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Photo courtesy of the Illinois Tollway.

Gas fizzling

ITS are useful tools to weaken greenhouse-gas emissions

As the debate continues over transportation's relationship to climate change, reducing greenhouse-gas (GHG) emissions has become a primary goal for the surface transportation system sector for a multitude of reasons. Transportation relies on petroleum for 95% of its energy, consumes approximately 20% of global energy and produces 28% of GHG emissions.

Emissions from transportation are growing faster than other sectors, representing almost half of the increase in total GHGs between 1990 and 2006. Almost 85% of transportation-sector emissions are related to the surface transportation system. Faced with mounting concerns about the environment and increased demands for air-quality improvement,

the transportation sector is actively pursuing strategies that will decrease its contributions to harmful emissions.

Fourth leg to stand on

To achieve the goal of reduced GHG emissions, transportation professionals have embraced a strategy that includes improving vehicle fuel economy, developing new fuel technologies, reducing vehicle-miles traveled (VMT) and improving system operations and efficiency. The fourth leg of this stool, formally known as transportation system management and operations, involves operational improvements to optimize the performance of existing road infrastructure by implementing systems, services and projects that preserve capacity and improve the transportation system's security, safety and reliability.

Transportation operations strategies and their supporting intelligent transportation system (ITS) technologies focus on reducing the vehicle hours of travel (VHT), enhancing



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overall mobility and reliability. Since these strategies generally have a minimal impact on reducing overall VMT, they are not always sought for their environmental benefits. However, implementing improvements to the operational efficiency of the surface transportation system can have an immediate impact on reducing GHG emissions, while it will take years to fully develop and implement alternative fuels and new vehicle-efficiency technologies.

Using a typical traffic condition in Southern California as an example, the research paper “Real-World CO₂ Impacts of Traffic Congestion” found “CO₂ emissions can be reduced by up to almost 20% through three different strategies: 1) congestion mitigation strategies that reduce severe congestion, allowing traffic to flow at better speeds; 2) speed management techniques that reduce excessively high free-flow speeds to more moderate conditions; and 3) shock-wave suppression techniques that eliminate the acceleration and deceleration events associated with stop-and-go traffic that exists during congested conditions.”

Some examples of the strategies and ITS technologies that alleviate congestion, while in turn reducing harmful emissions and providing fuel savings, include coordinated traffic-signal timing; electronic tolling systems; emergency and incident management; improved traveler information; speed harmonization via active traffic management; access management; integrated corridor management; and work-zone management. Examples of some of the environmental benefits of these strategies are described below.

Traffic-Signal Timing

The “2007 National Traffic Signal Report Card” found that improving traffic-signal timing has a 40-to-1 or better return on investment, as state and local agencies that invested in signal timing found that every \$1 spent on technologies like synchronized and adaptive traffic signals returns \$40 or more to the public in time and fuel savings, while emissions are reduced by up to 22%. When combined with transit-priority systems, smart signals can reduce fuel use for transit buses by up to 19% and reduce bus emissions by up to 30%.

Electronic Tolling

Reports on the E-ZPass system show that electronic tolling reduces congestion, emissions and fuel use, with E-ZPass reducing U.S. fuel consumption by almost 30 million gal and eliminating nearly 265,000 metric tons of emissions in 2007. Baltimore cut harmful emissions by 16% to 63% at upgraded toll plazas that implemented electronic toll systems. ITS systems like PrePass, which electronically verifies the safety, credentials and weight of trucks, reduced delays in 2008 by over 4.6 million hours, eliminated nearly 111,000 metric tons of emissions, conserved more than 11 million gal of fuel and saved U.S. truckers an estimated \$486 million.

Incident Management and Traveler Information

In Georgia, the NaviGator incident-management program reduced annual fuel consumption by 6.83 million gal and contributed to decreased emissions, as carbon monoxide emissions fell by 2,457 tons, hydrocarbon emissions declined by 186 tons and nitrous-oxide emissions decreased by 262 tons. Integrating traveler information with traffic- and incident-management systems could further reduce emissions by up to 3% and improve fuel economy by about 1.5%.

Moving cooler

Despite examples like the ones above, more studies are needed that illustrate the correlation between operational and ITS strategies and reduced GHG emissions, since the full potential of these solutions is often overlooked in addressing climate change. Furthermore, concerns that operational improvements will induce demand have led some to reject or diminish solutions that reduce VHT versus VMT. Although operations has gained wider acceptance as the fourth leg of the GHG-reduction stool, the benefits are often marginalized. For example, the recent study “Moving Cooler: An Analysis of Transportation Strategies for Reducing Greenhouse Gas Emissions,” indicated that “the implementation of the full set of operational and ITS improvements



Transportation operations strategies and their supporting ITS technologies focus on reducing the vehicle hours of travel, enhancing overall mobility and reliability.

Industry's natural resources for GHG reduction

The National Transportation Operations Coalition (NTOC), which fosters partnerships across many transportation stakeholder groups for the sharing, promotion and implementation of transportation system management and operations strategies that will optimize the performance of the U.S. surface transportation system, is drawing upon resources from across its member organizations to provide education on implementing operations and ITS strategies that address GHG reduction and other climate-change issues. Some of the NTOC member agencies and associations that have implemented climate-change initiatives with focuses on operational and ITS strategies include the American Association of State Highway & Transportation Officials (AASHTO), the American Public Works Association, the Federal Highway Administration, the Institute of Transportation Engineers (ITE), ITS America, the National Association of County Engineers, the Research and Innovative Technology Administration ITS Joint Program Office and the Transportation Research Board (TRB).

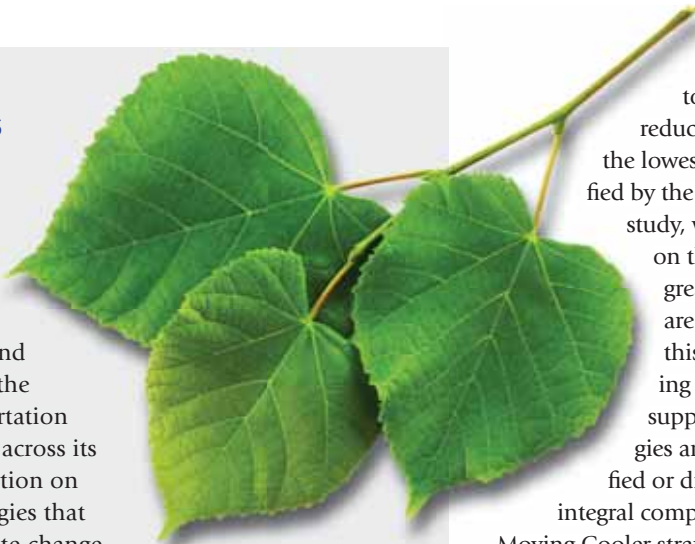
NTOC member organizations have launched a range of resources to assist transportation professionals, such as climate-change websites, clearinghouses, technical support programs, task forces, e-newsletters, web seminars, position papers and studies. AASHTO launched "Real Transportation Solutions for Green House Gas Emissions" (realsolutions.transportation.org), a website that highlights strategies to reduce GHG emissions from transportation and includes best practices, state examples, research findings and links to other climate-change information sites.

TRB's Regional Transportation Systems Management and Operations (RTSMO) Committee has established a subcommittee on climate change to examine the role management, operations and ITS can play in reducing GHG emissions. Louis Neudorff, chair of the subcommittee, has given several presentations on "Greenhouse Gas Emissions, Climate Change, and the Potential Role that Transportation Systems Management and Operations Can Play."

ITE has developed a Climate Change and Energy Task Force and is working with Transportation for America to advance sustainable transportation issues.

ITS America has established an Environmental Task Force, which will help transportation decision makers assess how transportation-planning decisions may affect climate change and our ability to adapt to it, and a Technical Forum on Sustainability to address how ITS technologies and operational strategies can reduce GHG emissions, improve transportation agencies' carbon footprints and help the transportation infrastructure adapt to the consequences of climate change.

The NTOC leadership is working to communicate efforts like these across all stakeholder groups to promote information sharing through the website www.ntoctalks.com. As more studies are conducted on this issue, the goal remains to reduce GHG emissions on as many levels as possible by exploring and educating on all the potential solutions. Transportation operations and ITS, while only one piece of the puzzle, are solutions that can be put into place and be expanded more quickly than many other measures, providing immediate GHG reduction benefits in the short term while other long-term solutions are being developed.



could achieve 0.3% to 0.6% cumulative reductions." This is one of the lowest reductions identified by the highly anticipated study, while other reports on the topic show much greater benefits. There are various reasons for this discrepancy, one being that operations and supporting ITS technologies are not readily identified or discussed as being an integral component of several other

Moving Cooler strategies with much greater cumulative reductions, such as:

- **Lower/enforced speed limits:** At a minimum, effective implementation of this strategy requires automated speed-enforcement technologies. Moreover, speed harmonization and variable speed limits via active traffic management can further enhance the GHG reductions;
- **Ecodriving:** As described in Moving Cooler, this strategy and the resulting reductions in GHG emissions is dependent on changing the efficiency of individual driving behavior through training programs. According to www.ecodrivingusa.com, ecodriving can be further promoted via operational strategies and ITS technologies, including "riding the green wave" (via coordinated traffic signals), "maintaining an optimum highway speed" (via active traffic management) and "navigating to reduce carbon dioxide" (via traveler information);
- **Congestion pricing:** ITS technologies (e.g., toll tags, automated license-plate reading and traveler information) are essential to deploying and operating congestion-pricing systems; and
- **Transit capital improvements:** Examples of improvements such as increased levels of service and improved travel times analyzed include signal prioritization and bus rapid transit, which are both operational/ITS strategies. **R&B**

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