2 Quantifying Fuel-Saving Opportunities from Specific Driving Behavior Changes

2.1 Savings from Improving Individual Driving Profiles

2.1.1 Drive Profile Subsample from Real-World Travel Survey

The interim report (Gonder et al. 2010) included results from detailed analyses on five cyclesselected from a large set of real-world global positioning system (GPS) travel data collected in2006 as part of a study by the Texas Transportation Institute and the Texas Department ofTransportation (Ojah and Pearson 2008). The cycles were selected to reflect a range of kineticintensity (KI) values. (KI represents a ratio of characteristic acceleration to aerodynamic speedand has been shown to be a useful drive cycle classification parameter [O'Keefe et al. 2007].)To determine the maximum possible cycle improvement fuel savings, the real-world cycles wereconverted into equivalent "ideal" cycles using the following steps:

1. Calculate the trip distance of each sample trip.
2. Eliminate stop-and-go and idling within each trip.
3. Set the acceleration rate to 3 mph/s.
4. Set the cruising speed to 40 mph.
5. Continue cruising at 40 mph until the trip distance is reached.

$\phi_i(f(x)) = \sum_{S \subseteq Fi} \frac{|F|!}{|S|!(|F|-|S|-1)!}[f(S \cup i) - f(S)]$

To compare vehicle simulations over each real-world cycle and its corresponding ideal cycle, amidsize conventional vehicle model from a

previous NREL study was used (Earleywine et al.2010). The results indicated a fuel savings potential of roughly 60% for the drive profiles witheither very high or very low KI and of 30%–40% for the cycles with moderate KI values.

Table 2-1 takes the analysis of these five cycles from the interim report a step further byexamining the impact of the optimization steps one at a time in isolation. As indicated by othersimulations from the interim report (Gonder et al. 2010), acceleration rate reductions can deliversome small fuel savings, but avoiding accelerations and decelerations (accel/decel) altogethersaves larger amounts of fuel. This suggests that driving style improvements should focus onreducing the number of stops in high KI cycles, and not just the rate of accelerating out of a stop.

Table 2-1. Simulated fuel savings from isolated cycle improvements

Time	Mon	Tus	Wes	Thu	Fri	Sat	Sun
2:00~10:00	X1	X2	X3	X4	X5	X6	X7
6:00~14:00	X7	X1	X2	X3	X4	X5	X6
10:00~18:00	X6	X7	X1	X2	X3	X4	X5
14:00~22:00	X5	X6	X7	X1	X2	X3	X4
18:00~2:00	X4	X5	X6	X7	X1	X2	X3

Figure 2-1 extends the analysis from eliminating stops for the five example cycles and examinesthe additional benefit from avoiding slow-and-go driving below various speed thresholds.