

Analysis Tool Generates Custom Vehicle Drive Cycles Based on Real-World Data

NREL's DRIVE tool delivers precise and easy-to-interpret assessments in a fraction of the time.

Understanding duty cycles plays a fundamental role in assessing the performance of new vehicle technologies, leading to more informed decision making, better test procedures, more successful designs, and lower manufacturing and operating expenses.

NREL's Matlab-based Drive-Cycle Rapid Investigation, Visualization and Evaluation (DRIVE) tool produces representative testable drive cycles at record speed from vehicle data gathered using onboard logging devices. Algorithms mimic the logic and expertise of a human engineer, cutting testing and analysis time by days or weeks, while establishing a repeatable process and making information accessible through a simple graphical user interface (GUI). Originally geared towards analysis of medium- and heavy-duty vehicle fleets, use of the tool has expanded to encompass the full range of vehicle types and sizes.

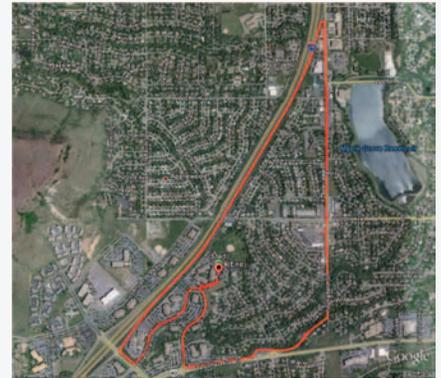
DRIVE helps manufacturers ensure designs are based on real-world usage, supplying information needed to perform vital development tasks, such as sizing electric motors in a hybrid vehicle configuration or optimizing battery storage in an electric vehicle. For researchers this information can lead to improved models and more precise experiment designs. For regulators, a better understanding of the way people drive can help guide policy regarding vehicle emissions and fuel economy test procedures.

NREL's tool filters large sets of raw data, removing erroneous data points and repairing missing data sections, before performing analyses covering 168 unique vehicle drive cycle metrics. The program then generates shortened custom drive cycles from "ideal" sections of filtered data using specialized statistical clustering methods. In addition, the program compares filtered in-use data to a library of standard test cycles to find the best fit. Output results range from simple tabulated summary statistics to Google Earth route maps, providing information that has enough depth for scientific applications, but is accessible to users without technical backgrounds.

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References: Barnitt, R., & Gonder, J. (2011). *Drive Cycle Analysis, Measurement of Emissions and Fuel Consumption of a PHEV School Bus*. 2011 Society of Automotive Engineers World Congress and Exhibition.

Walkowicz, Kevin. (October 2009). "Duty Cycle Analysis & Tools: Maximizing Vehicle Performance". Presented at the Hybrid Truck Users Forum 2009.



Sample Route Data Visualized in Google Earth

Key Research Results

Achievement

NREL's computerized DRIVE tool uses GPS, OBD and CAN data to produce customized and replicable vehicle test drive cycles based on real-world activity, analyzing thousands of hours of data in a matter of minutes.

Key Result

Algorithms designed to compress large amounts of experimental data into short custom test cycles allow for rapid evaluation reflecting real-world scenarios.

Potential Impact

Testing with the DRIVE tool should lead to more efficient and accurate vehicle component sizing, reducing technology cost and development time. The tool also may have applications to battery charge/discharge cycles, thermal stress behavior, bending moments, seismic data, electric grid demand, wind power and solar availability evaluation.