

## Investment Opportunities for Managing Transportation Performance through Technology

U.S. Department of Transportation, Intelligent Transportation Systems Joint Program Office

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The incoming Obama Administration has laid out several objectives for economic recovery plan investments, such as:

- Ready to go within a few months;
- Yield both short- and long-term benefits; and
- Create and maintain jobs.

In the transportation sector, state and local governments and transit agencies are compiling lists of projects that meet these criteria. AASHTO, APWA and APTA, for example, have identified \$64.3 billion, \$15.4 billion and \$12.2 billion respectively in “shovel-ready” projects that could begin quickly.<sup>1</sup> As transportation is about moving people and goods safely and effectively, it is important to consider the scope and timing of the operational benefits these projects will deliver. Effectively operating the transportation system is a daily process vital to the economy and central to transportation and transit agency missions. Moreover, transportation operations provide continual public and private sector employment opportunities. Intelligent Transportation Systems (ITS) use technology to enable operating agencies and private users to keep transportation systems performing as efficiently and safely as possible.

Investments in ITS and operations are fully consistent with the intent of the economic recovery plan and can be proffered as candidates. For example, ITS investments that support system operations have the following attributes:

**Quick to Implement** – ITS and operations investments requiring minimal new rights-of-way or construction are subject to a categorical exclusion under NEPA.<sup>2</sup> Examples include traffic signal upgrades and optimization, traffic adaptive signal control, transit signal priority, ramp metering, closed-circuit television, dynamic message signs, open road tolling, weigh-in-motion, transit AVL/CAD, and traffic incident management programs. These projects can get underway fast, turning project dollars into jobs quickly.

**Create Jobs** – ITS and operations investments create technology sector jobs for engineers, electronics technicians, software developers, and system integrators. On average, about 50 percent of ITS project spending is for direct labor as compared with 20 percent for new highway construction.<sup>3</sup>

**Provide Short- and Long-Term Benefits** – ITS and operations investments provide long-term operational benefits by reducing congestion and improving transportation safety. ITS technologies employed in work zones provide immediate benefits in congestion management and safety during construction.

**Environmental Benefits** – ITS and operations investments contribute to reduced emissions and fuel consumption.

When considering ITS and operations investment to support transportation management and operations, keep in mind that they can be:

- Stand-alone deployments;
- Incorporated as elements within new infrastructure-oriented projects; and
- Employed to manage traffic impacts created by other projects, such as work zones.

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<sup>1</sup> American Association of State Highway and Transportation Officials (AASHTO) and American Public Transportation Association (APTA) figures from “‘Ready to Go’ May Be The Stimulus Ticket, Engineering News Record,” December 10, 2008, <http://enr.construction.com/infrastructure/transportation/2008/1210-InfrastructureStimulus.asp>; the American Public Works Association (APWA) figure from APWA website chart at [http://www.apwa.net/documents/advocacy/Congressional\\_Testimony/Unfunded\\_PW\\_Projects\\_and\\_Funds\\_Needed\\_by\\_State.pdf](http://www.apwa.net/documents/advocacy/Congressional_Testimony/Unfunded_PW_Projects_and_Funds_Needed_by_State.pdf).

<sup>2</sup> National Environmental Policy Act (NEPA), 23 CFR 771.117.

<sup>3</sup> Indirect labor multiplier effects not addressed here. Labor cost information from FHWA’s Highway Statistics series (<http://www.fhwa.dot.gov/policy/ohpi/hss/hsspubs.cfm>) and RITA’s ITS Benefits and Costs databases (<http://www.itsbenefits.its.dot.gov/> and <http://www.itscosts.its.dot.gov/>).

ITS and operations investments are an important part of a transportation investment portfolio. Summarized below are benefit and cost data for two broad categories of ITS investments: (1) quickly-deployable projects to help maximize the safety, operational capacity, and environmental performance of existing, rehabilitated, or new infrastructure and (2) those that are specifically coupled to road and bridge projects to help mitigate traffic hazards and delays during construction. Project categories identified in this paper could begin within 120 days of funding as either enhancements to existing infrastructure or as elements within broader transportation construction projects.

## ITS for Maximizing Infrastructure Benefits

ITS can enhance the quality of life in most communities by improving traffic flow and decreasing delays. Examples of these technologies include traffic signal optimization and retiming, transit signal priority, transit CAD/AVL, safety service patrols, electronic border crossing systems, commercial vehicle credentialing, and surveillance and detection systems. Regarding surveillance and detection, Congress has directed USDOT to establish a real-time traffic and travel condition monitoring system to enable States to use and share that data with other governments and the traveling public.<sup>4</sup> The Department embarked on a regulatory development approach to stimulate and accelerate the expansion of real-time traffic and travel conditions monitoring. A notice of proposed rulemaking (NPRM) was published on January 14, 2009 to engage the transportation community in effective approaches to accomplish this effort.<sup>5</sup> The NPRM does not dictate a specific technology. Examples of technologies used for real-time data collection include roadside, overhead, probe-based, in-pavement sensors, and video detection devices.

Table 1 identifies deployment-ready ITS investments for either stand alone projects or technologies that can be incorporated into new or existing transportation infrastructure projects. The table includes a summary of the key benefits for each type of project, including an assessment of whether the safety, mobility,

**Table 1. ITS Upgrades for New, Rehabilitated or Existing Infrastructure**

Category/Project	B/C Ratio/Other Metrics	Safety	Mobility	Energy/ Environment
Traffic Signal Optimization/Retiming	17:1 to 62:1	High	High	High
Traffic Incident Management	Incident duration reduced 30-40%	High	High	High
<i>Safety Service Patrols</i>	2:1 to 42:1	High	High	High
<i>Surveillance/Detection</i>	6:1	High	Med	Med
Road Weather Information Systems	2:1 to 10:1	High	High	Med
Electronic Toll Systems	2:1 to 3:1	Med	High	High
<i>Open Road Tolling</i>	Crash rates reduced by up to 49% Speeds increased up to 57%	High	High	High
Ramp Metering Systems	15:1	Low	High	Med
Electronic Border Crossing Systems	85:1 to 718:1	Med	Med	Med
Commercial Vehicle Information Systems and Networks	3:1 to 5:1	Med	Med	Med
<i>Electronic credentialing</i>	1:1 to 50:1	Med	Med	Med
<i>Electronic screening</i>	2:1 to 12:1	Med	Med	Med
Bus Rapid Transit	2:1 to 10:1	Med	High	Med
Traffic Adaptive Signal Control	Improved travel time 6-11%	Med	High	High
Transit Signal Priority	Reduced transit delay 30-40% Improved travel time 2-16%	Med	High	Med
Traveler Information/Dynamic Message Signs	3% decrease in crashes	Low	High	Low
Parking Management Systems	Increase in transit mode share up to 6	Med	Med	Low
Transit Automated Vehicle Locator/Computer-Aided Dispatch	AVL improves on-time bus performance 9-58% CAD Improves on-time bus performance up to 9%	Med	Med	Med
High Occupancy Toll Facilities	23% would pay \$2 to save 10 minutes 59% would pay \$2 to save 20 minutes	Med	High	Med
Work Zone Management Systems	2:1 to 42:1	High	Med	Med

**Key:** Details on the ITS solutions presented in this table can be found in the supplemental background and appendix sections.

**Source:** ITS Benefits and Costs databases (<http://www.itsbenefits.its.dot.gov/> and <http://www.itscosts.its.dot.gov/>)

and energy and environment impacts are considered to be high, medium, or low. This assessment is based on the information contained in the ITS benefits database.

<sup>4</sup> Pub. L. 109-59, Sec.1201. <http://www.ops.fhwa.dot.gov/travelinfo/resources/policyv.htm>

<sup>5</sup> FHWA Docket No. FHWA-2006-24219; <http://edocket.access.gpo.gov/2009/E9-392.htm>

While these technologies can be deployed independently, there are good engineering, financial and political reasons to include them as elements of other capital projects. Coordinating project installation can leverage resources, minimize total amount of digging and repaving, and reduce the total time for deployment.

## ITS for Mitigating Construction Impacts

Construction projects can have traffic impacts that reverberate across a region. As the nation launches numerous construction projects, it will be crucial to move vehicles through the work zones as efficiently as possible and to better manage traffic and inform the traveling public in the surrounding region. Smart work zones, traffic incident management strategies, and enhanced traveler information are among the ITS solutions that can improve safety for workers and the motoring public as well as mitigate traffic delay during road and bridge construction projects. Portable traffic management systems, dynamic message signs, dynamic lane merge systems, and variable speed limit systems are just a few examples of smart work zone technologies that can be deployed during major construction projects. Table 2 follows the same format as table 1 and lists the significant benefits associated with integrating work zone management components with roadway and bridge construction projects. On average, the cost to deploy and operate smart work zone systems is 4.5 percent of total construction costs.<sup>6</sup>

**Table 2. ITS for Minimizing Road Construction Hazards and Delays**

Category/Project	B/C Ratio/Other Metrics	Safety	Mobility	Energy/ Environment
<b>Work Zone Management Systems</b>	2:1 to 42:1	High	Med	Med
<i>Smart Work Zones</i>	System delays reduced by up to 50%	High	High	High
<i>Traveler information/Dynamic Message Signs</i>	Traffic backups reduced by up to 56%	High	High	Med
<i>Dynamic Lane Merge Systems</i>	Traffic queues decreased by up to 60% in frequency and length	High	High	High
<i>Variable Speed Limit Systems</i>	Reduced the average speed through the work zone by up to 5%	Med	High	Med
<i>Portable Traffic Management Systems</i>	Work zone traffic volumes increase 4-7%	Med	Med	Med
<i>Surveillance/Detection</i>	6:1	High	High	Med
<b>Traffic Incident Management</b>	Incident duration reduced 30-40%	High	High	High
<i>Safety Service Patrols</i>	2:1 to 42:1	High	High	High
<i>Surveillance/Detection</i>	6:1	High	Med	Med
<i>Traveler Information/Dynamic Message Signs</i>	3% decrease in crashes	Low	High	Low

**Key:** Details on the ITS solutions presented in this table can be found in the supplemental background and appendix sections.

**Source:** ITS Benefits and Costs databases (<http://www.itsbenefits.its.dot.gov/> and <http://www.itscosts.its.dot.gov/>)

<sup>6</sup> The range of smart work zone costs in the ITS Costs Database is from two to six percent of total construction costs.