# Regulatory Benefit-Cost Analysis of Rulemaking
# Real-Time System Management Information Program

Section 1201 of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) calls for *a real-time system management information program to provide, in all States, the capability to monitor, in real-time, the traffic and travel conditions of the major highways of the United States and to share that information to improve the security of the surface transportation system, to address congestion problems, to support improved response to weather events and surface transportation incidents, and to facilitate national and regional highway traveler information.* DOT is setting the parameters and schedule for implementing this Real-Time System Management Information Program through rulemaking.

This document presents a detailed analysis of costs and a high level analysis of benefits from compliance with the rule that requires:

- the States corresponding to the 50 largest Metropolitan Statistical Areas (MSAs) to begin establishing metropolitan real-time information programs including travel time information on Interstates within two years of publication of the final rule;
- all States to establish statewide real-time information programs including roadway and lane closure, construction zone, and roadway weather conditions information on all Interstates including those in small urban and non-urban areas within two years of publication of the final rule;
- all 50 States and the District of Columbia to update their regional architectures within two years of publication of the final rule to reflect the deployment of real-time information program systems.

The scope of this document is the four-year period following the publication of the final rule. As of this writing, it is estimated that the final rule will be published in 2010, so the benefits are estimated from 2014. Depending on their states-of-readiness, systems will be implemented at various times throughout the 4-year period from 2010 through 2014, so costs are measured from 2010 onward. It is noted that this benefits and costs assessment does not articulate the requirements of the proposed rule that are to be completed within the six-year span following publication of the final rule. Since the States self select the facilities to be monitored within the six-year period, it is not possible to determine a reasonable assessment of those additional costs and benefits.

This document also estimates costs of operating and maintaining real-time information programs serving statewide and metropolitan areas through 2021. This period would reflect the establishment of all real-time information programs by the end of 2014, plus a eight-year period of operation. The eight-year period of operation assumes that equipment and supporting material for the real-time information program is fully replaceable after the operational life cycle.

The eight-year period of operation applied to this benefit cost analysis results from the following statement in the NPRM:

> *There is no requirement for a State to apply any particular technology, any particular technology-dependent application, or any particular business approach for establishing a real-time information program. States and other public agencies instead are encouraged to consider any salient technology, technology-dependent application and business approach options that yield information products consistent with the requirements set forth in this proposed rule.*

This establishes substantial uncertainty in approaching a cost estimation methodology, as the method of generating the data typically carries a specific period of operation after which there is a need for full replacement. As will be described further in this analysis, the cost estimation methodology is based on an assumption of inductive loop systems which are commonly used as in-pavement loop detectors for measuring vehicle presence on a roadway lane. This assumption in no way suggests a preference on the part of the Department for generating data. Instead, this approach enabled the cost estimation to proceed based on what is popularly viewed as among the most expensive option for generating data.

The period of operation for inductive loop surveillance is identified as five years in a 2004 report titled "Guidelines for Transportation Management Systems Maintenance Concept and Plans", FHWA Report No. FHWA-OP-04-011.[1] However, in light of the range of technologies that may be applied, some with an operational lifetime of ten years, others with twenty years, a eight year operational lifetime appears to be a reasonable assumption. The actual operational lifetime experienced by a State would depend on what is implemented, how it is implemented and maintained, and the operational environment.

Section 1201 of SAFETEA-LU also requires DOT to set data exchange formats for real-time information programs. The exchange formats are the subject of a separate Interim Guidance[2]. Therefore, the costs of compliance with that rule are not included here.

This Regulatory Benefit-Cost Analysis considers the costs and benefits associated with establishing real-time information as described in §511.311 and §511.313 within a four-year time period. It is recognized that §511.313(c) identifies that metropolitan areas may define "Routes of significance" which will be under the coverage of a real-time information program within a six-year time period. The costs and benefits associated with implementation of §511.313(c) is not considered in this analysis because the "Routes of significance" are an unknown quantity.

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[1] This report is available at the following URL: http://www.itsdocs.fhwa.dot.gov/JPODOCS/REPTS_TE/13882.html

[2] Further details on the data exchange formats and the interim guidance on their use are available at the following URL: http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=2007_register&docid=fr15oc07-84.pdf

This Regulatory Benefit-Cost Analysis is organized in the following manner:

- A discussion on the Analytical Approach applied to defining the scope of the implementation of this program
- A description of the methodology used to estimate compliance costs
- A description of the methodology used to estimate benefits
- A discussion on the estimated economic impact of the benefits and costs of the real-time information program

All monetary values shown in this analysis have been adjusted to Year 2004 constant dollars based upon the Consumer Price Index published by the Bureau of Labor Statistics.[3]

## A. ANALYTICAL APPROACH

This section of the Regulatory Benefit-Cost Analysis considers the scope of implementing the real-time information program, and the compliance costs for States corresponding to the 50 largest metropolitan areas. Metropolitan Statistical Areas (MSA) were considered in this approach because of the geographic and spatial consistency of reported data obtained from a variety of sources.

The costs for establishing a real-time information program, updating a regional architecture, and operating/maintaining a real-time information program are presented separately.

Establishing a real-time information program in 50 largest MSAs:

A real-time information program monitors the transportation system operations in a metropolitan area according to the coverage, accuracy, and currency parameters defined in this proposed rule. For metropolitan areas, the proposed rule would require that travel speeds on Interstate sections be reported with 85% accuracy, updated every 10 minutes. The cost of establishing a real-time information program in a metropolitan area depends to a large extent upon the existing real time monitoring and reporting capabilities. Based on data from the Intelligent Transportation Systems Deployment tracking program [see www.itsdeployment.its.dot.gov], the Texas Transportation Institute [see http://mobility.tamu.edu] and the 511 Deployment coalition [see www.deploy511.org] regarding existing capabilities, the 50 relevant MSAs can be categorized as high, medium, or low cost to establish a real-time information program. A list of the cities and their categorization is included in Appendix A.

Establishing a statewide real-time information program:

Outside metropolitan areas, the parameters for a real-time information program would require monitored information to be updated every 20 minutes. Real time

[3] U.S. Department Of Labor, Bureau of Labor Statistics Washington, D.C., Consumer Price Index All Urban Consumers - (CPI-U), U.S. city average (9/19/2007), available at the following URL: http://www.bls.gov/cpi/cpid0709.pdf

travel speed information would be excluded from real-time information programs applied outside the metropolitan areas. Significant additional monitoring will likely not be required for coverage of non-metropolitan area roads. Therefore, the effort to establish a real-time information program for non-metropolitan areas is regarded as analogous to setting up a statewide 511 traveler information system[4] or updating an existing one. Costs of existing statewide 511 systems are used as the basis for that cost estimate.

Updating regional architectures:

The level of effort required to update a regional ITS architecture, as defined by a State and/or a Metropolitan Planning Organization (MPO) is estimated to be roughly a quarter of the effort required to initially develop a regional architecture. Costs of regional architecture development from the Preliminary Regulatory Evaluation that accompanied the rulemaking that resulted in 23 CFR 940 were used as the basis for that cost estimate[5].

Operations and maintenance:

The estimated operating/maintenance costs of the real-time information program would be 10% of the initial capital and labor required to establish the program in a given region. This estimate is based upon case studies of existing 511 traveler information systems and generally accepted systems engineering principles.

## B. COST ESTIMATION METHODOLOGY

The following four principal categories of compliance cost were estimated for the NPRM:

- Cost of establishing a real-time information program in the 50 largest MSAs within four years of publication of the final rule, including travel speeds updated every 10 minutes;
- Cost of establishing a real-time information program statewide within four years of publication of the final rule; including travel and weather information updated every 20 minutes;
- Annual operating and maintenance costs for a real-time information program (statewide and metropolitan area);
- Cost of updating regional architectures to include the establishment of a real-time information program.

[4] In 2000, the Federal Communications Commission designated "511" as the national number for traveler information. 511 systems provide traveler information via phone and websites in many states. More information is available at the following URL: http://www.deploy511.org.

[5] The Preliminary Regulatory Evaluation document was part of FHWA Docket No. FHWA-1999-5899. This is available at the following URL: http://dmses.dot.gov/docimages/pdf47/82833_web.pdf

## B.1 Cost Estimation Methodology for Establishing a Real-Time Information Program in the 50 Largest Metropolitan Areas

Cost data from existing 511 deployments, as well as costs of additional freeway monitoring to meet the requirements of this proposed rule, were used to estimate the cost of compliance with the NPRM's requirements in the 50 largest MSAs. Data from the U.S. DOT ITS Joint Program Office and from the Texas Transportation Institute (TTI) were used to estimate the costs of establishing a real-time information program. Low, medium, and high cost estimates are provided based on the suitability of existing monitoring capabilities to meet real-time information program requirements.

The cost of a real-time information program as described in the rule is considered to be analogous to the cost of creating a new 511 system, or upgrading an existing 511 system. In the medium and high cost cases, this also involves improving the geographic coverage, content, and currency of the data collection feeding the 511 system. More than half of the 50 of the largest metro areas already have some 511 system in place, so an estimate of the cost of starting from "zero" is relevant only for a few of the high cost cities. The cost of improved monitoring of data on real-time traffic and travel conditions, particularly traffic speed information, on Interstates represents the largest proportion of the estimated cost.

Based on deployment data from the 2005 ITS Deployment Tracking Survey[6] and the TTI Urban Mobility Studies,[7] a national cost estimate was developed for deploying real-time information programs in the 50 largest metropolitan areas. Seven cities were determined to be low cost because they are close to meeting the proposed real-time information program characteristics. Eleven cities were determined to be medium cost because they possess some monitoring on more than half of the freeway miles and they already operate a 511 system and/or traveler information Web sites. Thirty-two cities were determined to be high cost because they have limited freeway monitoring and thus have a restricted amount of information to share via a 511 system.

Multiplying the low, medium, or high estimates by 50 to derive a nationwide estimate would not be a realistic estimate, as the conditions for the "low" estimate (existing system is close to compliance with the rule) do not apply to all 50 metropolitan areas, nor do the "high" conditions (existing monitoring/data collection is not close to compliance with the rule) apply to all 50 metropolitan areas.

Information on current monitoring capability was not found for four of the metropolitan areas [Memphis, Richmond, Birmingham, and Rochester], and thus were assumed to be high cost.

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[6] Data on freeway miles under surveillance as reported by the Metropolitan Areas to researchers from the Oakridge National Laboratory in 2005 is available at http://www.itsdeployment.its.dot.gov. "Freeway surveillance" is the term used by this source for "the capability to monitor" as referred to in section 1201 of SAFETEA-LU

[7] The Texas Transportation Institute (TTI) conducts mobility studies and issues reports annually on their findings. The 2005 report is available at the following URL: http://mobility.tamu.edu/ums/report/

The national estimate was made by assigning 7 cities as low, 11 as medium, and 32 as high costs based on actual deployment status of relevant components of a real-time information program. Total number of Interstate miles per city and deployment status was determined from the 2005 ITS Deployment Tracking Survey and the TTI Urban Mobility Studies;

- "low" cost cities have more than 80% of Interstate miles in the MSA currently monitored,
- "medium" cost cities have 50-80% of Interstate miles being monitored, and
- "high" cost cities have fewer than 50% of Interstate miles being monitored.

Table A-1 in the appendix provides estimates of additional highway miles that will need to be monitored in each MSA and each MSA categorization as high, medium, or low.

### B.2 Cost Estimation Methodology for Establishing a Statewide Real-Time Information Program in all 50 States

The requirements for real-time information programs outside metropolitan areas would include construction and weather information, but not real time travel speeds on Interstates. Therefore, new monitoring requirements are likely to be minimal in most States; the primary cost will be formatting the information in standard formats and providing it to the public and other public sector agencies via the 511 system and the Internet. Establishing a real-time information program in a State would be analogous to the cost of a major update of a statewide 511 system. Most States already have 511 systems in place or will by the end of 2010.[8] Based on the cost of a major update of an existing 511 system in Arizona, the estimated cost for these deployments is $1.51 million per State.[9] This does not include the additional cost of metro coverage in that State, so the total cost of the program presented later is the sum of metro area and statewide costs.

The real-time information program would include monitoring certain types of real time information and providing "the capability and means to share that data with State and local governments and the traveling public." The assumption is that real-time information program data will be used by existing 511 systems and incident management systems, as well as other applications. However, the rule does not include requirements for any particular applications of the monitored information beyond basic 511 and inter-agency information sharing. Therefore, costs of other possible applications using the monitored data are not included here.

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[8] This claim appears in the following URLs: http://www.deploy511.org/deploystatus.htm OR http://www.fhwa.dot.gov/trafficinfo/511.htm. The statistics provided are used to represent the network and deployment for the Metropolitan Statistical Areas in question. It was found that they are based upon the similar but slightly different Metropolitan Planning Area boundaries for each region.

[9] This cost is based on costs of an actual upgrade to an existing 511 deployment in Arizona. "Interim Analysis Report Model Deployment of a Regional, Multi-Modal 511 Traveler Information System" http://www.itsdocs.fhwa.dot.gov//JPODOCS/REPTS_TE//14248.htm.

The District of Columbia is assumed to be covered by the real-time information program for the DC MSA, so there is not a separate statewide cost for DC.

### B.3 Cost Estimation Methodology for Operating and Maintaining a Real-Time Information Program for Eight Years in the 50 Largest Metro Areas

Based on analysis of annual costs for existing 511 systems, operations and maintenance costs were estimated at 10% of original deployment costs per year. Annual costs include costs for 511 telecommunications, labor, and equipment replacement.

### B.4 Cost Estimation Methodology for Updating a Regional ITS Architecture

An analysis of the cost of developing a regional ITS architecture was developed as part of this Regulatory Cost Analysis accompanying the rulemaking that resulted in 23 CFR 940. As part of that analysis, the cost of developing a regional architecture "from scratch" for a large metropolitan area was estimated to be $100,000 on average in 2000 dollars, or $109,698 in 2004 dollars. The cost was based on a survey of staff from impacted Metropolitan Planning Organizations (MPOs). An update should require no more than a quarter as much effort as the original development, given that much of the needed stakeholder coordination should already be in place from the initial architecture development process. Reflecting a new real-time information program should require a relatively modest modification to an existing architecture.

## C. BENEFITS ESTIMATION METHODOLOGY

The effects of establishing a real-time information program include both quantitative and qualitative benefits to the general commuting public, the environment, as well as to the subset of traveler who actively acquire and use traffic information. The benefits of information are through its use, so the benefits presented here as being achievable are based on the information being available to the public so that they may use it.

The methodology applied to estimate mobility, safety, and environmental benefits from the establishment of a real-time information program is based on the outcome of a comprehensive evaluation conducted in the Atlanta metropolitan region of the Georgia NaviGAtor system.[10] For purposes of this analysis, no benefits have been estimated for statewide systems outside of major metropolitan areas. Based on the Georgia evaluation, the greatest benefits result from reductions in excess hours of travel and in congestion; therefore, any benefits purely from the statewide system are unlikely to greatly affect the overall benefits described below.

[10] A summary of this analysis may be found at http://www.benefitcost.its.dot.gov/its/benecost.nsf/0/C56D9AB9E2F47E79852572170053B11B?OpenDocument&Query=Home. The full report by URS Corporation, "Benefits Analysis for the Georgia Department of Transportation NaviGAtor Program." August 2006. is available at the following URL: http://www.ops.fhwa.dot.gov/travelinfo/gdotbenefit/index.htm

The Georgia NaviGAtor system has deployed extensive monitoring on 150+ miles of Interstate and freeways in order to provide traveler information and to improve freeway management and incident management. The evaluation of the system measured the incident delay savings, emissions reductions, fuel savings, and secondary crash reduction savings from quicker incident detection, response, and clearance through the use of the NaviGAtor system. The analysis of the Georgia NaviGAtor system is particularly thorough in that it used actual incident logs to determine benefits.

The findings from the NaviGAtor system were extrapolated to the 49 other metropolitan regions that would be subject to this proposed rule.

The Georgia NaviGAtor estimation methodology applied a number of region-specific variables including the percentage of truck traffic on the highways, personal vehicle occupancy rate, the cost per hour per person for time spent in travel, the cost per hour per truck for time spent in travel, the personal and commercial vehicle fuel consumption rates, the cost of gasoline and diesel, and the average cost of a two-vehicle property-damage-only crash. In computing the benefits for the 50 largest metropolitan regions, the values of these variables were adjusted to reflect national averages and 2005 Vehicle Miles Traveled data was used.

The Georgia NaviGAtor program includes a substantial number of elements that are not required by this rule, such as safety patrols deployed on Atlanta's freeways to assist and remove accidents or stalled vehicles, thus most of the benefits found under that program will not be achieved under that program will not be gotten by this rule. Only the benefits that are directly attributable to advanced information systems should be included as a benefit of this rule. To capture this, the benefits were calculated assuming that only 1/10 of the delay reduction was directly attributable to the advanced information system. Sensitivity analysis was also performed assuming that 1/3 of the delay reduction was directly attributable to the advanced information system.

**The Georgia NaviGator Project was undertaken in Atlanta, one of the country's most heavily congested MSAs.**

**Is using the benefits results from the Georgia evaluation reasonable in extrapolating to other major metropolitan areas?**

## D. ESTIMATED ECONOMIC IMPACT OF THE BENEFITS AND COSTS OF THE REAL-TIME INFORMATION PROGRAM

This section provides details of the specific assumptions and details of calculation methods used to estimate the proposed rule's compliance costs and benefits. The benefit-cost analysis provided here applies the general principles described in Circular No. A-94,

"Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs" issued by the Office of Management and Budget in Executive Office of the President.[11]

Preliminary assessment of benefits and costs, applying a Net Present Value Base Case Analysis, in which there are assumed real discount rates of 3 and 7 percent.

### D.1 Cost of Establishing a Real-Time Information Program in Metropolitan Areas

The cost of establishing a real-time information program was based on known costs for existing 511 systems, with additional freeway monitoring and data fusion costs estimated for the "medium" and "high" parts of the range.

The cost elements include labor, equipment, marketing/outreach, standards compliance, and telecommunications for the 511 system. Additional data needed beyond existing systems in place may be achieved through new data monitoring infrastructure or by purchasing data from the private sector. All 50 metropolitan areas have multiple private sector traveler information data providers.[12]

Based on data from the ITS Deployment Tracking Program, 7 of the 50 largest MSAs already have monitoring on at least 80% of freeway miles and already have 511 and are thus assumed to have "low" cost to establish a real-time information program. Eleven MSAs have monitoring on 50-80% of freeway miles and are thus assumed to have "medium" costs to establish a real-time information program. Four smaller cities where data on existing monitoring is not available are also assumed to have "high" cost. Thirty-two MSAs have monitoring in place on fewer than 50% of freeway miles and will require "high" costs to establish a real-time information program.

Table A-2 indicating the estimated incremental costs for these cities, based on the assumptions above and the incremental costs described below, is included in Appendix A. **Do the estimated costs accurately reflect the likely costs that individual cities will incur to comply with the statute?**

Since the cost of additional freeway monitoring is much greater than the cost of setting up a 511 system, based on existing case studies, the main determinant of cost to establish a real-time information program would be the extent and quality of the existing monitoring network. All 50 cities have multiple private sector real-time information data

[11] The contents of Circular No. A-94 are available at the following URL: http://www.whitehouse.gov/omb/circulars/a094/a094.html

[12] Including but not limited to Navteq, Inrix, XMNavTraffic, and Westwood One. More than half of the 50 cities have received or will receive funding through the Intelligent Transportation Infrastructure Program (ITIP), which should accelerate the availability of high quality real time travel information by private sector providers. Please see the last section of this cost analysis for a discussion of issues and opportunities for private sector data. More information on the ITIP Program is available at the following URL: http://ops.fhwa.dot.gov/travelinfo/ttidprogram/ttidprogram.htm

providers, so cities may be able to purchase additional data to establish a real-time information program more quickly, but not necessarily at lower cost.[13]

D.1.1 Cost for "low" cities that already have 511 and monitoring on 80% of freeway miles

For these low cost cities, the estimated cost is the cost of minor upgrades to the existing 511 system in terms of data content, currency, and accuracy. The upgrades may be achieved through either additional monitoring by the State DOT or purchase of data from the private sector.

The cost of additional monitoring is assumed to be $76,789[14] per freeway mile, with an average of 32 miles[15] to be upgraded.

Per city:
Upgrade to 511 and Web site to include 1201 information = $1,512,040.[16]
Additional data collection/purchase ($76,789/mi * 32 mi) = $2,457,248.

***Total for seven "low" cities at $3.97 million each = $27.78 million.***

D.1.2 Cost for "medium" cities that have monitoring on 50-80% of freeway miles and limited 511 capabilities

Each of these 11 cities have existing public sector 511 phone systems and/or traveler information websites, but not necessarily with all of the information content, quality, and currency that would be required by the proposed rule. For these cities, the estimated cost includes major upgrades to the existing 511 and Web site, and significant additional monitoring. The upgrades may be achieved through either additional monitoring by the State DOT or purchase of data from the private sector.

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[13] It is possible that private sector probe data will be cheaper and more accurate than current monitoring technologies, but we have no data on how much cheaper or more accurate as these probe data technologies are not yet widely deployed in the U.S.

[14] This cost is based on estimates from Business Models and Cost Considerations for 511 Deployment, a 2002 report on 511 deployment costs, which assumed that the monitoring was done with loop detectors, video, CCTV, and/or microwave sensors. The cost per mile for those technologies range from $29,000 to $70,000 per mile per technology, including systems integration and installation costs, but not backhaul telecommunications. Other probe data technologies not available in 2002 could cost significantly less, but that has not been proven. The 2002 costs represent a reasonable, conservative estimate of freeway monitoring costs with current technology. The full report is available at the following URL: http://www.its.dot.gov/511/511_Costs.htm.

[15] Average number of freeway miles not under surveillance in Houston, San Diego, Minneapolis/Saint Paul, Buffalo, Sacramento, Salt Lake City, and Orlando. Current coverage and total number of Interstate miles per metropolitan planning area were obtained from the ITS Deployment Tracking survey available at the following URL: http://www.itsdeployment.its.dot.gov.

[16] This cost is based on costs of an actual upgrade to an existing 511 deployment in Arizona, from "Interim Analysis Report Model Deployment of a Regional, Multi-Modal 511 Traveler Information System", available at the following URL: http://www.itsdocs.fhwa.dot.gov//JPODOCS/REPTS_TE//14248.htm.

The cost of additional monitoring is assumed to be $76,789 per freeway mile[17], with an average of 149 miles[18] to be upgraded.

As noted earlier, the average of 149 miles of additional monitoring needed is based on data from 11 cities for which deployment status data is available.

Per city:
Major upgrade to website and 511 systems to meet real-time information program requirements = $1,512,040 [19]
Additional data collection/purchase ($76,789/mile*149 mi = $11.44 million)

Total:
11 "511" upgrades @ $1.51 million each = $16.63 million
11 cities of freeway monitoring upgrades @ $11.44 million each = $125.86 million

***Total for "medium" cities: = $142.49 million***

D.1.3 Cost for "high" cost cities that have monitoring on less than 50% of freeway miles
Fewer than half of these 32 cities already have 511 systems, and the existing ones tend to be statewide road closure Web sites that are updated infrequently and appear to lack the characteristics for a real-time information program defined in this rule. Therefore, the cost estimate is based on the cost of new 511 systems for major metro areas.

Per city:
New 511 systems = $1,995,053 each[20]
Additional monitoring is assumed to be $76,789 per freeway mile, with an average of 230 additional miles[21] to be monitored = $17.66 million each.

Total:

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[17] This cost is based on estimates from 2002 report http://www.its.dot.gov/511/511_Costs.htm
[18] Average number of freeway miles not under surveillance in Milwaukee, Providence, Portland, San Antonio, San Francisco including San Jose, Cincinnati, New York New Jersey, Washington, Tampa, and Atlanta. Current coverage and the total number of Interstate miles per metropolitan planning area are from the 2005 ITS Deployment tracking survey, available at the following URL: http://www.itsdeployment.its.dot.gov.
[19] This cost is based on costs of an actual upgrade to an existing 511 deployments in Arizona, from "Interim Analysis Report Model Deployment of a Regional, Multi-Modal 511 Traveler Information System", available at the following URL: http://www.itsdocs.fhwa.dot.gov//JPODOCS/REPTS_TE//14248.htm.
[20] 511 Deployment Costs: A Case Study", November 2006, 511 Deployment Coalition. Available at the following URL: http://www.deploy511.org/minutereports.htm#511costs. Average costs for new metropolitan area 511 systems in Tampa, Southeast Florida, and Central Florida.
[21] Average number of freeway miles not under surveillance in Philadelphia, Charlotte, Denver, Detroit, Phoenix, Seattle, Los Angeles including Riverside, Austin, Dallas, Chicago, Miami, Kansas City, Baltimore, Nashville, Boston, Indianapolis, Pittsburgh, Columbus, Saint Louis, Hampton Roads, Las Vegas, New Orleans, and Cleveland. Current coverage and total number of Interstate miles per metropolitan planning area are from the 2005 ITS Deployment Survey, available at the following URL: http://www.itsdeployment.its.dot.gov

32 new 511 systems at $1.99 million each = $63.84 million
32 cities of freeway monitoring upgrades at $17.66 million each = $565.16 million

***Total for "high" cities = $629.01 million***

### D.2 Cost of Establishing Statewide Real-Time Information Programs

Fifty States will be required to establish statewide real-time information programs that provide construction and weather information, including road closures, but not real time travel speed information. The entirety of the District of Columbia would be covered by the metro system for that area, so a separate statewide system would not be required. The assumption is that for statewide systems, monitoring can be obtained from existing systems used for other purposes. For example, existing road weather monitoring station system could be used to provide real time weather information to travelers, and existing work zone management systems could be used to provide road closure information. The cost of establishing a statewide real-time information program is assumed to be similar to that of implementing a 511 system in a State.

The average cost of new statewide 511 systems is about $2.2 million,[22] including planning, implementation, and the first year of operations and maintenance (in 2002 dollars). [This is not much more than the cost of a new metro system from the previous section. Costs of new statewide and metro 511 systems are quite similar, since most of the cost of a 511 system is for disseminating information rather than collecting it.] However, most States already have a 511 system in place or will by the end of 2010.[23] Therefore, the cost of establishing a statewide real-time information program should be analogous to an update of an existing statewide 511 system, or $1.51 million[24] (in 2004 dollars).

Estimated cost of implementing real-time information programs in states:
***50 States times $1.51 million = $75.6 million***

Using the above assumptions, the cost for each State to implement a real-time information program, excluding major metropolitan areas, is $1.51 million. Using 10% as the basis for annual operating costs results in $151,000 annual operating costs per State. **Do the estimated costs accurately reflect the likely costs that individual states will incur to comply with the statute?**

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[22] "511 Deployment Costs: A Case Study", November 2006, 511 Deployment Coalition, available at the following URL: http://www.deploy511.org/minutereports.htm#511costs. Average costs for Utah, Arizona, North Carolina, Virginia, Kansas, and Washington State.
[23] This claim appears in the following URLs: http://www.deploy511.org/deploystatus.htm OR http://www.fhwa.dot.gov/trafficinfo/511.htm.
[24] This cost is based on costs of an actual upgrade to an existing 511 deployment in Arizona (Interim Analysis Report Model Deployment of a Regional, Multi-Modal 511 Traveler Information System), available at the following URL: http://www.itsdocs.fhwa.dot.gov//JPODOCS/REPTS_TE//14248.htm.

## D.3 Cost of Maintaining and Operating a Real-time Information Program

Based on case studies of existing 511 systems, the maintenance and operating costs for 1201 are assumed to be 10% of the cost of the original implementation each year. This estimate covers labor to maintain the system and replacement hardware and software. If the metro area chooses to purchase data from private sector providers, or an entire turnkey system, the annual cost would be the license fee from that vendor.

Based on the estimates in sections 1 and 2, the total cost of establishing real-time information programs in all 50 major cities plus statewide systems is about $874.9 million. An operations and maintenance cost of ten percent would be $87.5 million per year nationwide.

Costs of maintaining expanded metro systems are not included, as the schedule for deployment of expanded coverage will be determined by cost-constrained state plans.

## D.4 Cost of Updating a Regional Architecture to Include a Real-Time Information Program

The universe of planning organizations impacted by the rule is taken as 50 State DOTs, plus the District of Columbia. The cost of updating a regional architecture to include the real-time information program was considered to be one quarter the cost of developing such architecture in the first place. Given that some of the stakeholder coordination should already be in place from the architecture development process, it seems reasonable to assume that updating the architecture should be no more than a quarter of the effort of developing the original architecture.

The estimated cost of developing a regional architecture, from the Regulatory Evaluation accompanying the architecture rule, is $100,000. That number was based on a survey of planning staff at State DOTs and MPOs circa 1999. It is reasonable to presume that those locations that have established a regional architecture would have continued to maintain the fidelity of the architecture to reflect current transportation operations. Assuming that the regional architecture is properly maintained, it would be a relatively small effort to complete an update to include enhanced real-time information programs. Therefore, adjusting to 2004 constant dollars, the estimate for updating the architecture to include a real-time information program is $27,425, or a quarter of the cost to create a new regional architecture.

Nationwide estimate: ***$27,425 times 50 States + DC = $1.399 million***

The architecture should be updated as part of the planning process for implementing the system. The systems are assumed to be implemented by the end of 2014. It is assumed that the systems will be implemented incrementally in metropolitan areas, with the low-cost cities implemented in the first two years and the medium- and high-cost cities implemented on an increasing scale over the four-year period for implementation – 2011 through 2014. Operations and maintenance costs are assumed for the systems

implemented incrementally over the time period. For 2011, it is assumed that three low-cost, two medium-cost and five high-cost cities will be implemented. For 2012, it is assumed that an additional four low-cost, four medium-cost and fourteen high-cost cities will be implemented. For 2013, it is assumed that an additional five medium-cost and thirteen high-cost cities will be implemented. For 2014 and beyond, it is assumed that all fifty cities are implemented. The total costs are discounted, for purposes of this analysis, to 2008 as the base year.

### D.5 Total Estimated Cost of Establishing Real-Time Information Programs

This estimate sums the cost of each element of the proposed rule.

| | |
|---|---|
| Updating regional architecture, 50 States + DC | = $ 1.399 million |
| Implementing in 50 metro areas | = $799 million |
| Implementing Statewide | = $76 million |
| **Estimated total national capital cost:** | **= $875 million** |
| **Estimated annual nationwide operating cost:** | **= $87.5 million** |

Projected Annual Costs, Combined Capital and Operating Costs (rounded):
2010: $ 1.399 million
2011: $163 million
2012: $389 million
2013: $392 million
2014: $ 87.5 million
2015: $ 87.5 million
2016: $ 87.5 million
2017: $ 87.5 million
2018: $ 87.5 million
2019: $ 87.5 million
2020: $ 87.5 million
2021: $ 87.5 million

| | |
|---|---|
| **Total Combined Cost by 2021:** | **$1,646 million** |
| **Net Present Value of Total Cost at 3%:** | **$1,405 million** |
| **Net Present Value of Total Cost at 7%:** | **$1,160 million** |
| **Annualized Costs Over 12 Years at 3%** | **$141 million** |
| **Annualized Costs Over 12 Years at 7%** | **$146 million** |

### D.6 Benefits to Travelers from Real-Time Information Programs

The effects of real-time information program deployments include both quantitative and qualitative benefits to the general commuting public, the environment, as well as to the subset of traveler who actively acquire and use traffic information. The methodology

applied to estimate mobility, safety, and environmental benefits from establishing a real-time information program is based on the outcome of a comprehensive evaluation conducted in the Atlanta metropolitan region of the Georgia NaviGAtor system. This evaluation measured the incident delay savings, emissions reductions, fuel savings, and secondary crash reduction savings from quicker incident detection, response, and clearance through the use of the NaviGAtor system.

The Georgia NaviGAtor system includes both advanced information systems (detection and communication) and a roadside "Hero" program of quick response vehicles deployed on the freeway system. Therefore, only 1/10 of the benefits of the Georgia NaviGAtor system was attributed to the rule. A sensitivity analyses was performed to examine how the benefits would change if 1/3 of the delay reductions shown were due to the advanced information system.

A previous evaluation of the Atlanta NaviGAtor found that a little over 1/3 of the reduction in a typical incident duration was due to incident detection and, verification, and dispatch (mostly advanced information) and a little less than 2/3 due to reaching the location after dispatch and clearance once at the location[25].
The Georgia NaviGAtor estimation methodology applied a number of region-specific variables including the percentage of truck traffic on the highways, personal vehicle occupancy rate, the cost per hour per person for time spent in travel, the cost per hour per truck for time spend in travel, the personal and commercial vehicle fuel consumption rates, the cost of gasoline and diesel, and the average cost of a two-vehicle property-damage-only crash. In computing the benefits for the 50 largest metropolitan regions, the values of these variables were adjusted to reflect national averages. The Georgia-specific values and the national average values are listed in Table 2 with sources for the national values.

The Georgia NaviGAtor study is based on 141 centerline miles of freeway coverage, however there are 342 centerline miles of freeway in the Atlanta metropolitan region. Therefore, benefits were adjusted to reflect a full real-time information program in the Atlanta metropolitan region. Furthermore, the national variables for the cost per hour per person for time spent in travel, the cost per hour per truck for time spend in travel, the personal and commercial vehicle fuel consumption rates, and the cost of gasoline and diesel were replaced in the Georgia NaviGAtor study and benefits were recomputed. These replacements were made to reflect more recent and nationally appropriate values. Findings from the NaviGAtor system were extrapolated to the 49 other metropolitan region. The Atlanta results were indexed for each MSA based on the vehicles-miles of travel for that city. Next, an attempt was made to capture the incremental benefits of the rule, by removing benefits for miles already being monitored in each city. . Incremental benefits were calculated using the percentage difference between the amount of freeway mileage currently under surveillance and the total freeway mileage in each city. The

[25] Presley, et al. "Calculating Benefits for NaviGAtor, Georgia's ITS" Paper presented at the 79th Transportation Research Board Annual meeting, Washington DC, 2000.

outcome from this estimation process is summarized in Table 1 in annual cost savings from a fully established real-time information program in the 50 largest metropolitan regions. This analysis indicates that annual savings from the rule will be about $282 million.A table indicating the annual benefits for each city can be found in Table A-3 of the Appendix.

**Table 1**

**Annual Benefits of the Rule**

| Benefits Measure | Benefit | | NaviGATor expanded | Sensitivity Analysis: 1/3 delay reduction due to ATIS | **Estimated Benefits of the Rule 1/10 delay reduction due to ATIS** |
|---|---|---|---|---|---|
| | | | Cost Savings | Cost Savings | **Cost Savings** |
| Mobility | 320,677,944 | vehicle hours of incident delay savings | $4,430,431,143 | $1,476,810,381 | **$443,043,114** |
| Environment | 8,222 | tons of HC emissions reduced. | $77,365,881 | $25,788,627 | **$7,736,588** |
| | 11,581 | tons of NOx emissions reduced. | | | |
| | 446,737,789 | gallons of gasoline consumption reduced | $1,205,607,850 | $401,869,283 | **$120,560,785** |
| | 51,356,246 | gallons of diesel consumption reduced | | | |
| Safety | 20,599 | secondary crashes reduced | $78,139,679 | $26,046,560 | **$7,813,968** |
| **TOTAL COST SAVINGS FROM FULL INSTRUMENTATION IN 50 REGIONS:** | | | $5,791,544,552 | $1,930,514,851 | **$579,154,455** |
| **SUM OF INCREMENTAL COST SAVINGS IN 50 REGIONS:** | | | $2,832,899,384 | $944,299,795 | **$283,289,938** |

All monetary values shown in Year 2004 constant dollars

**Table 1. Annual Benefits Summary from 100% Establishment of Real-Time Information Programs in the 50 Largest Metropolitan Region from Reduction in Incident Clearance With Sensitivity Analyses**

Given the absence of region-specific incident counts, the rate of incidents as a function of freeway vehicle-miles traveled in the Atlanta metropolitan region was applied to the other 49 regions. Consequently, a region with double the annual freeway vehicle-miles traveled in Atlanta is estimated to incur double the cost savings from a fully established real-time information program in that region. The daily vehicle miles of travel on Interstate, other freeways and expressways was acquired from the U.S. Department of Transportation report "Highway Statistics 2005."[26] The specific methodology applied by the Georgia NavGAtor study is presented in the report "Benefits Analysis for the Georgia Department of Transportation NaviGAtor Program.[27]"

It is important to note that these benefits reflect delay savings resulting from improved response to non-recurring events. The authors of the NaviGAtor Program study admit that total benefits estimation was not possible under their study.

> *"the NaviGAtor website (www.georgia-navigator.com) currently registers over half a million visits per month, clearly indicating that Georgians derive a significant benefit from the content (images, travel times, incident info, etc.) that it provides. Attempting to quantify the benefits of the NaviGAtor website and other Advance Transportation Information Systems (ATIS), such as the Changeable Message Signs and the *DOT phone service is very complex; however, and was not included in this analysis."*

The benefits estimation does not include traveler information user benefits experienced by routine users of the system to adjust trip time and route in the form of enhanced trip reliability.

Additionally, the establishment of a real-time information program will greatly facilitate and enhance a score of other functionalities such as evacuation planning and implementation, infrastructure maintenance, or motorist assistance operations. These types of benefits, although significant and substantial, are not yet fully quantified through field evaluation either due to their inherent difficulty of assessment or cost of evaluation.

Reduced congestion from even a small percentage of travelers shifting time or route based on real-time information could yield additional benefits to all travelers that cannot be reliably estimated at this time, including reduced costs for new road construction and fewer police-reported accidents. Qualitative "quality of life" benefits might accrue to individual travelers, including reduced stress and ability to avoid congestion by rescheduling discretionary trips. These qualitative benefits are not included in this analysis. Therefore, the actual benefit of real-time information programs will likely be higher than is estimated here.

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[26]Office of Highway Policy Information - Federal Highway Administration, U. S. Department of Transportation. "Highway Statistics 2005." Section 5, Table HM 71. The statistics for Federal Aid Urban Area were chosen to represent the Metropolitan Statistical Areas., which are available at the following URL: http://www.fhwa.dot.gov/policy/ohim/hs05/xls/hm71.xls

[27] URS, "Benefits Analysis for the Georgia Department of Transportation NaviGAtor Program." August 2006, available at the following URL: http://www.ops.fhwa.dot.gov/travelinfo/gdotbenefit/index.htm.

| Evaluation Variable | Georgia NaviGAtor | National Value | Source/Details |
|---|---|---|---|
| Percentage of trucks on freeways | 8.00% | 5.26% | 2005 Annual Vehicle Distance Traveled by Highway Category and Vehicle Type. "***Highway Statistics 2005***." , All Urban category, Passenger cars and other 2-axle 4-tire vehicles count versus single-unit 2-axle 6-tire or more and combination trucks. |
| Personal vehicle occupancy rate | 1.16 | 1.14 | *No documented information is available on national personal vehicle occupancy rate of vehicles on freeways. National personal vehicle occupancy rate for all trips is 1.63, while for work trips the value is 1.14. The NaviGAtor value of 1.16 is based on home to work trips for Atlanta. |
| Cost per hour for personal travel | $17.23 | $11.20 | From Recommended Valuation of Travel Time Saving 2003 update: Emil H. Frankel, "Revised Departmental Guidance: Valuation of Travel Tiem in Economic Analysis," USDOT-Office of the Secretary of Transportation, February 11, 2003. http://ostpxweb.dot.gov/policy/Data/VOTrevision1_2-11-03.pdf |
| Cost per hour for commercial vehicle travel | $32.15 | $32.15 | **"*Status of the Nation's Highways, Bridges, and Transit: 2006 Conditions and Performance*",** U.S. DOT, FHWA. Uses a "conservative" value of $32.15. from the FHWA Highway Economic Requirements System (HERS) Model. |
| Personal vehicle mileage | 25.8 mpg | 19.7 mpg | 2005 Annual Vehicle Distance Traveled by Highway Category and Vehicle Type. "Highway Statistics 2005." Average fuel consumption per gallon. |
| Truck vehicle mileage | 7.0 mpg | 6.7 mpg | 2005 Annual Vehicle Distance Traveled by Highway Category and Vehicle Type. "Highway Statistics 2005." Average fuel consumption per gallon. |
| Cost of Gasoline | variable / $1.52 avg. Year 2003 | $2.407 | Energy Information Administration, Official Energy Statistics from the U.S. Government. Average of Jan-Dec 2006 Regular Grade Retail Price per gallon. http://tonto.eia.doe.gov/oog/info/gdu/gaspump.html - Converted from 2006 $ to 2004 $ |
| Cost of Diesel | variable / $1.52 avg. Year 2003 | $2.535 | Energy Information Administration, Official Energy Statistics from the U.S. Government. Average of Jan-Dec 2006 Retail price per gallon. http://tonto.eia.doe.gov/oog/info/gdu/dieselpump.html - Converted From 2006 $ to 2004 $ |
| Cost of a two-vehicle property-damage-only crash | $3,793.36 | | NaviGAtor study applied data from U.S. Department of Transportation, National Highway Traffic Safety Administration, "**The Economic Impact of Motor Vehicle Crashes 2000."**Washington, DC: 2002, available at http://www.nhtsa.dot.gov/staticfiles/DOT/NHTSA/Communication%20&%20Consumer%20Information/Articles/Associated%20Files/EconomicImpact2000.pdf - Converted From 2000 $ to 2004 $ |
| Cost/Ton HC emissions | $1,745 | | From NHTSA NHTSA Office of Regulatory Analysis and Evaluation, National Center for Statistics and Analysis (March 2006); Table VIII-5 Lifetime Monetized Societal Impacts, Unreformed CAFÉ, 2008 MY; available at http://www.nhtsa.dot.gov/staticfiles/DOT/NHTSA/Rulemaking/Rules/Associated%20 |
| Cost/Ton NOx emissions | $5,441 | | |

**All monetary values shown in 2004 Constant dollars**

**Table 2. Variables Applied in Calculation of Benefits**

Table 1 shows that the additional monitoring will accrue incremental societal benefits potentially valued at $283 million per year nationally for all 50 cities beginning in 2014. At a discount rate of 7% the annualized benefits of the rule will equal $162 million. The annualized costs will equal $146 million. This will result in annualized net benefits of about $16 million.

Based on the annual costs described above in section D.5 and the annual benefits noted above, the following table summarizes the annualized costs, benefits and net benefits (in million $) at discount rates of 3% and 7%.

| **3%** | |
|---|---|
| NPV Costs | $1,404.62 |
| NPVBenefits | $1,765.04 |
| **Annualized Costs** | **$141.11** |
| **Annualized Benefits** | **$177.32** |
| **Annualized Net Benefits** | **$36.21** |
| | |
| | |
| **7%** | |
| NPV Costs | $1,158.50 |
| NPVBenefits | $1,289.20 |
| **Annualized Costs** | **$145.86** |
| **Annualized Benefits** | **$162.31** |
| **Annualized Net Benefits** | **$16.45** |

## E. STATEMENT ON THE ANALYSIS

This Regulatory Benefit-Costs Analysis was prepared to satisfy Executive Order No. 12866. The order states that each agency shall assess both the costs and the benefits of the intended regulation and, recognizing that some costs and benefits are difficult to quantify, propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs.

It is recognized that there are several sources of uncertainty introduced in this analysis. The costs estimation is acknowledged to be based upon a program in which inductive loop surveillance is the means for producing real-time information. This was done in order to avoid underestimating a “high” cost for fully establishing real-time information programs in each metropolitan area and each State. Technological advances and the market for information service providers evolve rapidly, allowing more cost effective approaches to be implemented. In addition, while the DOTs have the flexibility to use Federal highway dollars including Congestion Mitigation and Air Quality (CMAQ) program, National Highway System (NHS), Surface Transportation Program (STP), and

State Planning and Research (SPR) funds for real-time monitoring program implementation, there is no dedicated funding for the implementation of a real-time program. As a result, there could be opportunity costs associated with the use of these funds that the FHWA is unable to quantify. To the extent that the benefits of these foregone projects exceed their costs, the costs identified here will understate the true economic cost of the rule.

The benefits analysis is dependent upon an extrapolation of the assessed delay-reducing impacts of the Georgia NaviGAtor system. It is clear that there is substantial value in the active management of the nation's transportation assets. The challenge here is to attribute the societal benefits that accrue specifically from the provision of real-time information. It is widely acknowledged that the provision of real-time information enables travelers to make more informed decisions, which allows for more reliable travel.

The delay-reducing opportunity from real-time information enables one to quantify its inherent "value." That value is likely to vary in quality in different areas of the country because of characteristics such as physical features, climatic characteristics, crash rate, presence of traffic and travel conditions data generation, and exposure of travelers to information dissemination media.

The evaluation variables are highly sensitive to geography. Pollution damage per ton, for instance, is known to vary with location. The valuation of pollution damage per ton is varied, and multiple sources express a broad range of values for estimating the total impact. For the final rule on the Real-Time System Management Information Program, the FHWA intends to apply the same value for emissions damage valuation as used in upcoming National Highway Traffic Safety Administration (NHTSA) Corporate Average Fuel Economy (CAFE) rulemaking. The prevention of fatalities and injuries also will vary based on the amount of delay per lane mile generated by local traffic conditions.

What is clear is that further empirical evidence, collected over a long time span, will shed a more accurate light on the full value of real-time information programs. The evidence at hand appears to indicate that even using 1/10 of calculated potential benefits there is a positive benefit-cost ratio attributed to the implementation of this rule. It is acknowledged, however, that there is a limited possibility that the costs could exceed the benefits.

In developing this rulemaking, the FHWA considered a number of differing options and believes that this final rule represents a cost beneficial means of implementing this statutory requirement. Under this final rule, regulated parties have the flexibility to achieve regulatory objectives in the most cost-effective way because the FHWA chose to build its real-time program around performance parameters rather than engineering or design standards. The performance parameters require the information be made available and so shared with other agencies, private firms and the public upon request, such as through a website. Such flexibility would allow lower costs than requiring a particular type of information dissemination through a particular technology. This final rule allows

DOTs to apply any particular technology, and particular technology-dependent application, or any particular business approach for establishing a real-time information program. States and other public agencies are instead encouraged to consider any salient technology, technology-dependent application, and business approach options that yield information products consistent with the requirements set forth in this rule. States are encouraged to work with value added information providers to establish real-time information programs. Value added information providers presently and in the future will create information products for commercial use, for sale to a customer base, or for other commercial enterprise purposes. Based upon this rule, such products could be derived from information from public sector sources in addition to the private sector's own capabilities for creating information content.

The extent of the final rule is solely the provision of real-time information, yet the outcomes possible through this program would also reach the business of the private sector and the public sector. The final rule is neither centered on a particular technology nor on a technology-dependant application. States establishing a real-time information program would be able to employ any solution chosen to make information available. States and public agencies can enter into collaborative agreements with the private sector for establishing the program and gathering data. States and public agencies could purchase value added information products from value added information providers. States and public agencies could apply combinations of these and other approaches to establish a successful real-time information program.

The FHWA further believes that this final rule is cognizant of the limitations on DOTs that might affect the implementation of a Real Time System Information Program, and offers a final rule that meets the objectives of the statutory requirement in the least stringent way. For example, during the NPRM, the FHWA had proposed requirements to provide roadway weather information, with a 20 minute update requirement. Many commenters agreed that weather information is vital but noted that there are numerous providers currently in the business, and suggested that the requirements be diminished because updating this information every 20 minutes would not be feasible without large investments in unproven technology. In the final rule, the FHWA modified sec. 511.309(a)(3) to indicate that the State's Real-Time System Management Information Program is required to provide confirmed weather related hazardous driving conditions and roadway- or lane-closure information, and that the information made available is to be updated within 20 minutes of notice of a changed condition. Similarly, the FHWA determined that including transit event information delivery from a real-time information program is not practical at this time, and deleted the requirement from the final rule.

Further, this final rule was modified in response to a comment which noted that there is not a current system or algorithm that can be implemented at a reasonable cost that can collect travel times on surface streets. The FHWA agreed with this comment and the definition for traffic and travel conditions in sec. 511.303 removes the extent and degree of congested conditions as one of the characteristics of traffic and travel conditions and the requirements were modified in sec. 511.309(a)(4) for the real-time system

management system to make available travel time information in metropolitan areas only on Interstate and other limited-access roadways that are designated as routes of significance.

Finally, this final rule provides a sufficient lead time so that States can achieve the goals of the rulemaking at a lower overall cost. A two-stage implementation was proposed in the NPRM that included the Interstate highway system as the first stage for coverage within 2 years, followed by other routes of significance as identified by the States within 4 years. During the comment period, agencies almost unanimously responded that the 2-year time frame proposed in the NPRM to develop the information program was insufficient due to constraints imposed by their existing planning and budgeting cycles. Many agencies indicated that additional time was necessary to enable eligible funding categories to be programmed to develop their real-time management information program. Consequently, the FHWA reevaluated the consequences of extending the period of implementation. The FHWA concluded that a 4-year compliance date of the rule is an appropriate time frame for States to establish the real-time information program for traffic and travel conditions that encompass all Interstate highways operated by the State. Further, FHWA found appropriate a 6-year effective date to establish the real-time information program along the State-designated metropolitan area routes of significance. The additional time provided by the rule is expected to afford States adequate time to establish their real-time information management program in concert with their other needs, priorities, and budgets.

Appendix A

Table A-1
Mileage Estimate for Top 50 Metropolitan Areas and Categorization into "High", "Medium", and "Low" costs.

| | |
|---|---|
| **averages for miles to be covered using ORNL -low** | |
| Orlando | 0 |
| Minneapolis | 0 |
| Buffalo | 0 |
| Salt Lake City | 0 |
| San Diego | 54 |
| Houston | 117 |
| Sacramento | 50 |
| **average** | **31.57** |
| | |
| **average for miles to be covered - medium** | |
| Milwaukee | 29 |
| Providence | 37 |
| Portland | 31 |
| San Antonio | 91 |
| SFO, including San Jose | 177 |
| cincinatti | 102 |
| NYNJ | 595 |
| DC | 178 |
| Tampa | 81 |
| Atlanta | 168 |
| **average** | **148.9** |
| | |
| **average miles to be covered - high** | |
| Philadelphia | 262 |
| Charlotte | 56 |
| denver | 191 |
| detroit | 262 |
| phoenix | 115 |
| seattle | 220 |
| LA including Riverside | 870 |
| austin | 60 |
| dallas | 447 |
| chicago | 450 |
| miami | 164 |
| KC | 301 |
| baltimore | 285 |
| nashville | 138 |
| boston | 314 |
| Indianapolis | 124 |
| pittsburg | 329 |
| columbus | 147 |
| st loius | 372 |
| Hampton (VA Beach) | 111 |
| Las Vegas | 145 |
| New Orleans | 91 |
| Oklahoma City | 142 |
| Jacksonville | 115 |
| Hartford | 131 |
| Lousville | 91 |
| Cleveland | 277 |
| **average** | **230.00** |

no data: Memphis, Richmond, Birmingham, Rochester. Assume these are "high" cost

Oak Ridge National Laboratory (ORNL) Network Extent (Metropolitan Planning Areas) used in the ITS Deployment Database

**Table A-2**
**City Costs**

| Urbanized Area | Costs | | | |
|---|---|---|---|---|
| | Deploy (1) | Operating (2) | Total | Annual (2) |
| New York-Newark | $12,953,601 | $10,362,881 | $23,316,482 | $2,914,560 |
| Los Angeles-Long Beach-Santa Ana | $19,656,523 | $15,725,218 | $35,381,741 | $4,422,718 |
| Chicago | $19,656,523 | $15,725,218 | $35,381,741 | $4,422,718 |
| Philadelphia | $19,656,523 | $17,690,871 | $37,347,394 | $4,149,710 |
| Dallas-Fort Worth-Arlington | $19,656,523 | $19,656,523 | $39,313,046 | $3,931,305 |
| Miami | $19,656,523 | $17,690,871 | $37,347,394 | $4,149,710 |
| Washington | $12,953,601 | $10,362,881 | $23,316,482 | $2,914,560 |
| Houston | $3,969,288 | $3,572,359 | $7,541,647 | $837,961 |
| Detroit | $19,656,523 | $15,725,218 | $35,381,741 | $4,422,718 |
| Boston | $19,656,523 | $17,690,871 | $37,347,394 | $4,149,710 |
| Atlanta | $12,953,601 | $12,953,601 | $25,907,202 | $2,590,720 |
| San Francisco-Oakland | $12,953,601 | $12,953,601 | $25,907,202 | $2,590,720 |
| Riverside-San Bernardino | $19,656,523 | $15,725,218 | $35,381,741 | $4,422,718 |
| Phoenix | $19,656,523 | $19,656,523 | $39,313,046 | $3,931,305 |
| Seattle | $19,656,523 | $19,656,523 | $39,313,046 | $3,931,305 |
| Minneapolis-St. Paul | $3,969,288 | $3,969,288 | $7,938,576 | $793,858 |
| San Diego | $3,969,288 | $3,572,359 | $7,541,647 | $837,961 |
| St. Louis | $19,656,523 | $15,725,218 | $35,381,741 | $4,422,718 |
| Baltimore | $19,656,523 | $19,656,523 | $39,313,046 | $3,931,305 |
| Pittsburgh | $19,656,523 | $17,690,871 | $37,347,394 | $4,149,710 |
| Tampa-St. Petersburg | $12,953,601 | $11,658,241 | $24,611,842 | $2,734,649 |
| Denver-Aurora | $19,656,523 | $19,656,523 | $39,313,046 | $3,931,305 |
| Cleveland | $19,656,523 | $15,725,218 | $35,381,741 | $4,422,718 |
| Cincinnati | $12,953,601 | $10,362,881 | $23,316,482 | $2,914,560 |
| Portland | $12,953,601 | $11,658,241 | $24,611,842 | $2,734,649 |
| Kansas City | $19,656,523 | $17,690,871 | $37,347,394 | $4,149,710 |
| Sacramento | $3,969,288 | $3,572,359 | $7,541,647 | $837,961 |
| San Jose | $12,953,601 | $11,658,241 | $24,611,842 | $2,734,649 |
| San Antonio | $12,953,601 | $10,362,881 | $23,316,482 | $2,914,560 |
| Orlando | $3,969,288 | $3,969,288 | $7,938,576 | $793,858 |
| Columbus | $19,656,523 | $15,725,218 | $35,381,741 | $4,422,718 |
| Providence | $12,953,601 | $11,658,241 | $24,611,842 | $2,734,649 |
| Virginia Beach | $19,656,523 | $17,690,871 | $37,347,394 | $4,149,710 |
| Indianapolis | $19,656,523 | $17,690,871 | $37,347,394 | $4,149,710 |
| Milwaukee | $12,953,601 | $10,362,881 | $23,316,482 | $2,914,560 |
| Las Vegas | $19,656,523 | $17,690,871 | $37,347,394 | $4,149,710 |

| | | | | |
|---|---|---|---|---|
| Charlotte | $19,656,523 | $17,690,871 | $37,347,394 | $4,149,710 |
| New Orleans | $19,656,523 | $17,690,871 | $37,347,394 | $4,149,710 |
| Nashville | $19,656,523 | $17,690,871 | $37,347,394 | $4,149,710 |
| Austin | $19,656,523 | $15,725,218 | $35,381,741 | $4,422,718 |
| Memphis | $19,656,523 | $15,725,218 | $35,381,741 | $4,422,718 |
| Buffalo | $3,969,288 | $3,572,359 | $7,541,647 | $837,961 |
| Louisville | $19,656,523 | $17,690,871 | $37,347,394 | $4,149,710 |
| Hartford-Middletown | $19,656,523 | $15,725,218 | $35,381,741 | $4,422,718 |
| Jacksonville | $19,656,523 | $17,690,871 | $37,347,394 | $4,149,710 |
| Richmond | $19,656,523 | $15,725,218 | $35,381,741 | $4,422,718 |
| Oklahoma City | $19,656,523 | $17,690,871 | $37,347,394 | $4,149,710 |
| Birmingham | $19,656,523 | $15,725,218 | $35,381,741 | $4,422,718 |
| Rochester | $19,656,523 | $15,725,218 | $35,381,741 | $4,422,718 |
| Salt Lake City | $3,969,288 | $3,969,288 | $7,938,576 | $793,858 |

(1) Deployment costs are based on categorization of city into Low, Medium or High determined by amount of Interstate highway surveillance coverage as reported to the ITS Deployment Tracking database.

(2) Operating costs and Annualized costs vary based on number of years of system operation through 2021, with systems becoming operational between 2010 & 2014.

**Table A-3**
**City Benefits**

| Urbanized Area | Benefits (1) | | | |
|---|---|---|---|---|
| | Annualized | 1/10 Benefits | Percent Hwy Miles Already Monitored | Benefits from Incremental Monitoring |
| New York-Newark | $533,460,982 | $53,346,098 | 77 | $12,269,603 |
| Los Angeles-Long Beach-Santa Ana | $605,984,610 | $60,598,461 | 39 | $36,965,061 |
| Chicago | $247,701,406 | $24,770,141 | 55 | $11,146,563 |
| Philadelphia | $160,847,907 | $16,084,791 | 39 | $9,811,723 |
| Dallas-Fort Worth-Arlington | $261,034,060 | $26,103,406 | 29 | $18,533,418 |
| Miami | $179,717,620 | $17,971,762 | 26 | $13,299,104 |
| Washington | $175,683,217 | $17,568,322 | 34 | $11,595,093 |
| Houston | $211,150,445 | $21,115,044 | 100 | $0 |
| Detroit | $150,470,476 | $15,047,048 | 43 | $8,576,817 |
| Boston | $186,110,737 | $18,611,074 | 20 | $14,888,859 |
| Atlanta | $215,465,667 | $21,546,567 | 54 | $9,911,421 |
| San Francisco-Oakland | $179,863,332 | $17,986,333 | 100 | $0 |
| Riverside-San Bernardino | $109,379,673 | $10,937,967 | 39 | $6,672,160 |
| Phoenix | $130,813,008 | $13,081,301 | 43 | $7,456,342 |
| Seattle | $140,061,170 | $14,006,117 | 48 | $7,283,181 |
| Minneapolis-St. Paul | $128,144,655 | $12,814,466 | 100 | $0 |
| San Diego | $179,389,768 | $17,938,977 | 81 | $3,408,406 |
| St. Louis | $123,531,958 | $12,353,196 | 2 | $12,106,132 |
| Baltimore | $120,458,344 | $12,045,834 | 24 | $9,154,834 |
| Pittsburgh | $56,144,681 | $5,614,468 | 21 | $4,435,430 |
| Tampa-St. Petersburg | $59,537,040 | $5,953,704 | 52 | $2,857,778 |
| Denver-Aurora | $90,601,031 | $9,060,103 | 59 | $3,714,642 |
| Cleveland | $82,646,063 | $8,264,606 | 0 | $8,264,606 |
| Cincinnati | $84,517,552 | $8,451,755 | 56 | $3,718,772 |
| Portland | $62,023,252 | $6,202,325 | 73 | $1,674,628 |
| Kansas City | $94,143,655 | $9,414,366 | 29 | $6,684,200 |
| Sacramento * | $70,183,128 | $7,018,313 | 80 | $1,403,663 |
| San Jose | $76,585,351 | $7,658,535 | 100 | $0 |
| San Antonio | $77,700,959 | $7,770,096 | 65 | $2,719,534 |
| Orlando | $56,773,064 | $5,677,306 | 100 | $0 |
| Columbus * | $68,120,391 | $6,812,039 | 25 | $5,109,029 |

| | | | | |
|---|---|---|---|---|
| Providence | $52,388,041 | $5,238,804 | 73 | $1,414,477 |
| Virginia Beach | $59,682,752 | $5,968,275 | 50 | $2,984,138 |
| Indianapolis | $50,320,751 | $5,032,075 | 60 | $2,012,830 |
| Milwaukee | $48,931,933 | $4,893,193 | 100 | $0 |
| Las Vegas | $42,015,164 | $4,201,516 | 4 | $4,033,455 |
| Charlotte | $50,015,667 | $5,001,567 | 68 | $1,600,501 |
| New Orleans | $24,657,214 | $2,465,721 | 1 | $2,441,064 |
| Nashville | $60,875,769 | $6,087,577 | 25 | $4,565,683 |
| Austin | $42,757,385 | $4,275,738 | 43 | $2,437,171 |
| Memphis | $39,406,007 | $3,940,601 | 0 | $3,940,601 |
| Buffalo | $30,608,641 | $3,060,864 | 100 | $0 |
| Louisville | $52,743,215 | $5,274,321 | 32 | $3,586,538 |
| Hartford-Middletown | $48,217,033 | $4,821,703 | 34 | $3,182,324 |
| Jacksonville | $51,217,791 | $5,121,779 | 28 | $3,687,681 |
| Richmond | $53,194,011 | $5,319,401 | 0 | $5,319,401 |
| Oklahoma City | $42,088,020 | $4,208,802 | 36 | $2,693,633 |
| Birmingham | $43,918,528 | $4,391,853 | 0 | $4,391,853 |
| Rochester * | $26,751,825 | $2,675,182 | 50 | $1,337,591 |
| Salt Lake City | $34,447,243 | $3,444,724 | 100 | $0 |

Total Incremental Benefits of the Rule: $281,535,949

(1) Annualized benefits represent total estimated benefits for each city; 1/10 benefits represent potential benefits due to information portion of system.

(*) Since deployment data are unavailable, the percentage of current miles covered are assumed for Sacramento, Columbus & Rochester.

Excerpts from Georgia Evaluation:

*(Assume expansion beyond current 141 miles is less travelled and less effective at 1/2 delay reduction per mile.)*

Emissions Reductions from 342 centerline miles of NaviGAtor

| | |
|---|---|
| Dollars Savings (Atlanta) | $2,997,682 |
| Cost savings from person hours of incident delay reduction for full (342 miles) coverage (Atlanta) | $171,310,134 |
| Secondary Crash Cost Savings in Atlanta | $3,027,664 |
| Annual vehicle hours of incident delay reduction for full (342 miles) coverage (Atlanta) | 12,425,252 |