

Heavy Truck Duty Cycle

Introduction

Real-world data on Class-8 truck operation is necessary for fuel efficiency studies as well as for use in vehicle powertrain design software (Argonne National Laboratory's PSAT model). To gather this data, six Class-8 trucks were instrumented with a data acquisition system and a set of sensors to monitor the 60 vehicle performance parameters shown around the border of this poster.

Equipment



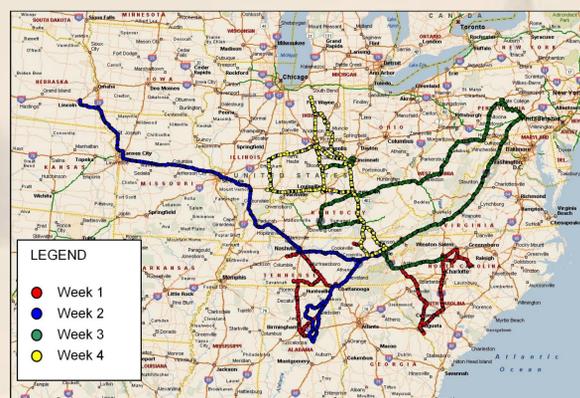
- 2005 Volvo VNL Tractor with Trailer (far right): Outfitted with all equipment and returned to real-world operation.
- SoMat eDAQ-lite (center): Data Acquisition System – Collects and stores data from the four sensors.
- Racelogic VBOX II Lite (top left): Provides GPS information on vehicle position and motion.
- Vaisala Weather Transmitter WXT510 (top right): Provides weather data, including wind speed and rain intensity.
- J1939 Data Bus (bottom right): Built in truck network. Data available includes fuel economy, gear position, engine torque.
- Air-Weigh 5800 Series Tractor & Trailer Scale (bottom left): Gives steer, drive, and trailer axle group weights.

Methods

Data is sampled at 5 Hz any time the truck is running. Every two weeks, data is downloaded by laptop from the data acquisition system, and data and equipment are checked for errors. Data is then stored and prepared for analysis. For verification of the collected data, additional information including planned routes and data from actual fuel receipts and weight tickets is also collected.

Results and Conclusions

Truck 4 Trips by Week for the First Month



Comparable distances are traveled each week. Routes are varied, and mainly cover the area east of the Mississippi River.

Initial Data of Interest to Partner Fleet

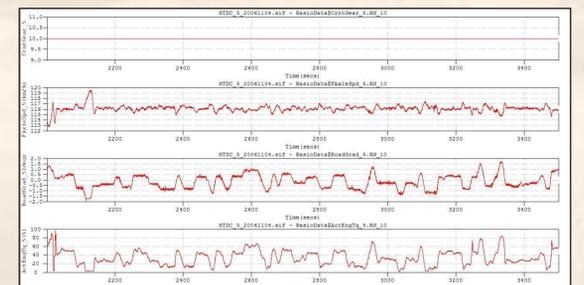
Truck and Week Ending Date	IdleHours	IdleFuel* (gal)	Total Fuel* (gal)	Total Miles	MPG	Schrader Map Distance	Schrader Fuel Tickets (gal)
463 11/11/06	20.9	9.8	unknown	2534	1900	1900	810.7
453 11/04/06	47.9	21.8	unknown	4051	3743	3743	695
463 10/28/06	17.7	8.5	unknown	3011	2843	2843	758
467 11/11/06	13.3	6.1	392.3	2902	6.38	2353	462
457 11/04/06	24.3	11.5	unknown	3119	3876	3876	630
467 10/28/06	11.4	5.3	unknown	862	0	0	0
459 11/11/06	34.5	16.4	380.7	2633	6.92	2360	584.7
459 11/04/06	41	21	unknown	2701	1019	1019	359.9
459 10/28/06	68.8	35.1	unknown	2720	2448	2448	497.9
461 11/11/06	54.4	26.9	388.3	2913	6.42	2310	596
461 11/04/06	77	36.8	unknown	2799	2516	2516	366.8
461 10/28/06	72.5	34.8	unknown	2568	2318	2318	583.3
462 11/11/06	8.7	4.1	501.4	3305	6.77	3189	509
462 11/04/06	12.5	6.5	unknown	3300	3008	3008	570
462 10/28/06	59	7.3	unknown	2969	1529	1529	549
463 11/11/06	unknown	unknown	unknown	unknown	2146	2146	743.2
463 11/04/06	unknown	unknown	unknown	unknown	1726	1726	433
463 10/28/06	60.8	34.1	unknown	3192	2873	2873	509.8

Truck	Lifetime Idle Hours Per Gallon*	Lifetime Miles Per Gallon*
453	1.831	6.005
457	1.831	6.103
459	1.829	6.081
461	1.927	6.043
462	1.742	6.058
463	1.857	6.88

* Data is for one week ending on the given date
 * Number of hours of engine operation while under idle conditions, collected from the truck database
 * Fuel used while under idle conditions, collected from the truck database
 * Total Fuel* (gal)
 * Fuel used for the week, collected from the truck database
 * Total Miles
 * Miles driven for the week, collected from the truck database
 * Miles per Gallon for the week: Total Miles/Total Fuel
 * Total travel distance for the week from spreadsheet supplied by Schrader
 * Schrader Fuel Tickets (gal)
 * Fuel Purchased during the week
 * Fuel use not yet calibrated with actual fuel receipts

The expected distance traveled is consistently lower than the actual distance traveled. Percent of time spent idling varies greatly between trucks, but is not the largest factor affecting truck fuel economy.

Sample Data: Gear, Speed, Road Slope, and Percent Engine Torque



At a constant gear and speed, engine torque is largely dependent on road slope.

Acknowledgements

Fiona Dunne

Science Undergraduate Laboratory Internships Program, Fall 2006

Oak Ridge Institute for Science and Education funded by the United States Department of Energy and Oak Ridge National Laboratory

Gary Capps, Oscar Franzese, Bill Kn  e, and Mary Beth Lascurain

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