



The HNTB Companies
Engineers Architects Planners

Driving for change in transportation funding and delivery

A better way to deploy IntelliDriveSM

WHITE PAPER | AUGUST 2010

A white paper on the future of U.S. transportation technology and the potential of mileage-based user fees.

Driving for change

America's surface transportation system is at a crossroads. Fuel consumption and fuel tax revenues are in decline while concerns for safety, congestion relief and environmental protection are at an all-time high.

The rising price of gas, the Gulf oil spill, continued instability in the Middle East, the electrification of automobiles and the inevitable degradation of the Highway Trust Fund place us at a tipping point.

IntelliDriveSM may show us the way forward.

Defining the way forward

IntelliDrive is a federal multimodal initiative that will create an integrated wireless network of connected vehicles and roadways. Data will flow from vehicle to vehicle, and to and from vehicles and infrastructure, such as roads, bridges and intersections.

Most of the initial applications will be vehicle-to-vehicle safety-related tools, such as:

1. **Blind spot warning** – Warns drivers when they try to change lanes if there is a car in the blind spot.
2. **Forward collision warning** – Alerts and then warns drivers if they fail to brake when a vehicle ahead of them is stopped or traveling radically slower.
3. **Electronic emergency brake lights** – Notifies drivers when a vehicle ahead that they can't see is braking hard for some reason.
4. **Intersection movement assist** – Warns drivers when it is not safe to enter an intersection – for example, when something is blocking a driver's view of opposing traffic.
5. **Do not pass warning** – Warns drivers if they attempt to change lanes and pass when there is a vehicle in the opposing lane within the passing zone.
6. **Control loss warning** – Warns drivers when they are about to lose control of the vehicle.

Other applications will involve vehicle-to-infrastructure communications, such as intersection safety, run-off road prevention, lane departure warning and commercial vehicle safety.

It is likely that toll authorities will be some of the first adopters of 5.9 GHz transceivers, which will be used long term for IntelliDrive communications. Many toll authorities already provide dedicated short-range communications transponders to customers, and some of them already are evaluating adoption of this newer technology.

The U.S. Department of Transportation, working with the American Association of State Highway and Transportation Officials, is developing a national deployment plan. IntelliDrive is expected to be the focus of the USDOT Intelligent Transportation Systems program for the next decade. One notable, short-term goal will be to have a regulatory decision by the National Highway Traffic Safety Administration in 2013 to equip all new vehicles with IntelliDrive safety equipment and applications.

The current thinking is that the regulatory decision will require DSRC radios integrated with GPS positioning equipment and on-board processors that run the applications in the vehicle. The equipment would be connected to vehicle sensors and control systems.

The decision also will focus on V2V applications that reduce crash rates. In essence, the equipment will transmit a "here I am" message to other nearby vehicles. The vehicles will "sense" each other, even if drivers cannot see these other vehicles. If there is impending danger of a collision, then specific warnings would be provided to the driver.

Light vehicles, trucks and transit vehicles are all subject to the regulatory decision. A model deployment of the V2V safety program will begin in 2011 with full-scale testing in 2012.

Many in the industry have lauded IntelliDrive's potential to dramatically improve the safety of surface transportation, greatly enhance mobility and provide environmental benefits by making better use of limited resources.

While the greatest safety benefits will be realized when a critical mass of infrastructure is deployed, funding issues will hold back substantial deployment unless a revenue source can be found.

Moving ahead now rather than later

With a new federal transportation reauthorization bill uncertain, state DOTs are dramatically scaling-back programs for 2011 and beyond.

Unfortunately, the current focus on IntelliDrive's safety, mobility and environmental benefits, while worthwhile, does not offer a viable business model for implementation. Instead, our focus should be on a mechanism that meets a different need – funding.

As of February 2009, the federal gas tax had lost 33 percent of its purchasing power due to inflation since it was last increased in 1993.

The effectiveness of the gas tax will decline even further as electric vehicles become more prevalent. Nissan and General Motors soon will release production model EVs. Many are jumping on the EV bandwagon,

especially with the damage caused by the Gulf oil spill, expected higher fuel prices, a growing emphasis on sustainability and the push toward “green collar” businesses and jobs.

Shifting our thinking

IntelliDrive offers a new way to generate transportation revenue through mileage-based user fees (MBUF). Such fees can be a game-changer this decade. But to do so, deployment scenarios must consider the opportunity to leverage IntelliDrive to supplement or replace fuel taxes as the primary source of U.S. transportation funding. It offers a sustainable source of transportation funding with all the ancillary safety, mobility and environmental benefits. It also offers operational efficiencies within transportation agencies that could save millions of dollars in public funding.

MBUF should be viewed as part of the evolving nature of IntelliDrive. Such fees are more consistent with national environmental and energy policies than traditional fuel taxes. A national roll-out of infrastructure this important should mitigate the undesirable impacts of current trends and leverage the changing political and institutional climate.

Combine the need for a sustainable revenue source and the push toward alternative fuels with the potential impact of NHTSA's regulatory decision about vehicle-to-vehicle safety in 2013:

As soon as such on-board equipment becomes mandatory, additional applications – including vehicle-to-infrastructure based functions that support services beyond safety – will be possible. The enabling technology for a MBUF application will be in our cars and trucks this decade.

The model for a national roll-out of IntelliDrive can be based on innovative financing and public-private partnerships already in use for large infrastructure deployment projects around the world. For example, state DOTs might use a design-build-finance model or obtain competitive proposals from concessionaires. This is possible if MBUF is adopted as a primary objective for deployment. In essence, the infrastructure is financed and built by the private sector. As revenues are collected by the system, the private sector recoups the initial investment with added profit. Toll facilities have done this successfully for decades.

When it comes to governance, a number of options are available:

- The states could use P3 contractors to not only finance the infrastructure, but also to maintain it. This may require concession agreements with the contractor teams.

- The public sector may wish to maintain the infrastructure, just as they currently maintain traffic signals and Intelligent Transportation Systems, especially with safety and mobility objectives in mind.
- Establish a separate authority within each state to maintain the infrastructure and process the revenues.

In any case, the pricing model must take into account the need for on-going maintenance and operation of the system.

Legislation would be required in many states to allow these approaches. Regulatory oversight will be required for separate authorities or concessions similar to those required for current concessions and public utilities. The federal role would be that of facilitator under this scenario. Of course, a portion of the MBUF receipts could be apportioned to federal coffers, similar to current fuel tax receipts, for national initiatives and support of federal transportation programs.

Achieving a balanced approach

The primary concern with this deployment scenario is the conflict between revenue generation and the desire to improve safety, mobility and the environment. Such an effort must include state DOT and local agency oversight to ensure infrastructure is deployed in a way that optimizes safety and mobility benefits while meeting MBUF requirements.

A systems engineering approach should be adopted to establish a concept of operations, clear roles and responsibilities, and the procurement approach within each state. A business plan must be part of the proposals from concessionaires or contractors.

A second issue involves the evolution of the driver-vehicle interface. We must seek to create tools that make drivers safer and more informed rather than distracted. Standards should be adopted to avoid confusion associated with different vehicle manufacturers and multiple applications operating at the same time. Prioritization of messages will be an important consideration. Message conflicts and false warnings must be minimized to avoid driver confusion, distraction and error.

Finally, we cannot ignore the privacy concerns many in the general public raise when introducing MBUF concepts. Last year, an America THINKS survey from HNTB found 80 percent of Americans would be concerned if a device were used to record where and when someone drove to charge a fee.

First, it's important to note the data required for MBUF does not necessarily require tracking or logging specific driver locations, rather the number of miles driven, similar to an odometer reading. It also would require logging the state in which the miles were driven, since

most MBUFs will be assessed on a state-by-state basis. Certain pricing applications (such as congestion pricing) may require more data granularity than others, but simple MBUF would not.

Second, rather than simply focusing on the fact vehicles could be tracked, a public debate should take place on the benefits of such applications and the specific information required for each. This might include:

- Tracking vehicle location at the city, county and regional level so states can equitably share the revenue with local jurisdictions. This would be much more accurate than current techniques, including the use of population totals, road/lane miles and estimated vehicle miles traveled.
- Logging vehicle type, so larger, heavier vehicles that cause more damage to the roads and require wider lanes, higher bridge clearances and greater enforcement pay a more equitable share than under the gas tax. In fact, current licensing and registration fees already vary by vehicle type.
- MBUFs also could be graduated by the level of their greenhouse gas emissions. For example, electric vehicles could pay less per mile than gas-powered vehicles. An America THINKS survey found 52 percent of Americans agreed that when adopting such fees, larger vehicles such as SUVs and trucks should pay more than other kinds of vehicles.
- Graduated rates also could be assessed for various congestion levels or by time of day, similar to how transponders or license plate cameras are used on managed lanes today. Congestion pricing rates would be based on real-time congestion levels and could be sent to drivers so they can make decisions on where and when to travel. The vehicles would need to track their GPS location and the on-board equipment would need to log and store the miles driven.

Such granulated data would reside in the vehicle for a certain, limited period of time, until the vehicle passes the next receiver or based on a certain cycle (daily, hourly, minute-by-minute as required for billing purposes) depending on the level of information needed.

The bottom line

IntelliDrive deployment can be self-funded and self-sustaining. However, this requires that we step outside the gas tank and look beyond the current funding scenarios for infrastructure deployment. The key is to consider IntelliDrive as the enabler for MBUF.

Since 2005 HNTB has been involved in a growing number of projects related to the national IntelliDrive initiative, including designing and building one of the first IntelliDrive test beds with the Michigan Department of Transportation.

Additional resources

For more information about the future of U.S. transportation technology, consult:

Jim Barbaresso, HNTB Corporation

Director Intelligent Transportation Systems
(white paper author)
(313) 961-3330
jbarbaresso@hntb.com

Pete Rahn, HNTB Corporation

Leader Transportation Practice
(816) 527-2034
prahn@hntb.com

Stephen Haag, HNTB Corporation

Technology Officer
(972) 661-5626
shaag@hntb.com

U.S. Department of Transportation, Research and Innovative Technology Administration

IntelliDriveSM
www.its.dot.gov/intellidrive/index.htm

OmniAir Consortium

www.omniair.org

American Association of State Highway and Transportation Officials

www.transportation.org

International Bridge, Tunnel and Turnpike Association

www.ibtta.org

For other HNTB-issued papers and viewpoints, visit HNTB.com

HNTB Corporation is an employee-owned infrastructure firm serving federal, state, municipal, military and private clients. With nearly a century of service, HNTB has the insight to understand the life cycle of infrastructure and the perspective to solve the most complex technical, financial and operational challenges. Professionals nationwide provide award-winning planning, design, program management and construction management services. For more information, visit www.hntb.com.

© 2010 HNTB Companies. All rights reserved. Reproduction in whole or in part without written permission is prohibited.