Communication Document

Contract: 65A0210
Task ID: 1520

Identifying Excessive Vehicle Idling in the Caltrans Fleet

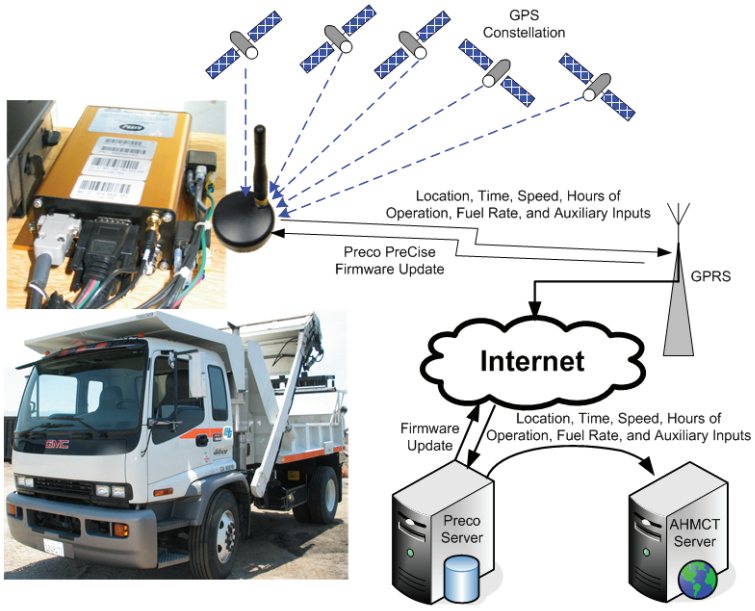
WHY WAS THIS RESEARCH UNDERTAKEN?

Caltrans' Division of Equipment is interested in knowing more about the amount of fuel used by its maintenance fleet and whether it is being used efficiently. In light of air quality mandates and good business practices, the Department wanted to measure the relative amount of fuel consumed by its vehicles while travelling to a job site compared to vehicles idling while stationary and to powering auxiliary work systems while at a job site. Quantifying baseline idling, identifying excessive idling, and measuring fuel consumption rates of vehicles of various types can result in the efficient use of idle shut down systems to reduce fuel costs and air pollution.

WHAT WAS DONE?

The Advanced Highway Maintenance and Construction Technology (AHMCT) program at the University of California at Davis (UCD) instrumented 30 Caltrans vehicles with commercial-off-the-shelf (COTS) fleet tracking, sensing, and communications components. As part of these in-vehicle systems, they also developed customized input triggers to identify periods of active work. The COTS systems provided vehicle location, vehicle sensor data (depending on engine and data bus type), and wireless communications to a central data repository. With the information from the COTS systems, along with the AHMCT-developed customized input triggers, idling and fuel use were quantified. Also, periods of stationary idling when work was being actively performed were identified.

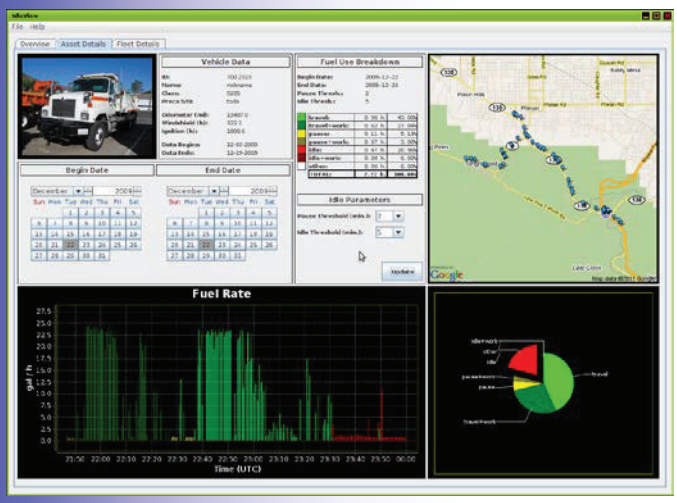
The researchers initially worked with the project's Technical Advisory Group (TAG), including members from the Caltrans Division of Equipment (DOE) and Division of Research and Innovation (DRI), to select the fleet of vehicles to test. The choice was based on relevance to the research problem (vehicle types that spend a large enough percentage of time working while idling), suitability for data collection (vehicles that include a modern engine data-bus such as SAE J1939 or J1708), and geographic location and distribution



(diverse but with reliable access to wireless data services). This led to a fleet representing the broad range of Caltrans vehicle types that would benefit from determining their idling characteristics as well as possible means to reduce unnecessary idling.

Once the research fleet was selected and instrumented, AHMCT performed field data collection and subsequent analysis. The equipped vehicles were used in normal Caltrans operations. No additional operator training was required to support the data collection. Field data was transmitted to the vendor's central data repository by the on-board commercial communications

system and archived for subsequent analysis and reporting. Standard reports were available from the vendor's web site, but AHMCT also worked with the vendor to arrange access to the raw data, which was hosted by the vendor for the duration of their business contract. However, to support long-term storage, visualization, and analysis, AHMCT developed means to download, store and access the data with its own server. In this way, AHMCT was able to perform a variety of statistical analyses to achieve the stated research objectives as well as to provide continuing access for future analysis by AHMCT and Caltrans. For this purpose, AHMCT developed a data visualization and analysis client program that Caltrans staff can use to query the permanently available data on AHMCT's server.



RESULTS OF THE RESEARCH

The data collection period for each vehicle varied from 8 to 20 months with an average of 14 months. The COTS systems were able to log the vehicles' instantaneous fuel rate in 25 out of the 30 vehicles instrumented. The Average idling fuel consumption rate ranged from 0.5 gallons/hr to 2.2 gallons/hr (largely depending on engine size). The average idle fuel consumption rate for all 25 vehicles was 0.96 gallons/hr. Thus, a 1 gallon/hr idle fuel consumption rate is a good figure to use as an estimate for a large fleet. The fuel used while idling ranges from 0.65 to 9.6 gallons per month. The average for the entire fleet of 25 vehicles is 4.2 gallons/month. The average idle duration per instance for each vehicle ranges from 10 to 20 minutes, and the average fleet idling duration per instance is 15 minutes. The average number of idling events is 1.5 per day per vehicle. The total fuel used while idling for the entire fleet during the survey period added up to 1584 gallons (i.e. 17 tons of CO_2), and the total idling duration for the entire fleet was 1720 hours.

WHAT DO THE RESEARCHERS RECOMMEND?

While the quantity of fuel used during idling may seem large, the researchers caution that the data do not take the modes of operation of the vehicles into account. For example, some idling events could be caused by maintenance and administration. Vehicle operators and managers could be further interviewed to determine if some of the idling events are necessary.

Given the large size of the Caltrans vehicle fleet, the potential fuel and cost savings realized by idling reduction could be considerable. Automatic engine shutoff systems are available as an add-on to exiting vehicles or are built in by the vehicle manufacturers to be activated by the customer if desired. Operator training and manager awareness, along with updated policies and operational procedures, could allow the Department to operate its fleet more efficiently, save fuel resources, improve air quality and save costs.

IMPLEMENTATION STRATEGIES

In addition to measuring fuel use rates and work states of the vehicles, the systems installed in this study also provide real time vehicle location. COTS systems like these are available and can be a valuable tool for fleet management. The systems used in this study are still installed in the vehicles and could be re-activated at any time by renewing the data communications subscription with the manufacturer. In terms of idling reduction in particular, many of the later model vehicles instrumented already have built in automatic idling shutoff systems that could be activated. In the mean time, the data visualization and analysis tools developed in this study are available for Caltrans' use. The client program can be installed on a laptop or desktop PC and connected to AHMCT's web server over the Internet to view and interpret the archived data.

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