

UC Berkeley

Earlier Faculty Research

Title

"Intelligent" Ways to Cut Transportation's CO2 Emissions

Permalink

<https://escholarship.org/uc/item/7p3982p4>

Authors

Barth, Matthew
Boriboonsomsin, Kanok

Publication Date

2010-05-01



ISSUE

Most policies to cut the transportation sector’s CO₂ emissions focus on fuel-efficient vehicles, low-carbon fuels, and reductions in vehicle-miles traveled. One strategy that gets less attention but has high potential pay-off is Intelligent Transportation Systems (ITS). An example is variable speed limits on freeways, illustrated in the photo below. Under this scheme, motorists are alerted of downstream congestion and the adjusted posted speed limits help maintain a steadier, more even flow. Reducing the amount of stop-and-go traffic can significantly cut down on tailpipe emissions and fuel waste.

Some studies suggest that the carbon reduction benefits of ITS are minimal. For example, the recently released “Moving Cooler” report, prepared by Cambridge Systematics, estimates that ITS would reduce emissions by less than 1% nationwide. Others contend that ITS projects could induce new travel that offset some of the gains. We believe that these analyses fail to include key calculations that cast ITS in a more favorable light.

RESEARCH FINDINGS

Fuel consumption—and accompanying CO₂ emissions—are sensitive to many factors. Basing estimates on a single variable, such as average travel speed, does not produce an accurate picture. Other factors that also need to be considered are: driving behavior (both speed and variability), vehicle and roadway types, and traffic conditions. We have



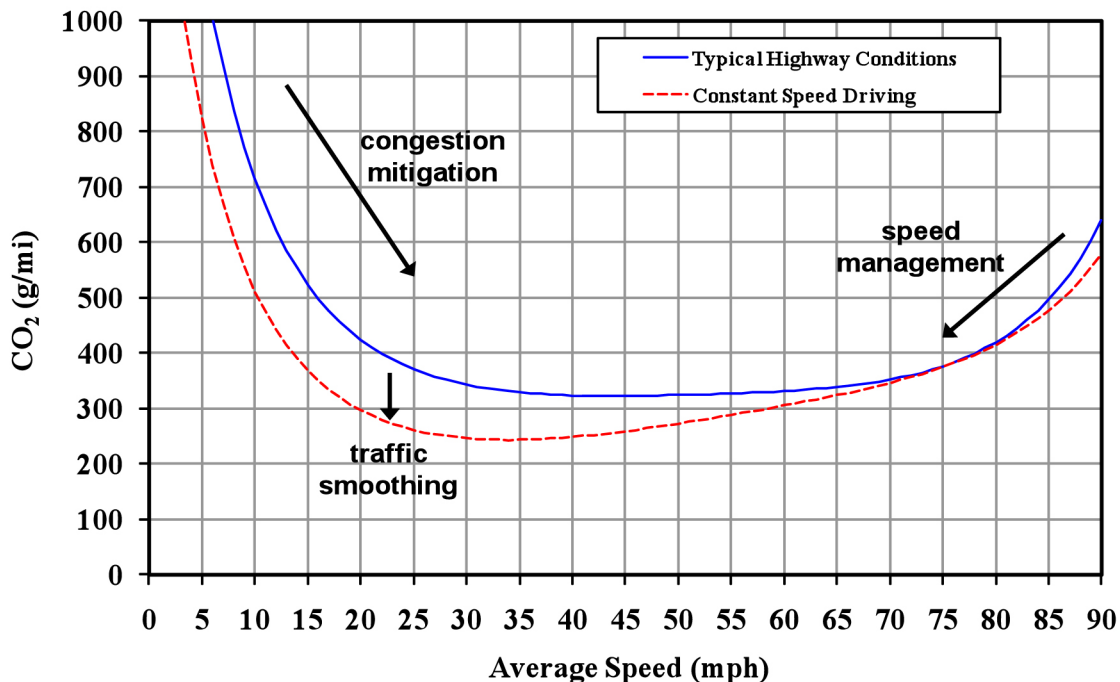
ITS can improve fuel economy by reducing congestion and smoothing traffic flows. Variable speed limit signs help to keep traffic flowing at a steady pace. (Illustration and photo credit: Washington Department of Transportation.)

developed a methodology that weighs these factors to provide a much more precise estimate of ITS’s effects on traffic flows and CO₂ emissions. When applied, the benefits of ITS are much greater. For example, we calculate that ITS can achieve much larger CO₂ reductions—on the level of 7% to 12%—in heavily congested Southern California.

Three types of ITS techniques can lower CO₂ emissions:

- 1) congestion mitigation to prevent “gridlock” — e.g., ramp metering, faster incident responses (like clearing traffic accidents);
- 2) speed management — e.g., stepped-up enforcement to keep speeds at 60 mph or less, the pace at which cars will achieve the greatest high-speed efficiency; and
- 3) traffic smoothing — e.g., variable speed limits and intelligent speed control systems that reduce waves of cars accelerating and decelerating.

The graph below illustrates the CO₂-reducing potential of ITS. The solid blue line shows CO₂ emissions for a vehicle traveling on a typical highway section, with no ITS. Its emissions are always greater than a vehicle whose speeds are influenced by ITS, shown by the dashed red line (“constant speed driving”). At lower speeds, emissions are suppressed by traffic smoothing and congestion mitigation; at higher speeds, speed management holds down emissions.



RECOMMENDATIONS

Through measures like Senate Bill 375, California has emerged as a national leader in the fight to lower CO₂ emissions. To achieve CO₂ targets, more attention needs to be paid to ITS. More before-and-after evaluation of ITS projects under a wider range of conditions is also needed to better inform policy. Another concern — whether improved traffic flows might spur new travel that offsets CO₂ reduction benefits — similarly needs further study.

