 2.43 | 40.1 | 51.4 | 0.819 | 0.811 | 13.79 | 11.69 | 2.105 | 0.0248 |
| 3 | 3.20 | 91000 | 1.14 | 16.95 | 14.58 | 2.37 | 33.8 | 51.3 | 0.824 | 0.811 | 13.96 | 11.82 | 2.134 | 0.0234 |
| 4 | 3.30 | 84000 | 1.12 | 16.34 | 14.04 | 2.30 | 39.9 | 51.1 | 0.819 | 0.811 | 13.38 | 11.39 | 1.996 | 0.0238 |
| 5 | 3.40 | 91000 | 1.12 | 16.87 | 14.41 | 2.46 | 38.2 | 51.4 | 0.820 | 0.811 | 13.83 | 11.69 | 2.147 | 0.0236 |
| 6 | 3.50 | 94000 | 1.12 | 16.93 | 14.62 | 2.31 | 34.3 | 51.5 | 0.823 | 0.811 | 13.93 | 11.86 | 2.077 | 0.0221 |
| 7 | 4.00 | 94000 | 1.12 | 16.93 | 14.44 | 2.49 | 36.6 | 52.1 | 0.822 | 0.811 | 13.91 | 11.71 | 2.197 | 0.0234 |
| 8 | 4.10 | 82000 | 1.11 | 16.38 | 14.11 | 2.27 | 36.0 | 52.3 | 0.822 | 0.811 | 13.46 | 11.44 | 2.025 | 0.0247 |
| 9 | 4.20 | 90000 | 1.11 | 16.79 | 14.38 | 2.41 | 38.5 | 52.5 | 0.820 | 0.811 | 13.77 | 11.65 | 2.113 | 0.0235 |
| 10 | 4.30 | 94000 | 1.12 | 16.94 | 14.49 | 2.45 | 36.5 | 52.6 | 0.822 | 0.811 | 13.92 | 11.74 | 2.172 | 0.0231 |
| 11 | 4.45 | 92000 | 1.12 | 16.90 | 14.33 | 2.57 | 35.0 | 52.9 | 0.823 | 0.810 | 13.90 | 11.61 | 2.296 | 0.0250 |
| 12 | 4.55 | 84000 | 1.11 | 16.41 | 14.09 | 2.32 | 38.6 | 53.1 | 0.820 | 0.810 | 13.46 | 11.41 | 2.043 | 0.0243 |
| | | | | | | | | | | | | | | |
| Mean | | 89417 | 1.12 | 16.76 | 14.36 | 2.41 | | | | | | | 2.126 | 0.0238 |
| Std Dev | | 4420.167 | 0.0085 | 0.2380 | 0.1867 | 0.0943 | | | | | | | 0.0853 | 0.00082 |
| C.V. | | 4.9% | 0.8% | | | 3.9% | | | | | | | 4.0% | 3.4% |

| % Change: Treated-Baseline | Load Kg | | Litres Consumed | | Fuel Consumed | kg Fuel Per Tonne |
|---|---|---|---|---|---|---|
| Baseline | 8.85% | | 23.28% | | 17.06% | 8.4% |

Graph 1 plots the truck's fuel efficiency over each test phase.

*GRAPH 1*

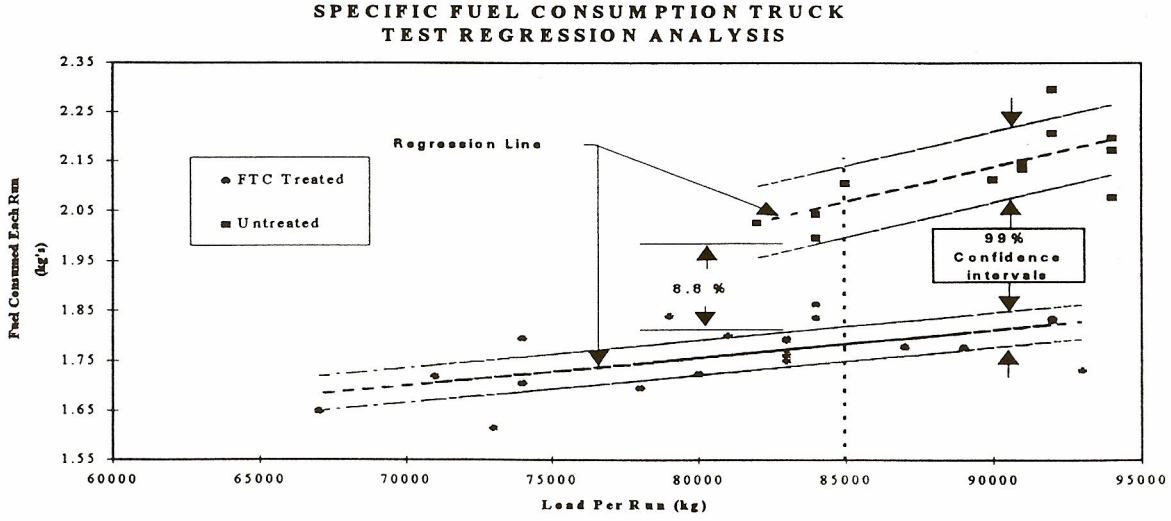



*FUEL EFFICIENCY CHANGE*

| | Kg/Tonne |
|---|---|
| Untreated | 0.0238 |
| FTC-1 Treated | 0.0218 |
| **% CHANGE** | **- 8.4** |

A direct comparison of fuel consumption rates at identical payloads can be made using regression analysis as shown in graph 2.

*GRAPH 2*



To prove the statistical significance of the difference in means between baseline and treated test a Students t-test was performed.

*Formula:*

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{(n_1 - 1)S_1^2 + (n_2 - 1)S_2^2}{(n_1 - n_2 - 2)} \left( \frac{1 + 1}{n_1 + n_2} \right)}}$$

*Hypothesis:*

$H_0: U_1 - U_2 = 0$

$H_1: U_1 - U_2 <> 0$

*where:-*

| **Baseline** | **Treated** |
|---|---|
| $\bar{x}_1 = 0.0238$ | $\bar{x}_2 = 0.0218$ |
| $n_1 = 12$ | $n_2 = 20$ |
| $S_1 = 0.000812024$ | $S_2 = 0.001580347$ |

| | | |
|---|---|---|
| Confidence Level | = | 99% |
| $\alpha$ | = | 0.005 |
| degrees of freedom | = | 30 |
| Critical t value | = | 2.75 |
| t | = | -4.06 |

Since -4.06 is outside the range +/- 2.75 we reject $H_0$ and accept $H_1$ and conclude that the difference between truck efficiency means is significant at a 99% confidence level.

T-test spreadsheet is included in the appendices.

*CONCLUSION*

Fuel efficiency studies at AWP Contractor's Keringal and Orient Well mine sites have provided clear evidence of reduced fuel consumption following the introduction of Fuel Technology's Combustion Catalyst, FTC.

The measured average reduction in kilograms of fuel per tonne of ore moved represents an efficiency gain in the order of **6% in the Cat 785B and 8.4% in the Cat 777C**.

The Student t-Test applied confirms that the difference between untreated and treated tests are significant at a 99% confidence level.

Appendix "*A*"

*"T" TEST SPREADHSEET*

t test: Two Sample Assuming Equal Population Variances

| | | | | |
|---|---|---|---|---|
| Company | | AWP Contractors | | |
| Site | | Keringal Mine Site | | |
| Test: | | Untreated | | |
| Record | | kg Load | kg Fuel | kg Fuel/Tonne Load |
| | 1 | 122000 | 9.1156 | 0.0747 |
| | 2 | 128000 | 9.2364 | 0.0722 |
| | 3 | 144000 | 10.0050 | 0.0695 |
| | 4 | 143000 | 10.0134 | 0.0700 |
| | 5 | 132000 | 9.6265 | 0.0729 |
| | 6 | 121000 | 9.5602 | 0.0790 |
| | 7 | 138000 | 10.0501 | 0.0728 |
| | 8 | 126000 | 9.5853 | 0.0761 |
| | 9 | 141000 | 10.1797 | 0.0722 |
| | 10 | 144000 | 10.5247 | 0.0731 |
| | 11 | 133000 | 9.7838 | 0.0736 |
| | 12 | 143000 | 9.8280 | 0.0687 |
| | 13 | 132000 | 9.6048 | 0.0728 |
| | 14 | 152000 | 10.5559 | 0.0694 |
| | 15 | 163000 | 11.4492 | 0.0702 |
| | 16 | 141000 | 10.2496 | 0.0727 |
| | 17 | 171000 | 12.3400 | 0.0722 |
| | 18 | 161000 | 11.8965 | 0.0739 |
| | 19 | 143000 | 11.3593 | 0.0794 |
| | 20 | 127000 | 10.4548 | 0.0823 |
| | 21 | 138000 | 11.4275 | 0.0828 |
| | 22 | 157000 | 12.6003 | 0.0803 |
| | 23 | 166000 | 13.3551 | 0.0805 |
| | 24 | 160000 | 13.2983 | 0.0831 |
| Mean | | 142750 | 10.67 | 0.0748 |
| Std Dev | | 14292.74672 | 1.253619681 | 0.004529067 |
| Observations | | | | 24 |

| | | | | |
|---|---|---|---|---|
| Test: | | FTC Treated | | |
| Record | | kg Load | kg Fuel | kg Fuel/Tonne Load |
| | 1 | 132000 | 9.1661 | 0.0694 |
| | 2 | 150000 | 10.2045 | 0.0680 |
| | 3 | 132000 | 9.0275 | 0.0684 |
| | 4 | 131000 | 9.1706 | 0.0700 |
| | 5 | 136000 | 9.7262 | 0.0715 |
| | 6 | 153000 | 10.1880 | 0.0666 |
| | 7 | 122000 | 8.4894 | 0.0696 |
| | 8 | 130000 | 9.4191 | 0.0725 |
| | 9 | 124000 | 9.0752 | 0.0732 |
| | 10 | 129000 | 9.3164 | 0.0722 |
| | 11 | 143000 | 9.8977 | 0.0692 |
| | 12 | 144000 | 9.8676 | 0.0685 |
| | 13 | 125000 | 9.1597 | 0.0733 |
| | 14 | 124000 | 9.4922 | 0.0766 |
| | 15 | 153000 | 10.2714 | 0.0671 |
| | 16 | 132000 | 9.3100 | 0.0705 |
| | 17 | 134000 | 9.2465 | 0.0690 |
| | 18 | 131000 | 9.2651 | 0.0707 |
| | 19 | 130000 | 9.2547 | 0.0712 |
| | 20 | 123000 | 8.4013 | 0.0683 |
| | 21 | 133000 | 9.3941 | 0.0706 |
| Mean | | 133857 | 9.40 | 0.0703 |
| Std Dev | | 9477.793595 | 0.496114803 | 0.002357465 |
| Observations | | | | 21 |

| | kg of Fuel/Tonne |
|---|---|
| Mean % change | -6.0% |
| Confidence Interval | 99% |
| Alpha | 0.005 |
| Degrees Of Freedom | 43 |
| t Critical Value | 2.58 |
| Hypothesis | $H_0$: $u_1 - u_2 = 0$ |
| | $H_1$: $u_1 - u_2 <> 0$ |
| t= | 4.09 |

Conclusion:

Since t= 4.09, is outside the range +/- 2.58 we reject $H_0$ and accept $H_1$ and conclude that the difference between FTC treated and untreated test means are significant at a 99 % confidence level.

t test: Two Sample Assuming Equal Population Variances

| | | | |
|---|---|---|---|
| Company | AWP Contractors | | |
| Site | Orient Well Mine Site | | |
| Test: | FTC Treated | | |
| Record | kg Load | kg Fuel | kg Fuel/Tonne Load |
| 1 | 71000 | 1.7182 | 0.0242 |
| 2 | 81000 | 1.7984 | 0.0222 |
| 3 | 83000 | 1.7600 | 0.0212 |
| 4 | 89000 | 1.7750 | 0.0199 |
| 5 | 83000 | 1.7487 | 0.0211 |
| 6 | 93000 | 1.7301 | 0.0186 |
| 7 | 87000 | 1.7776 | 0.0204 |
| 8 | 74000 | 1.7050 | 0.0230 |
| 9 | 92000 | 1.8327 | 0.0199 |
| 10 | 92000 | 1.8298 | 0.0199 |
| 11 | 78000 | 1.6953 | 0.0217 |
| 12 | 80000 | 1.7232 | 0.0215 |
| 13 | 67000 | 1.6490 | 0.0246 |
| 14 | 73000 | 1.6136 | 0.0221 |
| 15 | 74000 | 1.7937 | 0.0242 |
| 16 | 83000 | 1.7924 | 0.0216 |
| 17 | 84000 | 1.8348 | 0.0218 |
| 18 | 79000 | 1.8383 | 0.0233 |
| 19 | 83000 | 1.7889 | 0.0216 |
| 20 | 84000 | 1.8620 | 0.0222 |
| Mean | 81500 | 1.76 | 0.0218 |
| Std Dev | 7207.452284 | 0.065770695 | 0.001580347 |
| Observations | | | 20 |

| | | | |
|---|---|---|---|
| Test: | Untreated | | |
| Record | kg Load | kg Fuel | kg Fuel/Tonne Load |
| 1 | 92000 | 2.2069 | 0.0240 |
| 2 | 85000 | 2.1055 | 0.0248 |
| 3 | 91000 | 2.1339 | 0.0234 |
| 4 | 84000 | 1.9960 | 0.0238 |
| 5 | 91000 | 2.1469 | 0.0236 |
| 6 | 94000 | 2.0766 | 0.0221 |
| 7 | 94000 | 2.1972 | 0.0234 |
| 8 | 82000 | 2.0254 | 0.0247 |
| 9 | 90000 | 2.1128 | 0.0235 |
| 10 | 94000 | 2.1721 | 0.0231 |
| 11 | 92000 | 2.2960 | 0.0250 |
| 12 | 84000 | 2.0433 | 0.0243 |
| Mean | 89909 | 2.13 | 0.0238 |
| Std Dev | 4276.787239 | 0.085182949 | 0.000812024 |
| Observations | | | 12 |

| | kg of Fuel/Tonne |
|---|---|
| Mean % change | 8.4% |
| Confidence Interval | 99% |
| Alpha | 0.005 |
| Degrees Of Freedom | 30 |
| t Critical Value | 2.75 |
| Hypothesis | $H_0$: $u_1 - u_2 = 0$ |
| | $H_1$: $u_1 - u_2 <> 0$ |
| t = | -4.06 |

Conclusion:

Since t= -4.06, is outside the range +/- 2.75 we reject $H_0$ and accept $H_1$ and conclude that the difference between FTC treated and untreated test means are significant at a 99 % confidence level.

Appendix "*B*"

*TEST WORKSHEETS*

4 GEAR ONLY SOMETIMES.

6TH GEAR SELECTED FROM START

# FUEL CONSUMPTION TRIALS

| | | | |
|---|---|---|---|
| Customer | A.W.P. CONTRACTORS | Equipment Make/Model | CAT 785 STEEL TRAY |
| Location | KERINGAL | Unit No. | DT 91 |
| Engine Hours | 3030 | Fuel Density | ·826 @ 39·5 °C |
| Baseline/~~Treated~~ | 11 - 1 - 96 | Fuel Density corrected @ 15°C | ·843 |
| Circuit Distance | 684 m | Ambient Temp | Start 25°C Finish 39·1°C |

| Run No | Time | Load Kg | Haul Time Min/Sec | Fuel Litres | | Fuel L Cons | Fuel Temp °C | | Density | | Fuel Kg | | Fuel Cons Kg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | IN | OUT | | IN | OUT | IN | OUT | IN | OUT | (IN - OUT) |
| 1 | 7 10 | 122 | 3 48 | 57·14 | 46 49 | 10·65 | 47·3 | 58·3 | ·821 | ·813 | | | |
| 2 | 7·25 | 128 | 3·51 | 58·02 | 47·23 | 10·79 | 47·8 | 58·7 | ·821 | ·813 | | | |
| 3 | 7·35 | 144 | 4·07 | 6308 | 51·38 | 11 70 | 48·3 | 60 | ·820 | ·812 | | | |
| 4 | 7·50 | 143 | 4·06 | 63·11 | 51·40 | 11·71 | 49 | 60·8 | ·820 | ·812 | | | |
| 5 | 8·00 | 132 | 4·01 | 61·83 | 50·57 | 11·26 | 49·8 | 61·6 | ·819 | ·811 | | | |
| 6 | 8·15 | 121 | 4·00 | 61·65 | 50·47 | 11 18 | 50·4 | 61·5 | ·819 | ·811 | | | |
| 7 | 8·30 | 138 | 4·04 | 62·52 | 50 73 | 11·79 | 51 | 62·6 | ·818 | ·810 | | | |
| 8 | 8·45 | 126 | 3·54 | 60·11 | 48·87 | 11 24 | 51 8 | 62·5 | ·818 | ·810 | | | |
| 9 | 9·10 | 141 | 4·03 | 62·45 | 50·36 | 12·09 | 52·6 | 61 4 | ·817 | ·811 | | | |
| 10 | 9·25 | 144 | 4·20 | 66·35 | 53·93 | 12·42 | 53·2 | 63·4 | ·817 | ·810 | | | |
| 11 | 9·40 | 133 | 4·02 | 62·83 | 51·28 | 11 55 | 53·8 | 64·9 | ·816 | ·809 | | | |
| 12 | 9·55 | 143 | 4·06 | 62 96 | 51·42 | 11·54 | 54·5 | 65·3 | ·816 | ·808 | | | |
| 13 | 10·10 | 132 | 4·02 | 62·00 | 50·65 | 11 35 | 55 3 | 65 5 | ·815 | ·808 | | | |
| 14 | 10·25 | 152 | 4·18 | 65·61 | 53 18 | 12·43 | 56·1 | 65 7 | ·815 | ·807 | | | |
| 15 | 10 40 | 163 | 4·30 | 68·87 | 55·28 | 13·59 | 56·8 | 66·7 | ·814 | ·807 | | | |

* FOLLOWED WATER TRUCK. WHEELS SPINNING.

# FUEL CONSUMPTION TRIALS

| | | | |
|---|---|---|---|
| Customer | A.W.? | Equipment Make/Model | CAT 785 |
| Location | KERINGAL | Unit No. | DT 91 |
| Engine Hours | | Fuel Density | @ °C |
| Baseline/~~Treated~~ | 11 - 1 - 96 | Fuel Density corrected @ 15°C | |
| Circuit Distance | | Ambient Temp | Start_____ Finish _____ |

| Run No | Time | Load Kg | Haul Time Min/Sec | Fuel Litres | | Fuel L Cons | Fuel Temp °C | | Density | | Fuel Kg | | Fuel Cons Kg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | IN | OUT | | IN | OUT | IN | OUT | IN | OUT | (IN - OUT) |
| 16 | 10.55 | 141 | 4.02 | 61.99 | 49.75 | 12.24 | 57.5 | 67.5 | .813 | .807 | | | |
| 17 | 11.10 | 171 | 4.36 | 70.26 | 55.56 | 14.70 | 58.2 | 68.2 | .813 | .806 | | | |
| 18 | 11.25 | 161 | 4.24 | 67.24 | 53.13 | 14.11 | 58.8 | 69 | .813 | .805 | | | |
| 19 | 11.40 | 143 | 4.13 | 64.51 | 50.96 | 13.55 | 59.5 | 69.7 | .812 | .805 | | | |
| 20 | 11.50 | 127 | 3.56 | 60.64 | 48.18 | 12.46 | 60.3 | 70.4 | .812 | .805 | | | |
| 21 | 12.05 | 138 | 4.07 | 63.82 | 50.10 | 13.72 | 61 | 70.6 | .811 | .805 | | | |
| 22 | 12.20 | 157 | 4.24 | 67.43 | 52.28 | 15.15 | 61.5 | 70.4 | .811 | .805 | | | |
| 23 | 12.35 | 166 | 4.34 | 69.79 | 53.72 | 16.07 | 62.1 | 70.2 | .811 | .805 | | | |
| 24 | 12.50 | 160 | 4.29 | 68.36 | 52.33 | 16.03 | 62.5 | 71.4 | .810 | .804 | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |

# FUEL CONSUMPTION TRIALS

| | | | |
|---|---|---|---|
| Customer | A.W.P. | Equipment Make/Model | |
| Location | KERINGAL | Unit No. | DT 91 |
| Engine Hours | 3254 | Fuel Density | ·820 @ 52·5 °C |
| ~~Baseline~~/Treated | 24-1-96 | Fuel Density corrected @ 15°C | ·846 |
| Circuit Distance | | Ambient Temp | Start 17·2 Finish 32·2 |

| Run No | Time | Load Kg | Haul Time Min/Sec | Fuel Litres | | Fuel L Cons | Fuel Temp °C | | Density | | Fuel Kg | | Fuel Cons Kg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | IN | OUT | | IN | OUT | IN | OUT | IN | OUT | (IN - OUT) |
| 1 | 7·15 | 132 | 3·56 | 59·70 | 49·49 | 10·21 | 29·7 | 47·6 | | | | | |
| 2 | 8·00 | 150 | 4·14 | 64·72 | 53·20 | 11·52 | 34·7 | 50·8 | | | | | |
| 3 | 8·10 | 132 | 3·50 | 57·63 | 47·42 | 10·21 | 36 | 52 | | | | | |
| 4 | 8·25 | 131 | 3·49 | 58·20 | 47 79 | 10·41 | 37·2 | 52·5 | | | | | |
| 5 | 8·40 | 136 | 4·00 | 61·14 | 50·53 | 11·14 | 38·4 | 51·9 | | | | | |
| 6 | 8·55 | 153 | 4·09 | 63·19 | 51·52 | 11·67 | 39·5 | 53 3 | | | | | |
| 7 | 9·10 | 122 | 3·31 | 52·18 | 42·43 | 9·75 | 40·5 | 54 2 | | | | | |
| * 8 | 9·20 | 130 | 3·53 | 59·44 | 48·64 | 10·8 | 41·3 | 55·1 | | | | | |
| 9 | 9·35 | 124 | 3·47 | 57·21 | 46·78 | 10·43 | 42 | 55·3 | | | | | |
| 10 | 9·50 | 129 | 3·51 | 57·96 | 47·20 | 10·76 | 43 | 55·4 | | | | | |
| 11 | 10·05 | 143 | 4·01 | 61·37 | 49 96 | 11·41 | 43·6 | 56·9 | | | | | |
| 12 | 10·15 | 144 | 4·06 | 62·63 | 51·24 | 11·39 | 44·9 | 57·7 | | | | | |
| 13 | 10·35 | 125 | 3·49 | 58·32 | 47·69 | 10·63 | 45·6 | 57·1 | | | | | |
| 14 | 10·45 | 124 | 3 58 | 60·78 | 49·79 | 10 ·99 | 46·4 | 58·7 | | | | | |
| * 15 | 11 00 | 153 | 4 17 | 65·06 | 53·14 | 11·92 | 47·2 | 59·1 | | | | | |

1 * LOADED ON A SLOPE

# FUEL CONSUMPTION TRIALS

Customer A.W.?
Location KERINGAL
Engine Hours
~~Baseline~~/Treated 24-1-96
Circuit Distance

Equipment Make/Model
Unit No. DT 91
Fuel Density @ °C
Fuel Density corrected @ 15°C
Ambient Temp Start_____ Finish _____

| Run No | Time | Load Kg | Haul Time Min/Sec | Fuel Litres | | Fuel L Cons | Fuel Temp °C | | Density | | Fuel Kg | | Fuel Cons Kg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | IN | OUT | | IN | OUT | IN | OUT | IN | OUT | (IN - OUT) |
| 16 | 11:15 | 132 | 3·56 | 60·10 | 49·28 | 10·82 | 48·1 | 59·6 | | | | | |
| 17 | 11·25 | 134 | 3·59 | 60·73 | 50·00 | 10·73 | 48·9 | 60·7 | | | | | |
| 8 | 11 55 | 131 | 3·58 | 60·57 | 49·79 | 10·78 | 50·2 | 61·8 | | | | | |
| 19 | 12·30 | 130 | 3·54 | 59·62 | 48·73 | 10·91 | 52·1 | 61·3 | | | | | |
| 20 | 12·46 | 123 | 3·46 | 55·85 | 46·04 | 9·81 | 52·8 | 63·8 | | | | | |
| 21 | 12·55 | 133 | 3·53 | 59·39 | 48·38 | 11·01 | 53·4 | 64·2 | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |

# FUEL CONSUMPTION TRIALS

| | |
|---|---|
| **Customer** AWP CONTRACTORS | **Equipment Make/Model** DUMP TRUCK 777C |
| **Location** ORIENT WELL | **Unit No.** DT 78 |
| **Engine Hours** 02015 | **Fuel Density @ 15 C** 0.8455 |
| **Test Date** 1-6-93 | ~~**Baseline**~~/Treated |

**Ambient Temp Start** ..... **Finish** .....

| Run No. | Load Kg | Time | Haul Time Min/Sec | Fuel Litres | | Fuel Temp °C | | Density | | Fuel Kg | | Fuel Cons Kg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | A | B | A | B | A | B | A | B | (A - B) |
| 1 B | 86000 | 7.20 | 1.09 | 15.17 | 13.37 | 23.6 | 49.8 | 0.8371 | 0.8214 | | | |
| 2 B | 81000 | 7.30 | 1.10 | 15.23 | 13.34 | 27.6 | 50.2 | 0.8372 | 0.821 | | | |
| 3 B | 83000 | 7.45 | 1.12 | 15.80 | 13.98 | 26 | 50.1 | 0.838 | 0.8212 | | | |
| 4 B | 89000 | 8.00 | 1.15 | 16.38 | 14.57 | 25.6 | 50.9 | 0.8382 | 0.8205 | | | |
| 5 B | 83000 | 8.10 | 1.14 | 16.23 | 14.43 | 27.4 | 51.6 | 0.8368 | 0.820 | | | |
| 6 B | 93000 | 8.20 | 1.15 | 16.32 | 14.56 | 26.6 | 51.9 | 0.8374 | 0.8198 | | | |
| 7 B | 87000 | 8.35 | 1.15 | 16.35 | 14.52 | 28.1 | 52.4 | 0.8365 | 0.8195 | | | |
| 8 B | 74000 | 8.45 | 1.10 | 15.22 | 13.41 | 32 | 53.1 | 0.8338 | 0.8192 | | | |
| 9 B | 93000 | 9.05 | 1.15 | 16.44 | 14.56 | 27.2 | 53.1 | 0.837 | 0.8192 | | | |
| 10 B | 92000 | 9.15 | 1.15 | 16.41 | 14.54 | 27.2 | 53.6 | 0.837 | 0.8188 | | | |
| 11 B | 79000 | 9.30 | 1.11 | 15.38 | 13.60 | 31.6 | 54.1 | 0.834 | 0.8185 | | | |
| 12 B | 80000 | 9.40 | 1.10 | 15.14 | 13.33 | 31.2 | 54.6 | 0.8342 | 0.8182 | | | |
| 13 B | 67000 | 10.00 | 1.08 | 14.97 | 13.22 | 35.7 | 55.4 | 0.832 | 0.8174 | | | |
| 14 B | 73000 | 10.10 | 1.11 | 15.64 | 13.92 | 36.7 | 55.7 | 0.8305 | 0.8172 | | | |
| 15 B | 74000 | 10.25 | 1.10 | 15.30 | 13.41 | 31.1 | 55.9 | 0.8334 | 0.8171 | | | |
| 16 B | 83000 | 10.35 | 1.14 | 16.23 | 14.32 | 35.6 | 56.2 | 0.8312 | 0.8169 | | | |
| 17 B | 84000 | 10.45 | 1.12 | 15.58 | 13.62 | 34.7 | 56.2 | 0.8319 | 0.8169 | | | |
| 18 B | 79000 | 10.55 | 1.11 | 15.47 | 13.53 | 32.7 | 56.5 | 0.8332 | 0.8168 | | | |
| 19 B | 83000 | 10.05 | 1.12 | 15.55 | 13.61 | 38.2 | 57.1 | 0.8295 | 0.8163 | | | |
| 20 B | 84000 | 11.30 | 1.11 | 15.34 | 13.37 | 33.8 | 57.9 | 0.8325 | 0.8150 | | | |
| | | | | | | | | | | | | |

Data Recorded by ..... Checked by .....

# FUEL CONSUMPTION TRIALS

| | |
|---|---|
| **Customer** A.W.P. CONTRACTORS | **Equipment Make/Model** Dump Truck 777 C |
| **Location** ORIENT WELL | **Unit No.** DT 78 |
| **Engine Hours** 02984 | **Fuel Density @ 15 C** 0.8365 |
| **Test Date** 25-7-95 | **Baseline/~~Treated~~** 2 |

**Ambient Temp Start** ..... **Finish** .....

| Run No. | Load Kg | Time | Haul Time Min/Sec | Fuel Litres | | Fuel Temp °C | | Density | | Fuel Kg | | Fuel Cons Kg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | A | B | A | B | A | B | A | B | (A - B) |
| 1 | 92000 | 3:00 pm | 1:13 | 16.88 | 14.37 | 36.6 | 50.3 | 0.822 | 0.812 | | | |
| 2 | 85000 | 3:10 | 1:12 | 16.84 | 14.41 | 40.1 | 51.4 | 0.820 | 0.811 | | | |
| 3 | 91000 | 3:20 | 1:14 | 16.85 | 14.58 | 33.8 | 51.3 | 0.823 | 0.811 | | | |
| 4 | 84000 | 3:30 | 1:12 | 16.34 | 14.04 | 39.9 | 51.1 | 0.819 | 0.811 | | | |
| 5 | 91000 | 3:40 | 1:12 | 16.87 | 14.41 | 38.2 | [illegible] | 0.820 | 0.811 | | | |
| 6 | 94000 | 3:50 | 1:12 | 16.93 | 14.62 | 34.3 | [illegible] | 0.823 | 0.811 | | | |
| 7 | 94000 | 4:00 | 1:12 | 16.93 | 14.44 | 36.6 | 52.1 | 0.821 | 0.810 | | | |
| 8 | 82000 | 4:10 | 1:11 | 16.38 | 14.11 | 36 | 52.3 | 0.822 | 0.810 | | | |
| 9 | 90000 | 4:20 | 1:11 | 16.79 | 14.38 | 38.5 | 52.5 | 0.820 | 0.810 | | | |
| 10 | 94000 | 4:30 | 1:12 | 16.94 | 14.49 | 36.5 | 52.6 | 0.821 | 0.810 | | | |
| 11 | 92000 | 4:45 | 1:12 | 16.90 | 14.33 | 35 | 52.9 | 0.823 | 0.810 | | | |
| 12 | 84000 | 4:55 | 1:11 | 16.41 | 14.09 | 38.6 | 53.1 | 0.820 | 0.810 | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |

Data Recorded by ..... Checked by .....