AASHTO Technology Implementation Group

Nomination of Technology Ready for Implementation

2007 NOMINATIONS DUE BY FRIDAY, SEPTEMBER 7, 2007

<table>
<tr><td rowspan="9">Sponsor</td><td rowspan="9">Nominations <u>must</u> be submitted by an AASHTO member DOT willing to help promote the technology.</td><td colspan="3">1. Sponsoring State DOT: California Department of Transportation</td></tr>
<tr><td colspan="3">2. Name: Randy Iwasaki</td></tr>
<tr><td colspan="3">Title: Chief Deputy Director</td></tr>
<tr><td colspan="3">Mailing Address: 1120 N Street</td></tr>
<tr><td>City: Sacramento</td><td>State: CA</td><td>Zip Code: 95814</td></tr>
<tr><td>E-mail:
Randell_Iwasaki@dot.ca.gov</td><td>Phone: 916-654-5791</td><td>Fax:</td></tr>
<tr><td colspan="3">3. Date Submitted: 09/04/2007</td></tr>
<tr><td colspan="3">4. Is the Sponsoring State DOT willing to promote this technology to other states by participating on a Lead States Team supported by the AASHTO Technology Implementation Group?
Please check one: ☒ Yes ☐ No</td></tr>
<tr><td rowspan="3">Technology Description (10 points)</td><td rowspan="3">The term “technology” may include processes, products, techniques, procedures, and practices.</td><td colspan="3">5. Name the technology: The Sensys Wireless Vehicle Detection System</td></tr>
<tr><td colspan="3">6. Please describe the technology: The Sensys™ Wireless Vehicle Detection System uses pavement-mounted magnetic sensors to detect the presence and movement of vehicles. The magneto-resistive sensors are wireless, transmitting their detection data in real-time via low-power radio technology to a nearby Sensys access point that then relays the data to one or more local or remote traffic management controllers and systems.

A single Sensys installation thus consists of a number of Sensys wireless sensors installed in or on the roadway at various locations as required by the particular vehicle detection application, a Sensys access point to receive the data from the sensors and process and relay it onward, and one or more Sensys repeaters as may be needed to support sensors installed beyond the radio range of the Sensys access point. Each Sensys installation can then communicate its detection data in several ways:
• via contact closure to a roadside traffic controller;
• via IP (Internet Protocol) communications over twisted pair, coaxial cable, fiber optic cable, cellular data services, or other connectivity to one or more central servers and traffic management systems; or
• via both paths, simultaneously supporting local traffic signal control as well as centralized traffic management and information systems.</td></tr>
<tr><td colspan="3">7. If appropriate, please attach photographs, diagrams, or other images illustrating the appearance or functionality of the technology. (If electronic, please provide a separate file.)
Please check one: ☒ Yes, images are attached. ☐ No images are attached.</td></tr>
<tr><td rowspan="2">State of Development (30 points)</td><td rowspan="2">Technologies must be successfully deployed in at least one State DOT. The TIG selection process will favor technologies that have advanced beyond the research stage, at least to the pilot deployment stage, and preferably into routine use.</td><td colspan="3">8. Please describe the history of the technology’s development. The idea of combining a low-power radio with a low-cost in-pavement sensor was first developed by Prof. Pravin Varaiya of UC Berkeley as part of a research grant from the California Department of Transportation (Caltrans) to improve the quality and quantity of traffic monitoring on California freeways.

Starting in early 2003, Sensys co-founders Amine Haoui and Robert Kavaler collaborated with Prof. Varaiya to investigate the commercialization of the idea -- by July 2003, Sensys Networks, Inc., was born. Development continued at nights and on weekends until seed funding for the new venture was provided by Siemens TTB and ComVentures in May 2004.

The first working prototypes were available in Spring 2005, and the first trial deployment was in Fall 2005.</td></tr>
<tr><td colspan="3">9. For how long and in approximately how many applications has your State DOT used this technology? The first deployment of the Sensys Wireless Vehicle Detection System by Caltrans was in December 2005 as part of a trial conducted by CCIT (the California Center for Innovative Transportation) on I-80 in Emeryville, CA. The first operational deployment by Caltrans was then in Summer 2006 on US Highway 50 in Caltrans District 3 (Sacramento).

Since those first experiences, Caltrans has installed 14 deployments of the Sensys Wireless Vehicle Detection System in Caltrans Districts 3 (Sacaramento), 4 (Bay Area), and 7 (LA). with 120 deployments currently planned for late 2007 in District 8 (San Bernadino).</td></tr>
</table>

10. What additional development is necessary to enable routine deployment of the technology?
Sensys Networks is continually developing new features and capabilities, but the Sensys Wireless Vehicle Detection System has been a complete product suitable for routine use since at least Summer 2006.

11. Have other organizations used this technology? Please check one: ☒ Yes ☐ No
If so, please list organizations and contacts.

Organization	*Name*	*Phone*	*E-mail*
City of Ft. Collins, CO	Dan Holland	970-221-6816	dholland@fcgov.com
City of St. Louis, MO	Ken Cox	314-757-9011	kbcox@stlouis.missouri.org
City of Scottsdale, AZ	Bruce Dresse	480-312-2358	bdressel2@ci.scottsdale.az.us

Payoff Potential (30 points)

Payoff is defined as the combination of broad applicability and significant benefit or advantage over other currently available technologies.

12. How does the technology meet customer or stakeholder needs in your State DOT or other organizations that have used it?

The Sensys Wireless Vehicle Detection System represents a new way of creating sensor networks for the detection of vehicle traffic. Its exceptional accuracy, dependable reliability, flexibility to address a wide range of traffic management applications, and overall affordability make the Sensys Wireless Vehicle Detection System an ideal choice for both new and replacement deployments.

Because of its cost savings and overall flexibility, the Sensys Wireless Vehicle Detection System permits sensors to be deployed at a much higher density than has ever before been possible. The deployment of a pervasive network of vehicle sensors can facilitate expanded use of Intelligent Transportation System technologies to improve traffic efficiency, enhance traffic safety, increase mobility, safeguard and enhance economic productivity, and reduce fuel consumption and emissions.

13. What type and scale of benefits has your DOT realized from using this technology?

Include cost savings, safety improvements, transportation efficiency or effectiveness, environmental benefits, or any other advantages over other existing technologies. The Sensys Wireless Vehicle Detection System supports a greater variety of applications and deployment scenarios than any other alternative technology, whether it is an inductive loop, video, or radar system. More so than any other vehicle detection technology, the Sensys vehicle detection system provides a flexible platform for both today's and tomorrow's traffic management applications. The Sensys Wireless Vehicle Detection System can thus play a significant role in improving traffic efficiency and mobility, enhancing traffic safety, improving the use of local, regional, and national infrastructure, and compiling detailed historical traffic data to assist in planning future infrastructure. At the same time, the Sensys Wireless Vehicle Detection System represents an accurate, reliable, and cost-effective alternative to other detection technologies. Initial life cycle cost analysis concluded that this technology could cost less than half the cost of loop detectors while providing expanded functionality.

		14. Please describe the potential extent of implementation in terms of geography, organization type (including other branches of government and private industry) and size, or other relevant factors. How broadly might the technology be deployed? The Sensys Wireless Vehicle Detection System can measure volume (counts), speed, occupancy, presence, headway, gap, direction of travel, and length. It can thus be deployed to support count stations on freeways and arterials or traffic signal control applications such as stop bar detection and advance detection at intersections or ramp management at freeway entrances.. The Sensys Wireless Vehicle Detection System can be used by any municipal, town, county, state, provincial, or national organization chartered to maintain public roadways, and it can be deployed wherever inductive loops are used today. Moreover, the basic architecture of the Sensys Wireless Vehicle Detection System – battery-powered pavement-mounted sensors that communicate wirelessly to a pole-mounted access point or repeater – means that the system can easily overcome deployment complications such as split roadways, flyovers, bridges, long distances from the traffic signal controller, high water tables, poor pavement quality, or other site-specific issues that would otherwise make the installation of inductive loops impractical or impossible.
Market Readiness (30 points)	*The TIG selection process will favor technologies that can be adopted with a reasonable amount of effort and cost, commensurate with the payoff potential.*	15. What actions would another organization need to take to adopt this technology? Adoption of the Sensys Wireless Vehicle Detection System does not require any special actions. While its native IP communications facilitate integration of the Sensys Wireless Vehicle Detection System with current and future traffic management systems, the Sensys detection system can also be quickly and simply connected to existing roadside traffic controllers for the real-time control of traffic signals or for integration with existing freeway detection stations. As desired, both types of connectivity can be supported to allow a particular Sensys installation to fulfill varied objectives.
		16. What is the estimated cost, effort, and length of time required to deploy the technology in another organization? Deployment of the Sensys Wireless Vehicle Detection typically takes less personnel and less time than installation of comparable inductive loops. As a result, the installed cost is comparable to that of loops: ~$20k for traffic signal control at a typical intersection with 12 lanes at the stop bar for all four approaches or ~$10k for a freeway count station with a total of 8 lanes in both directions. In typical traffic management applications, a Sensys wireless sensor is placed in the middle of a traffic lane where it will detect the presence and passage of vehicles. To measure vehicle speeds and length, two wireless sensors are installed in the same lane with the exact distance between them measured and configured in software upon installation. Installation of each Sensys wireless sensor takes less than 10 minutes, simply requiring boring a 4-inch / 10-cm diameter hole approximately 2 ¼ inches / 5.7 cm deep at the desired sensing location, placing the sensor into the hole so that it is properly aligned with the direction of traffic, and sealing the hole with fast-drying epoxy. No lead-in cabling or long saw cuts are required, and the circular pavement hole produces the least amount of damage and stress to the roadway.
		17. What resources—such as technical specifications, training materials, and user guides—are already available to assist deployment? As a commercially available product, the Sensys Wireless Vehicle Detection System is supported by full documentation, including a System Reference Guide and Installation Guides. Training is provided by Sensys Networks or its authorized dealers.
		18. What organizations currently supply and provide technical support for the technology? Sensys Networks supplies the Sensys WIreless Vehicle Detection System both directly and through a nationwide network of regional traffic equipment distributors/dealers.

		19. Please describe any legal, environmental, social, intellectual property, or other barriers that might affect ease of implementation. The Sensys Wireless Vehicle Detection System is not subject to any legal, environmental, social, intellectual property, or other barriers -- the technology is available today.	
Submit to AASHTO Contact		***Keith Platte*** ***Phone: 202.624.7830*** ***Fax: 202.624.5469*** ***kplatte@aashto.org***	***American Association of State Highway & Transportation Officials*** ***444 North Capitol Street N.W., Suite 249*** ***Washington, DC 20001***

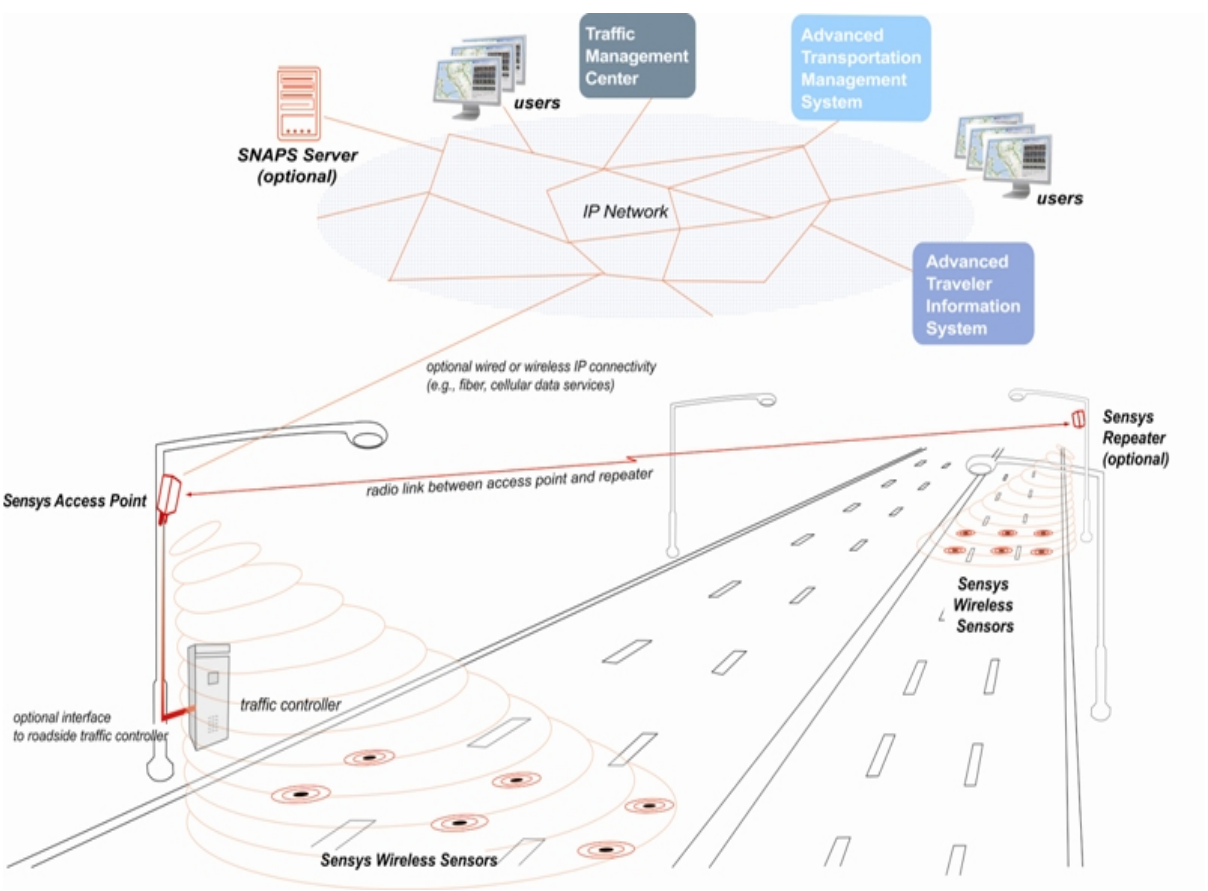

Figure 1: Sensys System Diagram (Freeway)

(ADDITIONAL IMAGES WERE ALSO ATTACHED)


Sensys Networks, Inc.
VSN240-F
ARROW IN DIRECTION OF
TRAFFIC FLOW
THIS END UP
000122
FCC ID# TDB-VSN240

AASHTO Technology Implementation Group

Nomination of Technology Ready for Implementation

2007 NOMINATIONS DUE BY FRIDAY, SEPTEMBER 7, 2007

Sponsor	*Nominations must be submitted by an AASHTO member DOT willing to help promote the technology.*	1. Sponsoring State DOT: Pennsylvania Department of Transportation (PennDOT)		
		2. Name: Lance Savant		
		Title: BMS Manager		
		Mailing Address: PO Box 3560		
		City: Harrisburg	State: PA	Zip Code: 17105-3560
		E-mail: lsavant@state.pa.us	Phone: (717) 783-7498	Fax: (717) 787-2882
		3. Date Submitted: 09/07/2007		
		4. Is the Sponsoring State DOT willing to promote this technology to other states by participating on a Lead States Team supported by the AASHTO Technology Implementation Group? Please check one: ☒ Yes ☐ No		
Technology Description (10 points)	*The term "technology" may include processes, products, techniques, procedures, and practices.*	5. Name the technology: Bridge Management System 2 (BMS2) Web and iForms		
		6. Please describe the technology: Pennsylvania's BMS2 Web is an extension of its internal, Pontis based BMS2. The internal Pontis-based BMS2 client version interfaces with other PennDOT systems (Roadway Management System, GIS, SAP/Maintenance, MPMS) and also includes additional applet screens to support PennDOT's needs. BMS2 Web provides Department personnel and external Business Partners (local bridge owners, consultants, planning partners, etc) most of the BMS2 Pontis client inspection functionality for users to securely view their specific bridge information via the internet. In addition, BMS2 web allows state and consultant inspectors to download previous and submit new inspection data remotely. BMS2 also allows external users to transfer inspection documents (reports, photos, design and shop drawings, etc) electronically for storage and retrieval. In conjunction with its new BMS2, PennDOT also developed its new data collection software, iForms, in order to support element level inspections, support other structure inspections (sign structures and walls), upload and download documents and to provide the ability to submit inspections remotely via the web. Department staff and consultants can now review electronic versions of field data through BMS2 web.		
		7. If appropriate, please attach photographs, diagrams, or other images illustrating the appearance or functionality of the technology. (If electronic, please provide a separate file.) Please check one: ☐ Yes, images are attached. ☒ No images are attached.		
State of Development (30 points)	*Technologies must be successfully deployed in at least one State DOT. The TIG selection process will favor technologies that have advanced beyond the research stage, at least to the pilot deployment stage, and preferably into routine use.*	8. Please describe the history of the technology's development. BMS2 Web was the second phase of a 30 month long project to re-write PennDOT's previous mainframe BMS. The first phase of the project was to design, construct and implement a Pontis-based BMS that included many Department specifc add-ons. These add-ons included new Applets to meet PennDOT's data collection needs, interfaces with other Department management systems and support the Department's new data collection system, iForms. The design and construction of iForms was also part of the project first phase. The BMS2 web phase utilized the foundation built in phase one to construct its website. BMS2 web includes most of the functionality that was added to its Pontis-based BMS. BMS2 web does not include the programming, planning and modeling capabilities that Pontis offers. iForms was configured in phase 2 so that inspection may be submitted via the web.		
		9. For how long and in approximately how many applications has your State DOT used this technology? BM2 Web has been available to users since July 16th, 2007. As of September 7, 23 Business Partners, a mixture of consultants and bridge owners, have access to BMS2 web and iForms in addition to approximately 100 PennDOT users. We expect to eventually have over 400 non-department external users. iForms was implemented in November, 2006 for PennDOT users only, and were made available to external users on July 16th, 2007.		
		10. What additional development is necessary to enable routine deployment of the technology? Maintenance and enhancements to BMS2 web will be added in the future as new needs are identified by users. PennDOT is currently working on adding new screens to BMS2 web that are already present in our BMS2 Ponits client. These screens include our maintenance applet, element condition states and other structures.		
		11. Have other organizations used this technology? Please check one: ☒ Yes ☐ No If so, please list organizations and contacts.		

		Organization	*Name*	*Phone*	*E-mail*
		Mercer County	Mark Miller	(724) 662-4977	
Payoff Potential (30 points)	*Payoff is defined as the combination of broad applicability and significant benefit or advantage over other currently available technologies.*	12. How does the technology meet customer or stakeholder needs in your State DOT or other organizations that have used it? BMS2 web offers local bridge owners the ability to manage their bridges by having the ability to view all of their NBI information, view and record maintenance needs and store and retrieve critical documents. BMS2 web also facilitates the inspection review process for inspection supervisors (both Department and consultant).			
		13. What type and scale of benefits has your DOT realized from using this technology? Include cost savings, safety improvements, transportation efficiency or effectiveness, environmental benefits, or any other advantages over other existing technologies. Consultants using iForms can collect data more efficiently and send data directly to District offices via BMS2 web. iForms and BMS2 web saves time and money in the data collection process and inspection review process by eliminating paperwork and zip file processing from an intermediate database. Built-in edits in iForms minimizes data errors.			
		14. Please describe the potential extent of implementation in terms of geography, organization type (including other branches of government and private industry) and size, or other relevant factors. How broadly might the technology be deployed? Any consultant who desires to do bridge inspections in Pennsylvania must be registered as a Business Partner and have access to BMS2. Planning organizations (RPO's and MPO's) throughout the state may have access to BMS2 web to view bridge information in their area. Other state agenices such as the Pennsylvania Turnpike Commission and Dept of Conservation of Natural Resources (DCNR) may have access to BMS2 web also to view their bridges and utilize iForms.			
Market Readiness (30 points)	*The TIG selection process will favor technologies that can be adopted with a reasonable amount of effort and cost, commensurate with the payoff potential.*	15. What actions would another organization need to take to adopt this technology? PennDOT developed its own customized BMS2 web to integrate with its other management systems. An organization must evaluate if this level of effort is the best approach to meet their needs. Organizations should examine their current business processes and needs to determine if a total customized web based BMS is required to fill those needs. Future Pontis 5.X versions are set to be web based. Other organizations who own Pontis licenses would only need to update their current Pontis license if they believe it meets their requirements. This can be done for a minimal cost. Other customization needed for systems integration would require additional efforts.			
		16. What is the estimated cost, effort, and length of time required to deploy the technology in another organization? The Department spent approximately $1.2 million over 6 months for a team of 8 consultancts to develop BMS2 Web. These costs reflect the design, construction and implementation for the BMS2 web. However, since Pontis 5.1 and future versions of Pontis will be web based, Pontis license owners will be able to have a comparable system for a significant lower cost. Costs associated with customization, implementation and training of a new Pontis version would only be realized. PennDOT's iForms was built from the ground up to ensure it met all of PA's needs. By creating its own software, an organization will typically spend more money. Other electronic data collection systems are available from manufacturers. Organizations could obtain an out-of -the-box system that fills their needs. Some custimization would probably need to be performed.			
		17. What resources—such as technical specifications, training materials, and user guides—are already available to assist deployment? PennDOT developed technical specifications for each web screen. Due to the user-friendly format of BMS2 web, no formal training was provided. Training materials were developed and training classes have been provided for iForms. A new coding and reference manual was developed to assist users navigate and understand the functionality of BMS2 web.			

		18. What organizations currently supply and provide technical support for the technology? PennDOT's consultant currently provides technical support to the user community. Upon completion of the project, technical support will be transferred to the Bureau of Design for basic functionality and general user questions, and the Bureau of Information Systems will provide support for technical problems.	
		19. Please describe any legal, environmental, social, intellectual property, or other barriers that might affect ease of implementation. Bridge inspection information is considered confidential in Pennsylvania. Stringent security measures are in place to prevent the misuse of the data.	
Submit to AASHTO Contact		***Keith Platte*** ***Phone: 202.624.7830*** ***Fax: 202.624.5469*** ***kplatte@aashto.org***	***American Association of State Highway & Transportation Officials*** ***444 North Capitol Street N.W., Suite 249*** ***Washington, DC 20001***

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<tr><td rowspan="8">Sponsor</td><td rowspan="8">Nominations <u>must</u> be submitted by an AASHTO member DOT willing to help promote the technology.</td><td colspan="3">1. Sponsoring State DOT: CDOT</td></tr>
<tr><td colspan="3">2. Name: Elizabeth Stolz</td></tr>
<tr><td colspan="3">Title: Traffic Analysis Unit Manager</td></tr>
<tr><td colspan="3">Mailing Address: 4201 East Arkansas Avenue</td></tr>
<tr><td>City: Denver</td><td>State: Colorado</td><td>Zip Code: 80222</td></tr>
<tr><td>E-mail:
elizabeth.stolz@dot.state.co.us</td><td>Phone: 303-757-9495</td><td>Fax: 303-757-9727</td></tr>
<tr><td colspan="3">3. Date Submitted: 09-06-07</td></tr>
<tr><td colspan="3">4. Is the Sponsoring State DOT willing to promote this technology to other states by participating on a Lead States Team supported by the AASHTO Technology Implementation Group?
Please check one: ☒ Yes ☐ No</td></tr>
<tr><td rowspan="3">Technology Description (10 points)</td><td rowspan="3">The term “technology” may include processes, products, techniques, procedures, and practices.</td><td colspan="3">5. Name the technology: Web-based Annual Travel Monitoring State DOT Survey</td></tr>
<tr><td colspan="3">6. Please describe the technology: The Colorado Department of Transportation (CDOT) developed an on-line travel monitoring survey for the purpose of gathering information from State Department of Transportations (DOT's) related to travel monitoring program management, operations, data usage and management, as well as software and technology. Although the on-line survey was available for over one month during June and July of 2007, obtaining a response from over 50 participants was a huge challenge. Over 40 DOT’s responded to the survey request by attempting to complete all the on-line survey questions.
7. The survey was developed by CDOT and reviewed by the Federal Highway Administration (FHWA) before activating the survey on-line. The on-line survey included a total of 30 questions and most of the survey questions provided respondents with the opportunity to provide additional information in an open-ended question format. Respondents had the opportunity to skip a question if they did not understand or know the answer to the question. Consequently, there were a number of respondents that skipped the last several questions of the survey. All skipped responses are reflected as a No Response throughout a final report of the on-line survey results presented in written and tabular formats. The final report was completed with a number of manual steps that included cleaning and formatting data. The key to completing this report included having adequate participation from state DOT travel monitoring representatives. CDOT would like automate the reporting functions and have this annually updated and available for all DOT's to include responses.
8.</td></tr>
<tr><td colspan="3">9. If appropriate, please attach photographs, diagrams, or other images illustrating the appearance or functionality of the technology. (If electronic, please provide a separate file.)
Please check one: ☒ Yes, images are attached. ☐ No images are attached.</td></tr>
<tr><td rowspan="3">State of Development (30 points)</td><td rowspan="3">Technologies must be successfully deployed in at least one State DOT. The TIG selection process will favor technologies that have advanced beyond the research stage, at least to the pilot deployment stage, and preferably into routine use.</td><td colspan="3">10. Please describe the history of the technology’s development. The need for DOT travel monitoring programs to provide information to FHWA and other state DOT's is critical and can save DOT's research, hardware, software, and other costs. Historically this information has not been gathered and reported on in one place in one report. Since the first report is completed, FHWA staff members have used the report to answer questions.</td></tr>
<tr><td colspan="3">11. For how long and in approximately how many applications has your State DOT used this technology? We have used Survey Monkey in 2 applications.</td></tr>
<tr><td colspan="3">12. What additional development is necessary to enable routine deployment of the technology? We need to develop automated reporting tools and provide a national hosting environment that will allow electronic updating of the DOT's information as needed or on an annual basis.</td></tr>
</table>

		13. Have other organizations used this technology? Please check one: ☒ Yes ☐ No If so, please list organizations and contacts.

Organization	*Name*	*Phone*	*E-mail*
See attachment			

Payoff Potential (30 points)	*Payoff is defined as the combination of broad applicability and significant benefit or advantage over other currently available technologies.*	14. How does the technology meet customer or stakeholder needs in your State DOT or other organizations that have used it? This provides FHWA with an updated understanding of State DOT's Travel Monitoring program and provides other DOT agencies with information about surrounding state DOT's Travel Monitoring Program. This survey provides an informational foundation for additional software development projects that are currently under development as well as future software tools development.
		15. What type and scale of benefits has your DOT realized from using this technology? Include cost savings, safety improvements, transportation efficiency or effectiveness, environmental benefits, or any other advantages over other existing technologies. This is difficult to quantify but it could save a lot of time and money based on the sharing of information across DOT's. For example, travel monitoring equipment testing results could be shared that will provide a DOT with critical equipment purchasing and budgeting decisions.
		16. Please describe the potential extent of implementation in terms of geography, organization type (including other branches of government and private industry) and size, or other relevant factors. How broadly might the technology be deployed? National (United States)
Market Readiness (30 points)	*The TIG selection process will favor technologies that can be adopted with a reasonable amount of effort and cost, commensurate with the payoff potential.*	17. What actions would another organization need to take to adopt this technology? If deployed correctly, they would only need an internet connection.
		18. What is the estimated cost, effort, and length of time required to deploy the technology in another organization? This project took approximately 4 to 6 months to complete.
		19. What resources—such as technical specifications, training materials, and user guides—are already available to assist deployment? The application can be provided upon request. No training was required to fill out the survey. An intenet connection was required.
		20. What organizations currently supply and provide technical support for the technology? Previously this technology was not used and surveys were not filled out for Travel Monitoring details gathered from the survey.

		21. Please describe any legal, environmental, social, intellectual property, or other barriers that might affect ease of implementation. None that are obvious?	
Submit to AASHTO Contact		***Keith Platte*** ***Phone: 202.624.7830*** ***Fax: 202.624.5469*** ***kplatte@aashto.org***	***American Association of State Highway & Transportation Officials*** ***444 North Capitol Street N.W., Suite 249*** ***Washington, DC 20001***

State Department of Transportation's (DOT's) Travel Monitoring Survey Results Report

Elizabeth Stolz
Colorado Department of Transportation
Division of Transportation Development
August, 2007

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1. Introduction

The Colorado Department of Transportation (CDOT) developed an on-line travel monitoring survey for the purpose of gathering information from State Department of Transportations (DOT's) related to travel monitoring program management, operations, data usage and management, as well as software and technology. Although the on-line survey was available for over one month during June and July of 2007, obtaining a response from over 50 participants was a huge challenge. Over **40** DOT's responded to the survey request by attempting to complete all the on-line survey questions.

The survey was developed by CDOT and reviewed by the Federal Highway Administration (FHWA) before activating the survey on-line. The on-line survey included a total of 30 questions and most of the survey questions provided respondents with the opportunity to provide additional information in an open-ended question format. Respondents had the opportunity to skip a question if they did not understand or know the answer to the question. Consequently, there were a number of respondents that skipped the last several questions of the survey. All skipped responses are reflected as a No Response throughout this report

On-line survey results will be presented in written and tabular formats throughout this report. The key to completing this report included having adequate participation from state DOT travel monitoring representatives. CDOT would like to thank all DOT travel monitoring representatives that took the time to answer questions through the on-line survey.

2. State Participants and Contact Information

In an effort to gather as much participation as possible, CDOT contacted all DOT's by e-mail to request participation. In some cases, phone calls were made in attempt to find the correct travel monitoring program contacts. Although CDOT attempted to gather responses from all DOT's, there were a few states that did not participate due to time constraints, incorrect contact information, or other reasons.

The survey was successfully completed by 41 states which is 82% of all DOT's. Some states did not attempt to complete the survey and some states did not fill out more than 5 questions in the survey. If a state did not fill out more than 5 questions, that state's survey was deleted out of the overall results.

States that participated in the survey were required to input their contact information. Table 1 shows the list of states that attempted or completed the survey including the state travel monitoring program contact names, titles, phone numbers, and e-mail addresses.

Table 1 - General Contact Information

	General Contact Information				
	State Name	State Traffic Monitoring Program Contact Name	State Contact Title	State Contact Phone Number	State Contact E-mail
1	Alabama	Charles W. Turney	Traffic Engineer	(334) 242-6393	turneyc@dot.state.al.us
2	Arizona	Mark Catchpole	Planner IV	(602) 712-8596	mcatchpole@azdot.gov
3	Arkansas	Elizabeth Mayfield-Hart	Staff Planning Engineer, Technical Services	(501) 569-2111	elizabeth.mayfieldhart@arkansashighways.com
4	California	Joe Avis	Chief, Traffic Data and Photolog Branch	(916) 654 3072	joe_avis@dot.ca.gov
5	Colorado	Elizabeth Stolz	Traffic Analysis Unit Manager	(303) 757-9495	elizabeth.stolz@dot.state.co.us
6	Connecticut	Kerry Ross	Transportation Supervising Planner	(860) 594-2087	Kerry.Ross@po.state.ct.us
7	Florida	Joey D. Gordon	Supervisor, Traffic Data Quality	(850) 414-4738	joey.gordon@dot.state.fl.us
8	Georgia	Tim Christian	QC & Data Reporting Branch Chief	(770) 986-1434	Tim.Christian@dot.state.ga.us
9	Hawaii	Napoleon Agraan	Engineer (Civil) V, DOT-Highways Division, Planning Branch	(808) 587-1838	napoleon.agraan@hawaii.gov
10	Idaho	Glenda Fuller	Roadway Data Manager	(208) 334-8217	glenda.fuller@itd.idaho.gov
11	Illinois	Rob Robinson	Data Management Unit Chief	(217) 785-2353	rob.robinson@illinois.gov

Table 1 – General Contact Information – Continued

	General Contact Information				
	State Name	State Traffic Monitoring Program Contact Name	State Contact Title	State Contact Phone Number	State Contact E-mail
12	Indiana	Scott MacArthur	Traffic Monitoring Section Engineer	(317) 233-1166	smacarthur@indot.in.gov
13	Iowa	Phillip Meraz	Systems Monitoring Manager	(515) 239-1548	phillip.meraz@dot.iowa.gov
14	Kansas	Alan Spicer	Traffic and Field Operations Engineer	(785) 296-3470	spicer@ksdot.org
15	Kentucky	Ted Noe	Transportation Engineering Branch Manager	(502) 564-7183	ted.noe@ky.gov
16	Louisiana	James C. Porter	Planning Support Engineer	(225) 242-4556	jimporter@dotd.la.org
17	Maine	Deborah Morgan	Traffic Monitoring Manager	(207) 624-3606	deborah.morgan@maine.gov
18	Maryland	Karl Hess	Manager-Traffic Monitoring System	(410) 545-5523	KHess@sha.state.md.us
19	Massachusetts	Stephen R. Greene	Supervisor Statewide Traffic Data Collection	(617) 973-7327	stephen.greene@MHD.state.ma.us
20	Michigan	Mike Walimaki	Transportation Planner Manager	(517) 335-2914	walimakim@michigan.gov
21	Minnesota	Gene Hicks	Principal Engineer	(651) 366-3856	gene.hicks@dot.state.mn.us
22	Mississippi	Jeff Altman	Engineering Analysis Manager	(601) 359-7675	jaltman@mdot.state.ms.us
23	Montana	Tedd Little	Weigh In Motion Analyst	(406) 444-9417	tlittle@mt.gov
24	Nebraska	Rick Ernstmeyer	Traffic Analysis Supervisor	(402) 479-4520	RickErnstmeyer@dor.state.ne.us
25	Nevada	Michael W Lawson	Traffic Information Division Chief	(775) 888-7443	mlawson@dot.state.nv.us
26	New Hampshire	Subramanian N. Sharma	Chief of Research and Engineering	(603) 271-1625	ssharma@dot.state.nh.us
27	New Jersey	Louis C. Whiteley	Section Chief	(609) 530-3501	Louis.Whiteley@dot.state.nj.us
28	New Mexico	Elizer Pena	Management Analyst -0	(505) 827-5529	ELIZER.PENA@state.nm.us
29	New York	Kurt Matias	Associate Transportation Anaylst	(518) 457-2815	kmatias@dot.state.ny.us
30	North Carolina	Kent Taylor	State Traffic Survey Engineer	(919) 212-4550	kltaylor@dot.state.nc.us
31	North Dakota	Robert Olzweski	Senior Transportation Project Manger	(701) 328-3479	rolzwesk@nd.gov
32	Ohio	Dave Gardner	Manager, Traffic Monitoring Section	(614) 752-5740	dave.gardner@dot.state.oh.us
33	Oklahoma	Jay Adams	Assist. Division Mgr. - Planning & Research	(405) 521-2175	jadams@odot.org
34	Oregon	Don R. Crownover	TSM Unit Team Leader	(503) 986-4132	don.r.crownover@odot.state.or.us
35	Pennsylvania	Laine Heltebridle	Manager, Transportation Planning Division	(717) 787-2277	lheltebrid@state.pa.us
36	Rhode Island	David A. Doyle, Jr.	Senior Planner	(401) 222-2694 ext 4213	ddoyle@dot.ri.gov
37	South Dakota	Kenneth E. Marks	Engineering Supervisor	(605) 773-3336	Ken.Marks@state.sd.us
38	Tennessee	Steve Allen	Director - Project Planning Division	(615) 741-2208	steve.allen@state.tn.us
39	Utah	Toni Butterfield	Research Analyst	(801) 965-4737	tbutterfield@utah.gov
40	Vermont	David Gosselin	Tech VI	(802) 828-2694	Dave.gosselin@state.vt.us
41	Virginia	Tom Schinkel	Program Manager	(804) 225-3123	Tom.Schinkel@VDOT.Virginia.Gov
42	Washington	John Rosen	Highway Usage Branch Manager	(360) 570-2373	rosenj@wsdot.wa.gov
43	West Virginia	Tom Myes	Transportation Manager	(304) 558-9611	tmyers@dot.state.wv.us

Table 1 – General Contact Information – Continued

	General Contact Information				
	State Name	State Traffic Monitoring Program Contact Name	State Contact Title	State Contact Phone Number	State Contact E-mail
44	Wisconsin	John Williamson	Program & Planning Analyst	(608) 267-2939	john.williamson@dot.state.wi.us
45	Wyoming	Sherman Wiseman	Supervisor, Transportation Surveys	(307) 777-4190	sherman.wiseman@dot.state.wy.us

3. General Program Management, Operations, and Staffing Question Results

The on-line survey requested that participants provide information related to their respective travel monitoring program management, operations, and staffing. Each travel monitoring program has different needs based on their geographic location and the centerline miles of roadway managed by the DOT. Each DOT was asked to provide the state agency managed centerline miles of roadway. The range of centerline miles was from **940 miles in Hawaii** to **115,000 miles in New York**. There were a total of 39 responses to this question. Table 2 shows the responses by state.

Table 2 - State Agency Managed Centerline Miles of Roadway

State Name	How many total centerline miles of roadway are managed by the DOT?
Alabama	11,005
Arizona	6,500
Arkansas	16,233
California	15,000+
Colorado	9,148
Connecticut	3,731
Florida	12,069
Georgia	18,000
Hawaii	940
Idaho	4,945
Illinois	16,000
Indiana	12,000
Iowa	9,355
Kansas	10,375
Kentucky	27,511
Louisiana	16,700
Maryland	5,235
Michigan	9,691
Minnesota	29,100
Mississippi	13,000
Nebraska	9,952
Nevada	5,200
New Hampshire	4,200
New Jersey	2,322
New Mexico	64,060
New York	115,000
North Carolina	78,000
North Dakota	7,382
Ohio	19,290
Oklahoma	12,300
Oregon	7,500

Order from Largest to Smallest Number of Centerline Miles of Roadway Managed		
New York	**115,000**	1
Tennessee	91,417	2
North Carolina	78,000	3
Virginia	67,763	4
New Mexico	64,060	5
Pennsylvania	39,890	6
West Virginia	36,292	7
Minnesota	29,100	8
Kentucky	27,511	9
Ohio	19,290	10
Georgia	18,000	11
Louisiana	16,700	12
Arkansas	16,233	13
South Dakota	16,000	14
Illinois	16,000	15
California	15,000	16
Mississippi	13,000	17
Oklahoma	12,300	18
Florida	12,069	19
Indiana	12,000	20
Alabama	11,005	21
Kansas	10,375	22
Nebraska	9,952	23
Michigan	9,691	24
Iowa	9,355	25
Colorado	9,148	26
Oregon	7,500	27
North Dakota	7,382	28
Washington	7,000	29
Wyoming	6,859	30
Arizona	6,500	31

Table 2 – State Agency Managed Centerline Miles of Roadway – Continued

State Name	How many total centerline miles of roadway are managed by the DOT?
Pennsylvania	39,890
South Dakota	16,000
Tennessee	91,417
Utah	942
Virginia	67,763
Washington	7,000
West Virginia	36,292
Wyoming	6,859

In Order from Largest to Smallest Number of Centerline Miles of Roadway Managed		
Maryland	5,235	32
Nevada	5,200	33
Idaho	4,945	34
New Hampshire	4,200	35
Connecticut	3,731	36
New Jersey	2,322	37
Utah	942	38
Hawaii	940	39

Another question in the on-line survey asked DOT contacts to provide the number of Full-time Employees (FTE's) either internal or outsourced required to manage their travel monitoring program. A majority of the DOT respondents indicated they manage their operations including data collection, processing, and dissemination, through state agency staff.

Specifically, DOT respondents indicated that **34%** require between 6 and 10 state agency employees for Data Collection operations. The responses showed an overwhelming **80%** of DOT's have between 1 and 5 FTE's for data dissemination. Also, **68%** of DOT respondents require between 1 and 5 state agency FTE's for data processing.

Figure 1 shows percentages derived from the answers selected by DOT respondents.

Figure 1 - Number of Travel Monitoring Staff

Total number of State employees, (Full-time employees (FTE's)), contractors, or consultants, required to manage (or currently in charge of managing) the federally mandated traffic monitoring program?

	None	1 to 5	6 to 10	11 to 20	21 to 50	50 to 100	Response Count
State Agency: Data Collection	2.4% (1)	24.4% (10)	**34.1% (14)**	29.3% (12)	9.8% (4)	0.0% (0)	41
State Agency: Data Processing	0.0% (0)	**68.3% (28)**	19.5% (8)	9.8% (4)	2.4% (1)	0.0% (0)	41
State Agency: Data Dissemination	5.0% (2)	**80.0% (32)**	10.0% (4)	2.5% (1)	2.5% (1)	0.0% (0)	40
Outsourced: Data Collection	**36.4% (12)**	30.3% (10)	15.2% (5)	6.1% (2)	9.1% (3)	3.0% (1)	33
Outsourced: Data Processing	**63.6% (21)**	30.3% (10)	6.1% (2)	0.0% (0)	0.0% (0)	0.0% (0)	33
Outsourced: Data Dissemination	**81.3% (26)**	12.5% (4)	6.3% (2)	0.0% (0)	0.0% (0)	0.0% (0)	32
						answered question	**41**
						skipped question	**0**

State respondents were asked to supply names of contractors and consultants that support the travel monitoring program management, operations, and staffing. Table 3 shows the responses by state.

Table 3 - Contractors and Consultants List

State Name	Name of contactor(s)/consultant(s)
Alabama	N/A
Arizona	Traffic Research & Analysis, Inc
Arkansas	The Traffic Group
California	N/A
Colorado	Traffic Data Services

Table 3 – Contractors and Consultants List – Continued

State Name	Name of contactor(s)/consultant(s)
Connecticut	N/A
Florida	Various District Offices using various consultants.
Georgia	Southern Traffic (for field collection) Mid Western Consulting (developed web site for displaying data) Northgrup Grummon is working on a future traffic database solution.
Hawaii	1) Continuous Count Program Contractor: Econolite Control Products, Inc 2) Short-Term Program Contractor: The Traffic Group 3) WIM/Continuous Vehicle Classification (CVC) Contractor: International Road Dynamics
Idaho	N/A
Illinois	Gewalt Hamilton & Associates Terra Engineering
Indiana	N/A
Iowa	N/A
Kansas	N/A
Kentucky	Southern Traffic Services
Louisiana	Southern Traffic
Maine	**No Response**
Maryland	Synergy Systems and Services Whitney Bailey Cox and Magnani/The Traffic Group-Joint Venture Sbra Wang and Associates/Roadway data Systems-Joint Venture The RBA Group Johnson Mirmiran and Thompson A. Morton Thomas
Massachusetts	N/A
Michigan	N/A
Minnesota	N/A
Mississippi	Southern Traffic Services 2911 Westfield Road Gulf Breeze, FL 32563
Nebraska	**No Response**
Nevada	Joe Wilkinson, Chaparal Systems provides the data processing software and support.
New Hampshire	NHDOT has a cooperative program to collect traffic data with the nine regional planning commissions in the state.
New Jersey	For short-term data collection: The Louis Berger Group (Northern NJ) Michael Baker Jr., Inc. (Central NJ) McCormick Taylor, Inc. (Southern NJ) Philadelphia MPO does counts in four New Jersey counties in addition to NJDOT's consultants.
New Mexico	All Traffic Data CO DH Consulting Inc.
New York	International Road Dynamics (CC) Planert Utility (CC) Tri-State (SC) Traffic Group (SC) ATI (SC)
North Carolina	N/A
North Dakota	**No Response**
Ohio	Count Electronics - Urichsville, Ohio. Used to conduct special request studies and turning movement counts.
Oklahoma	International Road Dynamics - AVC and WIM station installation and maintenance GeoDecisions - Database and GIS Development for data dissemination
Oregon	Wegehaupt, Gerald Quality Counts
Pennsylvania	We use our Metropolitan Planning Organizations (MPO)and our Rural Planning Organizations (RPO) to collect traffic data for us. These organizations receive funding through their United Planning and Work Programs to perform this task. We also have a statewide traffic counting services that is used to collect traffic data. This contract can be used by any governmental agency to collect traffic counts. Vendors submit bids based on the boundaries of the Department's Engineering Districts. Vendors have the option to bid on as many of the Engineering Districts that they choose. Each traffic counting season we send a request to each vendor on the contract for a quote on the number of traffic counts in that Engineering District. Quotes per count cannot exceed the bid on the contract. We select vendors based on these quotes. Currently, we are using three vendors from this contract: Tri-state, Count Electronics and McMahon Associates, Inc.
South Dakota	**No Response**
Tennessee	Kimley-Horn and Associates, Inc. Consultant (Highway-Railcrossing Counts) Sain Associates,Inc. Others as needed.
Vermont	N/A
Virginia	Ditital Traffic Systems, Inc. The Traffic Group, Inc. Tri-State Traffic Data
Washington	N/A
West Virginia	The Traffic Group

The DOT's were asked to provide a Yes or No response to whether or not the DOT has a formal quality control inspection program to check the quality of a contractor's data or fieldwork.

About **36%** of DOT respondents said they have a formal inspection program in place to check the quality of a contractor's data or fieldwork and **22%** of respondents said they do not have a formal inspection program in place at this time. Figure 2 shows the summary of results.

Figure 2 - Inspection Program

If contracted staff, does the DOT have a formal inspection program to check the quality of contractor data and/or fieldwork?

	Response Percent	Response Count
N/A	36.1%	13
No	22.2%	8
Yes (please explain)	**41.7%**	15
answered question		**36**
skipped question		**5**

Detailed responses were provided by DOT's and can be found in the Table 4 below.

Table 4 - Inspection Program Details

State Name	If contracted staff, does the DOT have a formal inspection program to check the quality of contractor data and/or fieldwork? Yes (please explain)
Alabama	N/A
Arizona	No
Arkansas	No
California	N/A
Colorado	The DOT does a ride along inspection with the contractor as they set out counters to check for accurate location and layout. The DOT does this at the start of the season to assure that new hire contractor personal know the process. The DOT does periodic field inspection of setout equipment to assure that the count is in the correct location and that the equipment is set out correct for the type of count taken at the location. The DOT tries to do these inspections once a week or every other week.
Connecticut	N/A
Florida	Traffic count/classification machines for portable sites are certified and signed off on. Permanent installations are check by field technicians.
Georgia	All incoming data is tested using our QC program.
Hawaii	No Comments added
Idaho	N/A
Illinois	We get the raw information from the contractor and it goes through the same QA/QC as if IDOT performed the counts. Normally, the consultants additional QA/QC will eliminate bad count data before it is submitted to IDOT.
Indiana	Traffic counts are reviewed for completeness and accuracy by two members of the staff. In the near future, the counts will be submitted electronically and there will be many electronic checks for completeness and accuracy.
Iowa	N/A
Kansas	N/A
Kentucky	Data is validated and processed in-house. We compare the data to prior years data and request a recount if the discrepancy is too great.
Louisiana	No
Maine	**No Response**

Table 4 – Inspection Program Details – Continued

State Name	If contracted staff, does the DOT have a formal inspection program to check the quality of contractor data and/or fieldwork? Yes (please explain)
Maryland	1.Our HPMS data collection field crews audit the traffic counts during execution. 2.We require all counts to be reviewed and certified by a Maryland licensed P.E. 3.Random equipment validation spot checks
Massachusetts	N/A
Michigan	N/A
Minnesota	N/A
Mississippi	An MDOT employee must be present during all phases of construction. In addition, a continuous 10 day polling acceptance and verification must be approved for new ATR site installation.
Nebraska	**No Response**
Nevada	N/A
New Hampshire	We review the counts for consistency with previous counts. Has developed an in house program to flag problem data.
New Jersey	No
New Mexico	NM State Standards applies to all data
New York	Both our CC and SC contractors are paid on days of acceptable counts. If a short count is not accepted by my staff, the contractor must take another count at his expense. For the CC contractors, they are paid on actual days of acceptable counts, it is up to the contractor to maintain the sites in proper working order to be paid.
North Carolina	**No Response**
North Dakota	**No Response**
Ohio	Data collected by the contractor is reviewed by office staff prior to any payment. All recounts completed prior to payment. Random field inspections completed by office manager.
Oklahoma	No
Oregon	No
Pennsylvania	Our traffic counting partnership with the MPOs and RPOs dates back to 1980s. If there is a question concerning the data after it is processed through the Department's mainframe computer system, this system has edits programmed into it that a count must pass before it is accepted, the MPO or RPO will be contacted about the count. One of the options available to the Department's traffic analyst would be to have the count reset. We have a slightly different process in place for counts taken by vendors from our Traffic Counting Services contract. After a vendor submits a count to the Department, we have 30 days to process the count and determine the quality of the data. These counts are uploaded to the same mainframe computer program as the counts taken by the MPOs and RPOs. If the traffic analyst makes the determination that the data is bad, the vendor is notified. The contract states that vendors are not paid for data we do not accept. The only way for the vendor to be paid for this count is to retake it.
South Dakota	**No Response**
Tennessee	No
Vermont	N/A
Virginia	Inspections are conducted on contract work.
Washington	N/A
West Virginia	No
Wyoming	N/A

4. Short-term Programs – Program Management, Operations, and Staffing

The on-line survey requested that DOT respondents provide information related to their short-term traffic counting programs. Each DOT respondent was asked what days of the week they collected short-term traffic counts. Somewhat expected, all the respondents that answered the question indicated they collect short-term traffic counts on Tuesday, Wednesday, and Thursday. However, **93%** of respondents collect short-term traffic counts on Monday and only approximately **15%** of respondents collect traffic counts on Saturday and Sunday. Figure 3 shows the results in a graphical format.

Figure 3 - Short-Term Traffic Data Collection Days

What days of the week do you collect short-term traffic counts?

	Response Percent	Response Count
Monday	92.7%	38
Tuesday	**100.0%**	41
Wednesday	**100.0%**	41
Thursday	**100.0%**	41
Friday	41.5%	17
Saturday	14.6%	6
Sunday	14.6%	6
	answered question	**41**
	skipped question	**0**

DOT respondents were asked if their travel monitoring program collects short-term traffic counts all year around and **61%** of respondents replied they do collect traffic counts year around. Figure 4 shows the responses.

Figure 4 - Short-term Traffic Data Seasons

Do you collect short-term traffic counts all year around?

	Response Percent	Response Count
No	39.0%	16
Yes, (please specify your count season dates or seasons: example: summer (June, July, and August))	**61.0%**	25
	answered question	**41**
	skipped question	**0**

DOT respondents also gave details about their travel monitoring program count season. See Table 5 for these details.

Table 5 – Short-term Traffic Data Season Details

State Name	Yes or No, Do you collect Short Term Counts all year around? If so, please explain.
Alabama	We do not define count seasons.
Arizona	All weeks/months of year except last half of December and first half of following January
Arkansas	Months are used, not seasons.
California	Short term are collected every month
Colorado	No
Connecticut	No
Florida	January 2nd (or first weekday after New Year's Day) through November 15th (our field data collection cut-off date).
Georgia	We generally count January-October.
Hawaii	Normally within a 12-month period. For Contractor is a 12-month period for selected state and county routes. For HDOT survey unit, it's a different cycle per islands (Oahu is every year and the neighbor islands on a two-year cycle). Oahu and Hawaii are surveyed during even number years, and Maui, Kauai, Molokai and Lanai are surveyed together in same year for with Oahu during the odd years

Table 5 – Short-term Traffic Data Season Details - Continued

State Name	Yes or No, Do you collect Short Term Counts all year around? If so, please explain.
Idaho	No
Illinois	April - October.
Indiana	We count the same all year. (The explanation box would seem more appropriate for the "no" response).
Iowa	No
Kansas	Count by Fiscal Year
Kentucky	No
Louisiana	Winter (November, December, January and February), Spring (March and April) Summer (May, June, July and August) and Fall (September and October)
Maine	No
Maryland	No
Massachusetts	We count all year if weather conditions allow.
Michigan	No
Minnesota	No
Mississippi	MDOT conducts short-term traffic counts January-November
Nebraska	No
Nevada	Varies by Geographic and climatic region.
New Hampshire	No
New Jersey	January through Thanksgiving, weather permitting. Also through December 15, if necessary.
New Mexico	All months of the year
New York	No
North Carolina	We factor data by day of week and month. We collect counts year round and do not have seasons. We do not collect data on holidays or during events (weather, sports, social, etc.).
North Dakota	No
Ohio	80% of district offices collect during peak summer time period...May - October. 20% of district offices collect all year round.
Oklahoma	All seasons
Oregon	No
Pennsylvania	No
South Dakota	April to Oct
Tennessee	All months of the year.
Vermont	No
Virginia	February through November (Thanksgiving). Use monthly factors.
Washington	We collect HPMS March - November. We ramp balance in December - February.
West Virginia	March thru October
Wyoming	Manual counts done 4 times a year by calendar quarter. Urban coverage counts done March - May. Statewide coverage counts done June - September. Special studies done anytime the weather allows.

Other short-term program questions asked in the survey related to the quantity of sites. Results are shown in Table 6. For example, the range of portable volume count sites from all respondents includes the lowest of **1200** total sites in Arizona to the highest of **80,000** including local roads in Virginia.

Table 6 – Short-term Traffic Data Quantity of Sites

	SHORT-TERM PROGRAM TRAFFIC COUNTING QUESTIONS How many...							
State Name	Total portable volume count sites	Annual portable volume count sites	Total portable classification axel count sites	Annual portable classification axel count sites	Total portable classification bin count sites	Annual portable classification bin count sites	Total portable WIM count sites	Annual portable WIM count sites
Alabama	8,500	5,000	**No Response**	**No Response**	**No Response**	**No Response**	**No Response**	**No Response**
Arizona	**1200**	1200	200	200	200	200	0	0
Arkansas	8,200	8,200	1,200	1,200	0	0	0	0
California	16,500	5,500	varies	**No Response**	**No Response**	**No Response**	0	0
Colorado	2200 average annually 3 year cycle	700 average annually 3 year cycle	1000 average annually 3 year cycle	300 average annually 3 year cycle	1000 average annually 3 year cycle	300 average annually 3 year cycle	35 average annually 5 year cycle	none
Connecticut	9600	3200	240	80	60	60	90	30

Table 6 – Short-term Traffic Data Quantity of Sites – Continued

SHORT-TERM PROGRAM TRAFFIC COUNTING QUESTIONS How many...								
State Name	total portable volume count sites	annual portable volume count sites	total portable classification axel count sites	annual portable classification axel count sites	total portable classification bin count sites	annual portable classification bin count sites	total portable WIM count sites	annual portable WIM count sites
Florida	6529	6529	3036	3036	2830	2830	0	0
Georgia	18,000	10,300	n/a	n/a	1,100	1,100	90	30 (3 year cycle)
Hawaii	2,052	1005 in 2006	810	398 in 2006	No Response	No Response	No Response	No Response
Idaho	unknown	2500 average	unknown	200 average	0	0	0	0
Illinois	10000	10000	5000 (we use length based classification, not axle)	5000 (we use length based classification, not axle)	0	0	0	0
Indiana	10337	3445	24118	8040	0	0	0	0
Iowa	11200	2800	31600	7900	0	0	0	0
Kansas	30,000	11,000 (includes off State System)	No Response	No Response	1000	300	90	25
Kentucky	13,500	5,000	No Response	No Response	No Response	No Response	No Response	No Response
Louisiana	55,000	0	55,000	0	300	0	100	0
Maine	4100	3800	0	0	150	145	0	0
Maryland	2031	Approx 677	1609	Approx 536	0	0	0	0
Massachusetts	No Response	No Response	No Response	No Response	No Response	No Response	0	0
Michigan	5080	2540	1100	550	0	0	0	0
Minnesota	32000	10000	1200	200	0	0	0	0
Mississippi	9,000	~3,000	~3,000	~1,000	n/a	n/a	~200	~70
Montana	4000	3000						
Nebraska	Approximately 8000	Approximately 4200	Nearly all are axle counts	Nearly all are axle counts	Very limited portable classification	Very limited portable classification	75	33
Nevada	4,000	2,500	240	80	240	80	90	30
New Hampshire	6000	2000	300	100	No Response	No Response	No Response	No Response
New Jersey	4,879	about one-third of above	1,204 (including 194 manual)	about one-third of above	no length bin class at this time	see above	No portable	No portable
New Mexico	13366	2000	0	0	33% of total counts sites	33% of total annual counts	0	0
New York	28,150 highway segments in NYS have station numbers assigned, this includes on and off state system. There are a total of 9,900 short count segments (both on state and HPMS) counted on a 3 year cycle	6200	28,150 highway segments in NYS have station numbers assigned, this includes on and off state system highways	1700	N/A	N/A	0	0

Table 6 – Short-term Traffic Data Quantity of Sites – Continued

SHORT-TERM PROGRAM TRAFFIC COUNTING QUESTIONS How many...								
State Name	total portable volume count sites	annual portable volume count sites	total portable classification axel count sites	annual portable classification axel count sites	total portable classification bin count sites	annual portable classification bin count sites	total portable WIM count sites	annual portable WIM count sites
North Carolina	42,000	25,000	0	0	1,000	500	0	0
North Dakota	2495	2495	302	302	No Response	No Response	0	0
Ohio	3,460	1/3 of Total	10,259 (13 vehicle classifications)	1/3/of Total	0	0	0	0
Oklahoma	17,000	8,500	10	10	0	0	0	0
Oregon	4500	1500	300	100	0	0	0	0
Pennsylvania	19,565	4,550	8,385	1,950	0	0	0	0
Rhode Island	1000	1000	300	300	0	0		
South Dakota	5810	varies different cycles around 2000	584	584	584	584	0	0
Tennessee	14,519	12,173 (Active Stations)	609	203	0	14	94	31
Utah								
Vermont	300	No Response	No Response	No Response	700	No Response	No Response	No Response
Virginia	80000 - Local roads	14000 - Local Roads	11000	3600	6000	2000	0 - I don't believe portable WIM is reliable	0
Washington	1992	664	810	270	?	?	0	0
West Virginia	11000	3600	No Response	No Response	14400	480	0	0
Wisconsin								
Wyoming	8000	3180	600	120	0	0	0	0

5. Permanent/Continuous Count Programs – Program Management, Operations, and Staffing

The on-line survey requested that DOT respondents provide information related to their permanent traffic counting programs.

In the permanent count program results (Table 7), all high and low numbers are highlighted. For example, the range of total permanent sites from all respondents includes the lowest of **40** total sites in Connecticut to the highest of **2,728** in California.

Table 7 – Number of Permanent Traffic Count Sites

Permanent/Continuous Traffic Program Counting Questions How many…				
State Name	total ATR (permanent/continuous) sites	volume only ATR (permanent/continuous) sites	volume and classification ATR (permanent/continuous) sites	WIM ATR (permanent/continuous) sites
Alabama	115	92	20	3
Arizona	100	5	95	0
Arkansas	60	10	1	49
California	**2728**	1710	1854	97
Colorado	106	4	85	17
Connecticut	**40**	16	24	0
Florida	298	76	188	34

Table 7 – Number of Permanent Traffic Count Sites – Continued

Permanent/Continuous Traffic Program Counting Questions How many…				
State Name	total ATR (permanent/continuous) sites	volume only ATR (permanent/continuous) sites	volume and classification ATR (permanent/continuous) sites	WIM ATR (permanent/continuous) sites
Georgia	313	147--with plans to upgrade these to class	166	0
Hawaii	26	18	8	7
Idaho	203	57	125	21
Illinois	85	45	40	1
Indiana	125	3	71	51
Iowa	156	47	146	35
Kansas	110	90	12	8
Kentucky	78	No Response	No Response	No Response
Louisiana	63	63	0	0
Maine	70	44	14	12
Maryland	79 of which 11 are down	17	51	6 of which 5 are down
Massachusetts	212	212	0	4
Michigan	145	105	6	39
Minnesota	76	46	30	7
Mississippi	77	5	57	15
Montana				
Nebraska	61	13	48	0
Nevada	110	104	2	4
New Hampshire	55	55	No Response	3
New Jersey	171	90	13	68
New Mexico	148	75	54	19
New York	176	62	86	22
North Carolina	130	85	4	45
North Dakota	48	12	48	12
Ohio	200	30	125 (70 Length, 55 Axle Class)	45
Oklahoma	83	0	62	21
Oregon	172	139	11	22
Pennsylvania	81	63	5	13
Rhode Island		41	0	7
South Dakota	65	29	21	15
Tennessee	31	17	14	0
Utah	95	22	70	3
Vermont	65	61	4	16
Virginia	330	20	300	10
Washington	160	2	124	34
West Virginia	47	47	47	29
Wisconsin				
Wyoming	113	52	52	9

6. Permanent/Continuous Count Programs

Questions in the on-line survey included software, hardware, and technology questions that could provide information related to DOT's continuous count program.

6.1 Automated Polling

Approximately **90%** of the DOT respondents indicated their respective DOT's utilize some form of automated polling software for their permanent / continuous ATR stations. Table 8 shows a list of the responses indicated the polling software utilized by DOT's to download permanent traffic data.

Table 8 – Automated Polling Software Products

State Name	What automated polling software do you use to download permanent traffic data?
Alabama	IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link), TOPS (Peek), DataCollector from Wavetronix
Arizona	TOPS (Peek)
Arkansas	TOPS (Peek)
California	IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link), TOPS (Peek), PAT Reporter
Colorado	Centurion, ECM (wElCoMe)
Connecticut	TOPS (Peek)
Florida	Custom written
Hawaii	TOPS (Peek), IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link)
Georgia	TOPS (Peek)
Idaho	IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link)
Illinois	IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link)
Indiana	Centurion, IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link)
Iowa	TOPS (Peek)
Kansas	Centurion, IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link), ECM (wElCoMe)
Kentucky	TOPS (Peek)
Louisiana	TOPS (Peek)
Maine	Peek TDP, but will upgrade to TOPS
Maryland	TOPS (Peek)
Massachusetts	IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link)
Michigan	In-house written application
Minnesota	IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link)
Mississippi	IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link), TOPS (Peek)
Montana	**No Response**
Nebraska	TT-Link, Trafman
Nevada	TRADAS from Chaparral
New Hampshire	**No Response**
New Jersey	IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link), TOPS (Peek)
New Mexico	TDP (Peek)
New York	IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link)
North Carolina	TOPS (Peek)
North Dakota	TOPS (Peek)
Ohio	Centurion
Oklahoma	TOPS (Peek)
Oregon	IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link), Translink
Pennsylvania	IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link)
Rhode Island	**No Response**
South Dakota	TOPS (Peek)
Tennessee	IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link), TOPS (Peek)
Utah	**No Response**
Vermont	**No Response**
Virginia	TOPS (Peek)
Washington	Centurion, IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link)
West Virginia	PAT
Wisconsin	**No Response**
Wyoming	Centurion, IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link)

In addition to the responses above, DOT respondents were given an opportunity to indicate if the DOT utilizes other software for automated polling. These responses can be found in Table 9.

Table 9 – Other Automated Polling Software Products

State Name	Other Software for Automated Polling (please specify)
Alabama	DataCollector from Wavetronix

Table 9 - Other Automated Polling Software Products - Continued

State Name	What automated polling software do you use to download permanent traffic data?
Arizona	TOPS (Peek)
Arkansas	TOPS (Peek)
California	IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link), TOPS (Peek), PAT Reporter
Colorado	Centurion, ECM (wElCoMe)
Connecticut	TOPS (Peek)
Florida	Custom written
Hawaii	TOPS (Peek), IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link)
Georgia	TOPS (Peek)
Idaho	IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link)
Illinois	IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link)
Indiana	Centurion, IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link)
Iowa	TOPS (Peek)
Kansas	Centurion, IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link), ECM (wElCoMe)
Kentucky	TOPS (Peek)
Louisiana	TOPS (Peek)
Maine	Peek TDP, but will upgrade to TOPS
Maryland	TOPS (Peek)
Massachusetts	IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link)
Michigan	In-house written application
Minnesota	IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link)
Mississippi	IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link), TOPS (Peek)
Montana	**No Response**
Nebraska	TT-Link, Trafman
Nevada	TRADAS from Chaparral
New Hampshire	**No Response**
New Jersey	IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link), TOPS (Peek)
New Mexico	TDP (Peek)
New York	IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link)
North Carolina	TOPS (Peek)
North Dakota	TOPS (Peek)
Ohio	Centurion
Oklahoma	TOPS (Peek)
Oregon	IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link), Translink
Pennsylvania	IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link)
Rhode Island	**No Response**
South Dakota	TOPS (Peek)
Tennessee	IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link), TOPS (Peek)
Utah	**No Response**
Vermont	**No Response**
Virginia	TOPS (Peek)
Washington	Centurion, IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link)
West Virginia	PAT
Wisconsin	**No Response**
Wyoming	Centurion, IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link)

6.2 Data Collection Interval

DOT respondents were asked what their data collection intervals were and **83%** of respondents indicated they collect data at 60 minute intervals. Another **15%** of respondents indicated the DOT collects data at 15 minute intervals. See the response in Figure 5 for specific details.

Figure 5 - Data Collection Interval Percentages

If the DOT collects permanent / continuous ATR data, at what interval does the DOT collect data?	Response Percent	Response Count
N/A	0.0%	0
15 minute	14.6%	6
30 minute	0.0%	0
60 minute	**82.9%**	34
Other (please specify)	12.2%	5
answered question		**41**
skipped question		**0**

6.3 Automated Polling Software

DOT respondents were specifically asked to indicate what polling software the DOT utilizes to download permanent traffic data. **48%** of respondents indicated the DOT utilizes Peek's TOPS software product to download permanent traffic data. Another **42%** of respondents indicated the DOT utilizes IRD's i-Analyze, RoadReporter, Trafman, and Telecom-TT-Link software products. Figure 6 shows the specific responses to the automated polling software question.

Figure 6 - Automated Polling Software Responses Summary

What automated polling software do you use to download permanent traffic data?	Response Percent	Response Count
Centurion	15.4%	6
TOPS (Peek)	**48.7%**	19
ECM (wElCoMe)	5.1%	2
IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link)	43.6%	17
Other (please specify)	30.8%	12
answered question		**39**
skipped question		**2**

Specifically each DOT respondent indicated the automated polling software utilized by the DOT to download permanent traffic data and these details can be found in the table below.

Table 10 – Automated Polling Software

State Name	What automated polling software do you use to download permanent traffic data?
Alabama	IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link), TOPS (Peek), DataCollector from Wavetronix
Arizona	TOPS (Peek)
Arkansas	TOPS (Peek)
California	IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link), TOPS (Peek), PAT Reporter
Colorado	Centurion, ECM (wElCoMe)
Connecticut	TOPS (Peek)
Florida	Custom written
Hawaii	TOPS (Peek), IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link)
Georgia	TOPS (Peek)

Table 10 – Automated Polling Software - Continued

State Name	What automated polling software do you use to download permanent traffic data?
Idaho	IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link)
Illinois	IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link)
Indiana	Centurion, IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link)
Iowa	TOPS (Peek)
Kansas	Centurion, IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link), ECM (wElCoMe)
Kentucky	TOPS (Peek)
Louisiana	TOPS (Peek)
Maine	Peek TDP, but will upgrade to TOPS
Maryland	TOPS (Peek)
Massachusetts	IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link)
Michigan	In-house written application
Minnesota	IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link)
Mississippi	IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link), TOPS (Peek)
Montana	**No Response**
Nebraska	TT-Link, Trafman
Nevada	TRADAS from Chaparral
New Hampshire	**No Response**
New Jersey	IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link), TOPS (Peek)
New Mexico	TDP (Peek)
New York	IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link)
North Carolina	TOPS (Peek)
North Dakota	TOPS (Peek)
Ohio	Centurion
Oklahoma	TOPS (Peek)
Oregon	IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link), Translink
Pennsylvania	IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link)
Rhode Island	**No Response**
South Dakota	TOPS (Peek)
Tennessee	IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link), TOPS (Peek)
Utah	**No Response**
Vermont	**No Response**
Virginia	TOPS (Peek)
Washington	Centurion, IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link)
West Virginia	PAT
Wisconsin	**No Response**
Wyoming	Centurion, IRD (i-Analyze, Road Reporter, Trafman, Telecom-TT-link)

7. Year-end Processing of Traffic Data

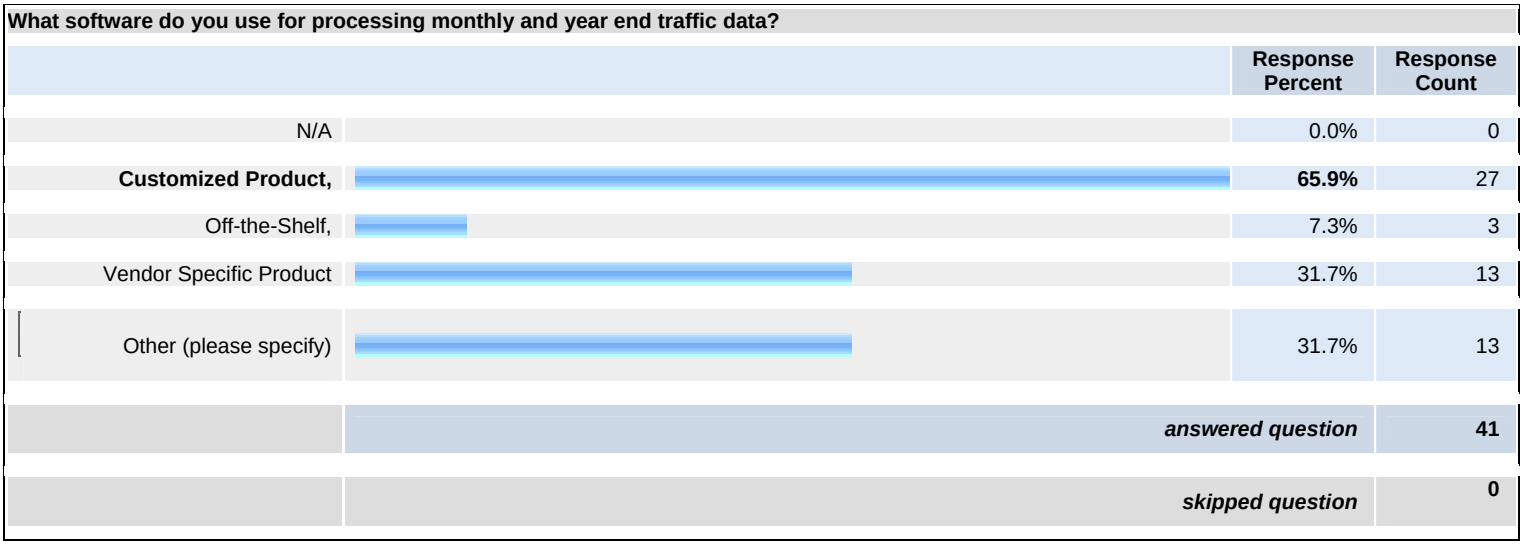
A number of questions in the on-line survey were related to year-end processing of traffic data. The responses for these questions can be found below.

7.1 Automated Procedures for Data Processing

When asked if the DOT has automated procedures in place for monthly and year-end traffic data processing, **84%** of DOT respondents indicated they do not have automated procedures in place for monthly and year-end traffic data processing.

Additionally, DOT respondents were asked to indicate what software was utilized for processing monthly and year-end traffic data. The responses can be found in the Figure 7.

Figure 7 - Monthly and Year-end Data Processing Software Summary



What software do you use for processing monthly and year end traffic data?		
	Response Percent	Response Count
N/A	0.0%	0
Customized Product,	**65.9%**	27
Off-the-Shelf,	7.3%	3
Vendor Specific Product	31.7%	13
Other (please specify)	31.7%	13
answered question		**41**
skipped question		**0**

Every DOT respondent was given the opportunity to specify other software used for processing monthly and year-end traffic data. The individual responses can be found in Table 11.

Table 11 – Data Processing Software Summary

State Name	What software do you use for processing monthly and year end traffic data?			
	Customized Product	Off-the-Shelf	Vendor Specific Product	Other (please specify)
Alabama	X			
Arizona			X	
Arkansas	X			
California	X			
Colorado	X		X	
Connecticut	X			
Florida	X			
Georgia	X		X	We have a vendor (mid western consulting) who provides us with a web site for displaying data. The web site still has bugs in it and we are tweaking the bugs.
Hawaii	X	X	X	
Idaho	X			
Illinois	X			Internal ACCESS developed database
Indiana			X	
Iowa				Currently in-house automation transitioning to TRADAS
Kansas	X	X		
Kentucky	X			
Louisiana			X	
Maine			X	Microsoft Excel
Maryland	X			
Massachusetts			X	
Michigan	X			We developed the software ourselves.
Minnesota	X		X	
Mississippi	X			
Nebraska	X			All written in-house
Nevada			X	
New Hampshire				Software program developed in house
New Jersey				In-house mainframe and TRADAS
New Mexico	X		X	TRADAS developed by Chaparral
New York	X			

North Carolina	X			

Table 11 – Data Processing Software Summary – Continued

State Name	What software do you use for processing monthly and year end traffic data?			
	Customized Product	Off-the-Shelf	Vendor Specific Product	Other (please specify)
North Dakota				in house product
Ohio	X			
Oklahoma	X	X		
Oregon	X			
Pennsylvania	X			
South Dakota	X			
Tennessee			X	Advanced traffic Data Analysis Management (ADAM)
Vermont	X			
Virginia	X			
Washington				Internal Mainframe Legacy System
West Virginia			X	
Wyoming				RFP in progress

State DOT's were asked to provide information related to the types of data processing programming languages used to develop customized, off-the-shelf, or other types of software products. Figure 8 shows the percentages of data processing programming languages.

Figure 8 - Summary of Data Processing Software Programming Platforms

If automated processing software, please specify software platform used.

	Response Percent	Response Count
Visual Basic	35.3%	12
Java	8.8%	3
C++	8.8%	3
.NET	2.9%	1
Other (please specify)	**58.8%**	20
answered question		**34**
skipped question		**7**

DOT respondents had the opportunity to provide detailed information about other types of data processing program languages. The detailed responses can be found in Table 12.

Table 12 – Detailed Data Processing Programming Languages

State Name	If automated processing software, please specify software platform used.				
	Visual Basic	Java	C++	.NET	Other (please specify)
Alabama	X				Oracle SQL
Arizona	X				
Arkansas					datacom (main frame app)
California		X			
Colorado	X				
Connecticut	X				
Florida			X		
Georgia	X				We still use VMS FORTRAN on our mainframe computer to process/QC traffic data.
Hawaii					Modified New England Traffic Monitoring Software (NE TMS)
Idaho			X		

Table 12 – Detailed Data Processing Programming Languages

State Name	If automated processing software, please specify software platform used.				
	Visual Basic	Java	C++	.NET	Other (please specify)
Illinois					**No Response**
Indiana					Not sure
Iowa					Currently mainframe transitioning to Oracle database .NET framework
Kansas	X				C
Kentucky					Mainframe
Louisiana					**No Response**
Maine					**No Response**
Maryland					Stored procedures in the database
Massachusetts					**No Response**
Michigan	X				
Minnesota					**No Response**
Mississippi					MicroSoft Visual FoxPro
Nebraska	X				
Nevada					Oracle
New Hampshire					Microsoft Access
New Jersey					I don't know
New Mexico					oracle
New York					Oracle, MS-DOS
North Carolina	X	X			
North Dakota					in house
Ohio		X			
Oklahoma	X				
Oregon					FoxPro; Building SQL system now
Pennsylvania				X	COBOL programs on Department's mainframe computer
Rhode Island					
South Dakota	X				
Tennessee					Oracle
Vermont					**No Response**
Virginia	X				
Washington			X		
West Virginia					Vendor Software
Wyoming					**No Response**

DOT respondents were asked to provide a yes or no response to whether or not their respective DOT's have developed any customized code for travel monitoring program items such as AADT, DD, ADT, DHV, etc. **46%** of the DOT respondents indicated their DOT does have customized code and **54%** of respondents indicated they do not have any customized code written for any traffic monitoring program items (See Figure 9). DOT's that have customized code were asked to specifically provide information on which travel monitoring program items are automated. Table 13 summarizes the type of travel program monitoring items that have automated software.

Figure 9 - Automated Travel Monitoring Program Item Summary

Do you currently have contractors or vendors that are writing customized code for any traffic monitoring program items?

	Response Percent	Response Count
Yes	46.3%	19
No	**53.7%**	22
If Yes, who is the contractor or vendor?	46.3%	19
answered question		**41**
skipped question		**0**

Table 13 – Automated Travel Monitoring Program Item Details

State Name	Please select any items that are automatically generated, or use automated software, to calculate the following traffic monitoring program items										
	N/A	AADT	DD	ADT	DHV	ESAL	AADT Single Trucks	AADT Combination Trucks	Seasonal Factors	Axle Adjustment Factors	Other (please specify)
Alabama											We adjust 7 day counts directly to AADT. The factors for each time period counted are generated by in house programs written in Quick Basic. Programs to automate axle correction and AADT development are currently being written and should be completed within the next year.
Arizona		X					X	X	X	X	K & D Factors
Arkansas		X							X	X	
California		X					X	X	X		AADT is only calculated if certain business rules are met. Accuracy needs to be manually verified.
Colorado		X	X		X	X	X	X			
Connecticut		X		X		X	X	X	X	X	
Florida		X	X	X	X	X	X	X	X	X	
Georgia		X	X			X			X	X	We generally roll up class data as a "truck percentage". Bins 4-13 are considered to be "heavy trucks".
Hawaii		X		X							
Idaho		X		X							
Illinois		X		X			X	X	X		All of the checked items are calculated in our internally developed ACCESS database
Indiana		X	X	X	X				X		
Iowa		X		X		X			X	X	
Kansas		X				X			X	X	
Kentucky		X							X		
Louisiana	X										
Maryland		X	X	X			X	X	X	X	We use an Oracle 10 database with stored procedures and crystal reports for the reporting
Massachusetts				X							
Michigan		X			X	X			X	X	We calculate CADT, but not broken down by single/combo. We also generate Overweight Trucks reports.
Minnesota	X										
Mississippi		X	X	X	X	X			X	X	Daily Adjustment Factors
Nebraska		X		X	X	X	X	X	X	X	
Nevada		X		X	X	X			X	X	
New Hampshire		X	X	X	X	X			X	X	
New Jersey		X				X				X	Seasonal factors are generated iteratively with automated output and manual intervention.
New Mexico		X		X	X	X	X	X	X	X	Daily factors Growth factors
New York		X		X							
North Carolina		X	X	X	X				X	X	
North Dakota		X		X		X	X	X	X	X	
Ohio		X	X	X	X	X	X	X	X	X	
Oklahoma	X										
Oregon					X		X	X	X	X	
Pennsylvania		X		X		X	X	X	X	X	

Table 13 – Automated Travel Monitoring Program Item Details – Continued

State Name	Please select any items that are automatically generated, or use automated software, to calculate the following traffic monitoring program items										
	N/A	AADT	DD	ADT	DHV	ESAL	AADT Single Trucks	AADT Combination Trucks	Seasonal Factors	Axle Adjustment Factors	Other (please specify)
South Dakota		X	X	X	X	X	X	X	X	X	
Tennessee		X	X	X	X	X	X	X	X	X	Peak Hour %
Virginia		X		X		X	X	X	X	X	
Washington		X		X	X	X	X	X	X	X	
West Virginia		X		X		X	X	X	X	X	
Wyoming	X										

8. Traffic Data Collection Equipment

The on-line survey also included a number of questions related to the types of traffic data collection equipment utilized at each DOT. Figure 10 shows a summary of the responses by DOT's indicating the percentages of each type of equipment utilized.

Figure 10 - Traffic Data Collection Equipment Summary

What type of traffic collection equipment do you (or your contractors) currently use?

	Response Percent	Response Count
Peek	**68.3%**	28
Diamond	58.5%	24
Metro Count	19.5%	8
Mitron	9.8%	4
Wavetronic	24.4%	10
IRD	53.7%	22
PAT	26.8%	11
EMC	0.0%	0
Metter-Toledo	0.0%	0
Jamar	46.3%	19
Time Mark	14.6%	6
Nu Metrics	9.8%	4
Other (please specify)	26.8%	11
	answered question	**41**
	skipped question	**0**

Specifically, Table 14 shows each individual response to the traffic data collection equipment used at each DOT.

Table 14 – Traffic Data Collection Equipment Detail

State Name	What type of traffic collection equipment do you (or your contractors) currently use?												
	Peek	Diamond	Metro Count	Mitron	Wavetronic	IRD	PAT	EMC	Metter-Toledo	Jamar	Time Mark	Nu Metrics	Other (please specify)
Alabama	X	X			X								Micros RacTel
Arizona	X												
Arkansas	X				X	X							
California	X	X				X	X						
Colorado		X	X	X						X			
Connecticut	X	X			X	X				X			
Florida	X	X	X	X	X		X			X	X		
Georgia	X		X										
Hawaii	X		X			X	X			X			DCMS-Econolite Control Products, Inc
Idaho		X				X							ECM
Illinois				X								X	
Indiana		X				X	X					X	
Iowa	X				X								
Kansas		X				X	X			X		X	RTMS
Kentucky	X									X			
Louisiana	X	X				X					X		
Maine	X												
Maryland	X		X	X		X				X	X		We use PEEK in our permanent sites but allow consultants to use any counter type for portables.
Massachusetts						X							
Michigan		X					X			X			Testing Wavetronics and TIRTL
Minnesota	X				X	X					X		
Mississippi	X		X			X	X			X			
Montana													
Nebraska	X	X			X					X			Video camera
Nevada		X				X	X			X			Golden River
New Hampshire		X								X			
New Jersey	X					X				X			
New Mexico	X					X							
New York	X		X			X				X			Smartek and 3M Micro-Loops
North Carolina	X	X			X					X			
North Dakota	X	X				X	X			X			
Ohio	X	X											
Oklahoma	X	X				X							

Table 14 – Traffic Data Collection Equipment Detail

State Name	What type of traffic collection equipment do you (or your contractors) currently use?												
	Peek	Diamond	Metro Count	Mitron	Wavetronic	IRD	PAT	EMC	Metter-Toledo	Jamar	Time Mark	Nu Metrics	Other (please specify)
Oregon	X	X				X					X		170 Signal Controllers
Pennsylvania	X	X			X	X	X			X	X		
South Dakota	X	X			X	X	X						
Tennessee	X	X								X		X	RTMS
Vermont										X			
Virginia	X	X											
Washington		X				X							
West Virginia			X										
Wyoming		X											

8.1 Non-intrusive Traffic Counting Equipment

Each DOT was asked to provide a response to whether or not their DOT uses non-intrusive traffic counting equipment. The responses indicated that **65%** of DOT's do not use non-intrusive traffic counting equipment whereas **35%** of respondents do use non-intrusive traffic counting equipment. The specific detailed responses can be seen in Table 15.

Table 15 - Non-intrusive Traffic Counting Equipment Usage

State Name	Does the DOT use non-intrusive traffic counting equipment?	
	No	Yes (please specify type of technology utilized)
Alabama		SmartSensor by Wavetronix
Arizona	X	
Arkansas		Wavetronics Smart Sensor
California		Limited use of radar, testing infra red
Colorado		The DOT has radar station for ATRs
Connecticut	X	
Florida		Wavetronics, RTMS
Georgia		We are migrating away from RTMS technology. It is not reliable.
Hawaii	X	
Idaho		Radar
Illinois		TIRTL - Traffic Infrared Traffic logger. We have two ATR sites equipment with the TIRTL and plan on many more.
Indiana	X	
Iowa		Digital Microwave Radar
Kansas		Radar
Kentucky		NILAD and RADAR
Louisiana		Radar
Maine	X	
Maryland		Consultants use the TIRTL and are researching the PEEK Axle light
Massachusetts	X	
Michigan		We are currently testing Wavetronics and TIRTL for portable collection. We utilize data from Michigan Intelligent Transportation Center and Traffic.com
Minnesota		TIRTL, infrared axle sensors Wavetronix, radar RTMS, radar
Mississippi	X	
Nebraska		Wavetronics radar detection
Nevada	X	
New Hampshire		Experimenting with Wavetronix radar device for volume, speed, and length based vehicle classification
New Jersey	X	

New Mexico		camera sites radar sites

Table 15 – Non-intrusive Traffic Counting Equipment Usage

State Name	Does the DOT use non-intrusive traffic counting equipment?	
	No	Yes (please specify type of technology utilized)
New York		Smartek Acoustic Sensor and 3M micro- loops
North Carolina		Wavetronics Radar, TIRTL Infrared
North Dakota	X	
Ohio	X	
Oklahoma	X	
Oregon		One Wavetronix being tested
Pennsylvania		We are currently testing the Wavetronics Smartsensor
South Dakota		Wavetronic
Tennessee		Numetric Groundhogs RTMS
Vermont	X	
Virginia		Wavetronix HD Sensor RTMS from EIS
Washington		RTMS (Microwave), ITERIS Advantage (Optical) and TIRTL (Infrared)
West Virginia	X	
Wyoming	X	

9. Software Systems

DOT respondents were asked to comment on their software systems documentation practices, publishing, and integration capabilities. Figure 11 shows the percentage of DOT's that have fully automated and/or integrated software systems.

Figure 11 - Integration/Automation of Data Processing, Polling, and Publishing Software

Are any of the following software systems fully automated and/or integrated?

	Yes	No	Response Count
Processing software and Data Publishing Software	27.8% (10)	**72.2% (26)**	36
Polling software and Processing Software	36.8% (14)	**63.2% (24)**	38
Polling software and Publishing Software	20.0% (7)	**80.0% (28)**	35
		answered question	**39**
		skipped question	**2**

If respondents indicated the DOT had fully automated and/or integrated software systems, the DOT was asked to describe fully automated and/or integrated software systems. Table 16 shows the individual responses.

Table 16 – Data Processing, Polling, and Publishing Software Integration Details

State Name	If Yes on any, please describe
	Open-Ended Response
Alabama	Vendor supplied polling software. Data is processed and checked manually and stored on mainframe. Reports generated from mainframe for submittal to FHWA and mailing.
Arizona	**No Response**
Arkansas	**No Response**
California	Polling and Processing for WIM data only
Colorado	Business process have been documented and charted. Software is in the process of being documented. Contract specifications are documented
Connecticut	**No Response**

Table 16 – Data Processing, Polling, and Publishing Software Integration Details

State Name	If Yes on any, please describe
	Open-Ended Response
Florida	Automated polling, conversion from binary to ASCII, loading and editing.
Georgia	We are in the processing of migrating to a new system being developed by Northgrup Grummon. Once this is done, we hope to be "fully automated" or closer to it.
Hawaii	The Hawaii Department of Transportation (HDOT) traffic program business processes, software/hardware, etc., is described in the Hawaii Traffic Monitoring System (H-TMS) document which is updated every three years and submitted to FHWA. The H-TMS is intended to be a systematic process for the collection, analysis, summary, and retention of highway related user and vehicular traffic data for the HDOT. The H-TMS is based on the requirements prescribed in the 23CFR, Part 500 Subpart B- Traffic Monitoring System, effective January 21, 1997 and the Traffic Monitoring Guide, dated January 2001. The intent of HDOT is to continually make revisions to the H-TMS to reflect the timely needs and requirements of HDOT while conforming to the FHWA requirements. Additionally, H-DOT has developed contract specifications (or service contracts) for the operation and maintenance of its Portable Count Program, Continuous Traffic Monitoring Program, Digital Videolog Program (roadway inventory data) and Coordinated Data System/Geographic Information System (CDS/GIS) which is the central data repository and foundation for HDOT RIS system.
Idaho	Our processing software also produces monthly and annual reports.
Illinois	**No Response**
Indiana	**No Response**
Iowa	**No Response**
Kansas	---
Kentucky	**No Response**
Louisiana	**No Response**
Maine	**No Response**
Maryland	Processing software and Data Publishing Software- stored procedures to populate report tables then exported through Adobe Acrobat or Crystal Reports
Massachusetts	**No Response**
Michigan	Our short term and PTR(ATR) data processing software also archives data to the Corporate database and produces reports. The Polling software also processes data for the various databases for each data type.
Minnesota	No
Mississippi	**No Response**
Nebraska	Polling software generates "ASCII with labels - Old Style" (Diamond output format), then our own software reads those text files, reformats data, and populates station-specific files that are used for viewing, editing, reporting, and converting data to any necessary format.
Nevada	Tradas from Chapparal polls and processes
New Hampshire	**No Response**
New Jersey	All are semi-automated but several manual processes persist.
New Mexico	TDP (polling) TRADAS (processing and Publishing)
New York	We use TRAFMAN to poll our continuous count sites and download the data. The data is loaded into a consultant produced computer application called TCE (CC) and data integrity checks are performed. The data is then loaded into another consultant produced computer application called HDMS where our data is stored. HDMS does not calculate factors such as the axle adjustment factors or the seasonal adjustment factors. Due to limitations in our HDMS software we are currently considering purchasing TRADAS.
North Carolina	**No Response**
North Dakota	In house software
Ohio	**No Response**
Oklahoma	**No Response**
Oregon	Currently in development.
Pennsylvania	Processing of all short term traffic counting is fully automated by using software developed by consultants or within the Roadway Management System (RMS). I am not sure what is meant by data publishing. Polling and processing software is fully automated. The software was developed by a vendor for the Department. Polling software and publishing software: The polling software is automated. I am not sure what is meant by data publishing.
South Dakota	**No Response**
Tennessee	Integrated.
Vermont	**No Response**
Virginia	Honestly, the question was confusing as written. We have automation in all those areas.
Washington	Vendor software (IAnalyze, TRAFMAN/Centurion Gold)
West Virginia	Thru vendor software polling and processing is accomplished
Wyoming	**No Response**

9.1 GIS

Each DOT respondent was asked if their DOT's used a GIS system. If respondents replied Yes, the DOT respondent was asked to provide details on how the GIS was currently being utilized. Figure 12 and Table 17 show responses for the GIS question.

Figure 12 - Percentage of DOT's with GIS

Does the DOT use GIS?

	Response Percent	Response Count
No	12.8%	5
Yes	**87.2%**	34
	answered question	**39**
	skipped question	**2**

Table 17 - GIS Software Details

State Name	If Yes, is GIS used for:	
	Display of Traffic Data (Stations, Volume, etc.), describe	Processing of Traffic Data, Publishing of Traffic Data, Other Please specify and describe
Alabama	Volume and related data entered into GIS application.	GIS application is used to push traffic data to our WEB page, the various management systems in place
Arizona	In development	In development
Arkansas	**No Response**	Traffic data and truck percent maps and location maps
California	**No Response**	**No Response**
Colorado	Traffic count station locations, traffic volume by segment	Traffic volume map
Connecticut	no	no
Florida	Real-time polling system	Traffic DVD
Georgia	Display of Traffic Data and other data such as FC maps	QC of Traffic Data--we verify through the GPS data that the data collector collected the data on the correct location. Processing of Traffic Data, Publishing of Traffic Data, Other Please specify and describe - HDOT GIS system uses an Internet based website technology and includes the following features:-HPMS Data-Mileage-Milepoint-Roadway Project Data-Roadway Inventory-Traffic Data-NHS Map-Bridge Location-Pavement Markings-Traffic Stations Locations
Hawaii	Yes	
Idaho	**No Response**	**No Response**
Illinois	All ADTs are displayed on interactive web-based application on IDOT web site	Yes
Indiana	Counts and locations can be obtained by clicking on the map	Map will be on website within next year
Iowa	**No Response**	**No Response**
Kansas	Flow Map	Flow Map, ADT updates for HPMS
Kentucky	Mapping traffic count stations	**No Response**
Louisiana	**No Response**	**No Response**
Maine	**No Response**	Providing estimates as well as actual counts for all roads within the system
Maryland	just station locations	N/A
Massachusetts	Stations	**No Response**
Michigan	Used to display ATR locations, short count locations, AADT and CADT estimates.	**No Response**
Minnesota	Displaying traffic data	Publish on ArcIMS website
Mississippi	Display of Hurricane Evacuation Sites, Special Mapping Projects	Data Verification, LRS Maintenance
Nebraska	not at this time	not at this time
Nevada	**No Response**	**No Response**

Table 17 – GIS Software Details – Continued

State Name	If Yes, is GIS used for:	
	Display of Traffic Data (Stations, Volume, etc.), describe	Processing of Traffic Data, Publishing of Traffic Data, Other Please specify and describe
New Hampshire	Location of stations and AADT's on highway segments	**No Response**
New Jersey	Display of stations and volumes	**No Response**
New Mexico	Stations site locations	Processing of traffic data (identifying sites)
New York	IMS application used to display off system traffic counts as points and AADT's as line events. Using Identify button and selecting a station allows the user to view and download latest traffic data	GIS is used in coordination with other programs for analysis to meet their goals in using geographically referenced traffic counts to plan, regulate and meet other statewide transportation needs.
North Carolina	ArcGIS Shapefiles for map generation and viewing on computer.	ArcGIS Shapefiles are distributed to customers that use GIS.
North Dakota	locations of the traffic counts in the field and maps	**No Response**
Ohio	Generate Traffic Volume maps using Geo Media. Display count stations.	**No Response**
Oklahoma	Yes - Web portal displays data, volume, truck percentages, etc.	Yes - publishing of AADT official maps are thru GIS mapping procedures.
Oregon	flow maps, ATR locations	**No Response**
Pennsylvania	Traffic Monitoring System (used by DOT traffic analysts) Internet Traffic Monitoring System (iTMS) website used by the public to access traffic data	Traffic Information System (TIS) used to edit ATR data, TMS and iTMS
South Dakota	Yes	Yes
Tennessee	Yes - Website	**No Response**
Vermont	**No Response**	**No Response**
Virginia	Yes	No
Washington	Not yet but soon	Not yet but soon
West Virginia	**No Response**	**No Response**
Wyoming	**No Response**	**No Response**

9.2 Software Requirements

Respondents were asked if their DOT had developed any software requirements documentation. Each individual response can be found in Table 18.

Table 18 – Software Requirements Documentation

State Name	Does the DOT have formal requirements documentation for the following?						If Yes to any above, please specify or explain
	Business Processes? If yes please specify - Yes	Business Processes? If yes please specify - No	Software / Hardware? If yes please specify - Yes	Software / Hardware? If yes please specify - No	Contract Specifications? If yes please specify - Yes	Contract Specifications? If yes please specify - No	Open-Ended Response
Alabama		No		No		No	**No Response**
Arizona		No		No		No	**No Response**
Arkansas		No		No		No	**No Response**
California	Yes		Yes			No	**No Response**
Colorado	Yes		Yes		Yes		Business process have been documented and charted. Software is in the process of being documented. Contract specifications are documented
Connecticut		No		No	Yes		Under DAS contracting procedures
Florida	Yes		Yes		Yes		Procedures, business plan, handbooks
Georgia		No		No		No	We are in the process of developing business processes/software/hardware requirements for the NG project.

Table 18 – Software Requirements Documentation – Continued

State Name	Does the DOT have formal requirements documentation for the following?						If Yes to any above, please specify or explain
	Business Processes? If yes please specify - Yes	Business Processes? If yes please specify - No	Software / Hardware? If yes please specify - Yes	Software / Hardware? If yes please specify - No	Contract Specifications? If yes please specify - Yes	Contract Specifications? If yes please specify - No	Open-Ended Response
Hawaii	Yes		Yes		Yes		The Hawaii Department of Transportation (HDOT) traffic program business processes, software/hardware, etc., is described in the Hawaii Traffic Monitoring System (H-TMS) document which is updated every three years and submitted to FHWA. The H-TMS is intended to be a systematic process for the collection, analysis, summary, and retention of highway related user and vehicular traffic data for the HDOT. The H-TMS is based on the requirements prescribed in the 23CFR, Part 500 Subpart B- Traffic Monitoring System, effective January 21, 1997 and the Traffic Monitoring Guide, dated January 2001. The intent of HDOT is to continually make revisions to the H-TMS to reflect the timely needs and requirements of HDOT while conforming to the FHWA requirements. Additionally, H-DOT has developed contract specifications (or service contracts) for the operation and maintenance of its Portable Count Program, Continuous Traffic Monitoring Program, Digital Videolog Program (roadway inventory data) and Coordinated Data System/Geographic Information System (CDS/GIS) which is the central data repository and foundation for HDOT RIS system.
Idaho		No		No		No	**No Response**
Illinois	Yes			No	Yes		IDOT is being ISO certified for all processes. We put our traffic contract specs on the PTB (Professional Transportation bulletin) when needed.
Indiana		No		No	Yes		Contracts specify count requirements, what is expected of them, and what we will provide to them.
Iowa		No		No		No	
Kansas		No	Yes		Yes		---
Kentucky		No		No		No	**No Response**
Louisiana		No		No		No	**No Response**
Maine		No		No		No	**No Response**
Maryland	Yes			No	Yes		Business Processes for Traffic Monitoring are documented Available on our website(www.marylandroads.com) under TMS consultant information.
Massachusetts		No		No		No	**No Response**
Michigan		No		No		No	**No Response**
Minnesota		No		No		No	No
Mississippi		No		No		No	**No Response**
Nebraska		No		No		No	**No Response**
Nevada		No		No		No	**No Response**

Table 18 Software Requirements Documentation - Continued

State Name	Does the DOT have formal requirements documentation for the following?						If Yes to any above, please specify or explain
	Business Processes? If yes please specify - Yes	Business Processes? If yes please specify - No	Software / Hardware? If yes please specify - Yes	Software / Hardware? If yes please specify - No	Contract Specifications? If yes please specify - Yes	Contract Specifications? If yes please specify - No	Open-Ended Response
New Hampshire		No		No		No	**No Response**
New Jersey	Yes		Yes		Yes		NJ Treasury's Office of Information Technology has requirements for processes, hardware and software. Contract specifications have requirements within the Professional Services process.
New Mexico		No		No	Yes		Contract counts must be in accordance with the NM State Standards Business Processes: Engineering Instruction and Bulletins Software / Hardware: Included in the Maintenance Contracts Contract Specifications: Maintenance Contracts that are performance based
New York	Yes		Yes		Yes		
North Carolina		No		No		No	**No Response**
North Dakota	Yes		Yes			No	in house procedures
Ohio		No	Yes		Yes		Documentation for TKO software used to process permanent count data. All DOT contract specifications are documented.
Oklahoma		No		No		No	**No Response**
Oregon		No	Yes		Yes		The business process is behind, awaiting a description of how we use the new software. The first phase of the software project included a specification of data and process. We have contract specifications for the classifiers we recently purchased, the interval counters in process, and the contract with the counting company.
Pennsylvania		No	Yes		Yes		Software/Hardware: Documentation provided by the vendor as required by the DOT. Contract Specifications: Required by Commonwealth purchasing procedures and guidelines
South Dakota	Yes		Yes		Yes		Have wrote traffic manuals
Tennessee	Yes		Yes			No	Manual & Vendor provided.
Virginia		No		No	Yes		Again, the question is confusing. We have established contract specifications for data collection.
Washington		No		No		No	**No Response**
West Virginia		No		No		No	**No Response**
Wyoming		No		No		No	**No Response**

9.3 Software Diagrams

Respondents were also asked if their DOT has developed any software system diagrams. Each individual response can be found in Table 19.

Table 19 - Software System Diagrams

State Name	Does the DOT have any system diagrams for the following?								If Yes to any, please specify or explain
	Business Processes? - Yes	Business Processes? - No	Software? - Yes	Software? - No	Hardware? - Yes	Hardware? - No	Databases? - Yes	Databases? - No	Open-Ended Response
Alabama		No		No		No		No	**No Response**
Arizona		No		No		No		No	**No Response**
Arkansas		No		No		No		No	**No Response**
California		No		No		No		No	**No Response**
Colorado	Yes		Yes		Yes		Yes		See 27
Connecticut		No		No		No		No	**No Response**
Florida		No	Yes			No	Yes		Some software documentation for end-of-year processing, polling, editing.
Georgia		No		No		No		No	All these activities are under development.
Hawaii	Yes		Yes		Yes		Yes		See 27
Idaho		No		No		No		No	**No Response**
Illinois		No		No		No		No	**No Response**
Indiana		No		No		No		No	**No Response**
Iowa	Yes		Yes			No	Yes		Business Processes as they relate to software on the legacy mainframe system are well documented in text, flowcharts, and examples. The TRADAS system provides diagrams and table layouts for non-proprietary sections of the database.
Kansas		No		No		No		No	---
Kentucky		No		No		No		No	**No Response**
Louisiana		No		No		No		No	**No Response**
Maine		No	Yes			No	Yes		We recently completed the mapping of our processing for all data - will begin steps to hire a consultant to develop a comprehensive processing/storage/reporting software.
Maryland		No		No		No		No	**No Response**
Massachusetts		No		No		No		No	**No Response**
Michigan	Yes			No		No	Yes		Business process diagram needs updating. Database diagram is the corporate database.
Minnesota	Yes		Yes			No	Yes		We have a flow diagram that shows process, systems and software.
Mississippi		No		No		No		No	**No Response**
Nebraska			Yes				Yes		Flow chart diagrams are included in our TMS documentation as we deem necessary and helpful.
Nevada		No		No		No		No	**No Response**

Table 19 – Software Systems Diagram

State Name	Does the DOT have any system diagrams for the following?								If Yes to any, please specify or explain
	Business Processes? - Yes	Business Processes? - No	Software? - Yes	Software? - No	Hardware? - Yes	Hardware? - No	Databases? - Yes	Databases? - No	Open-Ended Response
New Hampshire		No		No		No		No	**No Response**
New Jersey		No		No		No		No	**No Response**
New Mexico		No		No		No		No	**No Response**
New York		No		No		No		No	**No Response**
North Carolina	**No Response**		**No Response**		**No Response**		Yes		We have some documentation of database development. flow charts, graphs, tables
North Dakota	Yes		Yes		Yes		Yes		
Ohio		No		No		No	Yes		TKO Database GIS Database Warehousing models for all enterprise data including AADT's and Volume groups thru HPMS
Oklahoma		No		No		No	Yes		
Oregon		No		No		No		No	**No Response**
Pennsylvania	Yes		Yes			No	Yes		Business Processes: Flow charts exist for the Roadway Management System (RMS), Traffic Monitoring System (TMS) and Internet Traffic Data Upload System (iTDUS). Software: Any software designed for the traffic counting program has been documented. Part of the documentation process includes system diagrams. Databases: All databases designed for the traffic counting program has been documented. Part of the documentation process includes system diagrams.
South Dakota		No		No		No		No	**No Response**
Tennessee		No		No		No		No	**No Response**
Virginia		No		No		No		No	**No Response**
Washington	Yes		Yes		Yes		Yes		We conducted data modeling sessions to document our procedures and work flow. We also have mainframe documentation.
West Virginia		No		No		No		No	**No Response**
Wyoming		No		No		No		No	**No Response**

9.4 Databases

The on-line survey also asked the DOT respondents what database software is used to store traffic counts. The responses are summarized in Figure 13.

Figure 13 - Database Software Summary

What database software is used to store traffic counts?

	Response Percent	Response Count
Oracle	**60.0%**	24
SQL Server	17.5%	7
Sybase	2.5%	1
MySQL	0.0%	0
Other (please specify)	52.5%	21
	answered question	**40**
	skipped question	**1**

Each DOT respondent had the opportunity to provide information on what database software is used to store traffic counts. The results can be found in the Table 20.

Table 20 - Database Software Summary

State Name	What database software is used to store traffic counts?			
	Oracle	SQL Server	Sybase	Other (please specify)
Alabama	Oracle			VSAM file on mainframe. Will be converted to Oracle within the year
Arizona	Oracle			
Arkansas				dat com (main frame)
California	Oracle			
Colorado	Oracle			
Connecticut				Ascii
Florida	Oracle			IBM mainframe DB2
Georgia				VMS Flat File.....(we are migrating away from this) We plan on using Oracle in the future.
Hawaii	Oracle			
Idaho	Oracle			
Illinois		SQL Server		ACCESS
Indiana	Oracle			
Iowa	Oracle			Mainframe flat files transitioning to Oracle
Kansas	Oracle			
Kentucky				Mainframe
Louisiana		SQL Server		
Maine				Microsoft Access
Maryland	Oracle			
Massachusetts				Microsoft Access
Michigan	Oracle			Visual Foxpro
Minnesota	Oracle			Rbase, MS Access
Mississippi				Visual Foxpro
Nebraska		SQL Server		db2
Nevada	Oracle			
New Hampshire				Microsoft Access
New Jersey	Oracle			Mainframe legacy systems
New Mexico	Oracle			
New York	Oracle			
North Carolina	Oracle			MS Access
North Dakota	Oracle	SQL Server		

Table 20 – Database Software Summary - Continued

State Name	What database software is used to store traffic counts?			
	Oracle	SQL Server	Sybase	Other (please specify)
Ohio			Sybase	Permanent Counts - Sybase. Short Term Counts - Paradox/Access
Oklahoma	Oracle			Access
Oregon		SQL Server		FoxPro
Pennsylvania	Oracle			
South Dakota		SQL Server		
Tennessee	Oracle			
Virginia	Oracle			
Washington				Mainframe system
West Virginia		SQL Server		
Wyoming	Oracle			

10. Conclusion

In summary, responses from DOT representatives indicated that travel monitoring program operations, software platforms, and program management activities vary depending on the DOT. Some DOT travel monitoring programs are centrally organized and some DOT's have distributed management and responsibilities.

Operationally, most state travel monitoring programs require from one to twenty staff members including both internal and outsourced staff. The centerline miles of roadway managed by state travel monitoring programs ranges from the lowest of 940 miles managed in Hawaii to the highest in New York with 115,000 miles.

When DOT's outsource traffic data collection activities, data quality can be managed by performing on-site inspections. Only 36% of DOT respondents said they have a formal inspection program in place and 22% of respondents said they do not have a formal inspection program in place at this time. Some DOT's indicated a heavy reliance on the contractor or other agency partners to provide quality data and other DOT's perform random quality checks as often as possible. Note, some DOT's collect data in-house and therefore responded as not-applicable. In any case, these results indicate the strong need for more staff and resources to provide higher quality data through a formal inspection program.

Short term traffic count data can vary depending on the time, day of the week, and season in which the traffic data is collected. All DOT respondents consistently indicated they collect short-term traffic counts on Tuesday, Wednesday, and Thursday but only 92% collect short-term counts on Monday, 42% collect short-term traffic counts on Friday, and 15% of respondents collect data on Saturday and Sunday. As expected, 39% of DOT respondents indicated they do not collect traffic data all year which indicates geographic region differences including weather conditions and larger or smaller spatial areas to cover.

Survey results showed an extremely high variability in number of both permanent and short term count stations. Specifically the number of short term count stations varied from 1200 sites in Arizona and up to 80,000 sites in Virginia. The number of permanent stations varied from 40 sites in Connecticut to the highest of 2,728 sites in the state of California. Many different factors could account for such a high variability in number of permanent and short term sites such as the amount of funding available, number of resources available, etc. This could potentially indicate a need for more standardization in travel monitoring program site selection and required number of sites to obtain the most accurate data as possible.

Travel monitoring technology related question results indicated most DOT's have advanced technologies in place but several DOT's indicated they are currently working on updating, upgrading, or documenting their hardware and software technology solutions. Most DOT's have automated polling technologies in place and 87% of DOT's have a GIS. As expected, only 7% of respondents indicated using an off-the-shelf software solution for monthly and year-end data processing of traffic counts which indicates limited existing off-the-shelf software choices for travel monitoring program managers. An overwhelming 66% of DOT's indicated using a customized product for processing monthly and year-end traffic data and of these 66%, there are a variety of software programming platforms used such as Visual Basic, Java, C++, and .NET. Attempting to share data across DOT's is difficult at best when using different software platforms therefore indicating a strong need for standardized traffic processing software that can integrate state travel monitoring data.

AASHTO Technology Implementation Group

Nomination of Technology Ready for Implementation

2007 NOMINATIONS DUE BY FRIDAY, SEPTEMBER 7, 2007

<table>
<tr><td rowspan="6">Sponsor</td><td rowspan="6">Nominations <u>must</u> be submitted by an AASHTO member DOT willing to help promote the technology.</td><td colspan="3">1. Sponsoring State DOT: Connecticut Department of Transportation</td></tr>
<tr><td colspan="3">2. Name: Michael W. Lonergan, P.E.</td></tr>
<tr><td colspan="3">Title: Acting Chief Engineer</td></tr>
<tr><td colspan="3">Mailing Address: P.O. Box 317546</td></tr>
<tr><td>City: Newington</td><td>State: CT</td><td>Zip Code: 06131-7546</td></tr>
<tr><td>E-mail:
mike.lonergan@po.state.ct.us
Please cc: Chief Engineer
Arthur Gruhn at
awgruhn@snet.net</td><td>Phone: 860-594-2701</td><td>Fax: 860-594-2706</td></tr>
<tr><td rowspan="3">Technology Description (10 points)</td><td rowspan="3">The term “technology” may include processes, products, techniques, procedures, and practices.</td><td colspan="3">3. Date Submitted: 9-7-2007</td></tr>
<tr><td colspan="3">4. Is the Sponsoring State DOT willing to promote this technology to other states by participating on a Lead States Team supported by the AASHTO Technology Implementation Group?
Please check one: ☒ Yes ☐ No</td></tr>
<tr><td colspan="3">5. Name the technology: High Definition (HD) Photolog DigitalHIWAY System</td></tr>
<tr><td rowspan="2"></td><td colspan="3">6. Please describe the technology:

The High Definition DigitalHIWAY System is an interactive desktop roadway viewing environment that ultimately delivers 1920X1080 resolution HD images with roadway geometry, GPS, and pavement management data to unlimited local area network users and non-networked users via any external media format. The system includes multiple modules that include image and engineering data QC/QA, HD image editing, GPS-aided linear referencing of traditional features and landmarks, image and data network management, and client retrieval. All modules are designed to work cohesively in an efficient step-by-step fashion that makes it possible for a small staff to collect, conduct quality control, and distribute data to an entire agency or multiple agencies effectively.</td></tr>
<tr><td colspan="3">7. If appropriate, please attach photographs, diagrams, or other images illustrating the appearance or functionality of the technology. (If electronic, please provide a separate file.)
Please check one: ☒ Yes, images are attached. ☐ No images are attached.</td></tr>
<tr><td rowspan="3">State of Development (30 points)</td><td rowspan="3">Technologies must be successfully deployed in at least one State DOT. The TIG selection process will favor technologies that have advanced beyond the research stage, at least to the pilot deployment stage, and preferably into routine use.</td><td colspan="3">8. Please describe the history of the technology’s development. High Definition collection and distribution began in 2003 as a cooperative initiative between the Federal Highway Administration, the Connecticut Department of Transportation and the University of Connecticut to improve photolog image quality. Prior to the project researchers at FHWA and the University of Connecticut were attempting to employ pattern recognition to automatically extract lane, pavement markings, sign, and curb attributes from photolog images, but had met with limited success due to the low image resolution. Although many aspects of photologging had undergone upgrading and improvements, imaging improvements had not been addressed at ConnDOT since 1997. The Division of Research and DSS became aware of technologies, such as high resolution digital cameras and high-definition cameras that could provide photolog’s client-base immediate improvement in general viewing applications as well as potentially allow for new applications.</td></tr>
<tr><td colspan="3">9. For how long and in approximately how many applications has your State DOT used this technology? While the Connecticut Dept. of Transportation has used photolog internally since 1973, network retrieval of HD quality images has been in use since 2005. Internal applications include traffic and planning studies and review, multiple asset inventories such as guide rails, drainage, signs, traffic light and intersections, rights-of-way property review, location confirmation by numerous offices; plus safety and accident reconstruction and review by Department of Public Safety, States Attorney, Division of Criminal Justice, and deer-vehicle collision assessment by the Connecticut Agricultural Experiment Station.</td></tr>
<tr><td colspan="3">10. What additional development is necessary to enable routine deployment of the technology? Minor software modifications to each module would be required, depending upon the data collection platform in use.</td></tr>
</table>

		11. Have other organizations used this technology? Please check one: ☒ Yes ☐ No If so, please list organizations and contacts.

Organization	*Name*	*Phone*	*E-mail*
CT State Police	Jae Fontanella	860-685-8666	Jae.fontanella@po.state.ct.us
Close, Jensen and Miller	John H. Miller	860-563-9375	
FHWA	Robert Ramirez	860-659-6703	Robert.Ramirez@fhwa.dot.gov
CT South Central COG	Hurb Burstein	203-234-7555	jgott@scrcog.org
Purcell and Associates	Michael Fisher	860-633-8341	purcell@purcellassociates.com
Connecticut Agricultural Experiment Station	Dr. Jeffrey S. Ward	(203) 974-8495	Jeffrey.Ward@po.state.ct.us

Payoff Potential (30 points)	*Payoff is defined as the combination of broad applicability and significant benefit or advantage over other currently available technologies.*	12. How does the technology meet customer or stakeholder needs in your State DOT or other organizations that have used it? DigitalHIWAY is used daily by more than 500 clients that span agencies for familiarization, review, confirmation, documentation, and presentation. Photolog is a safe and efficient means of becoming familiar with a roadway location either prior to or in conjunction with a planned field trip. For state agencies, as well as private sector use, photolog is often the only accurate documentation for a given piece of state roadway and its surroundings during a calendar year. Utility audits, accident reconstruction and investigation, and safety studies are all augmented and enhanced by HD and photolog technology. HDTV images make a powerful presentation tool. DigitalHIWAY is used by the State Traffic Commission at public meetings to more clearly present proposed changes to roads that impact communities, enhancing public understanding.
		13. What type and scale of benefits has your DOT realized from using this technology? Include cost savings, safety improvements, transportation efficiency or effectiveness, environmental benefits, or any other advantages over other existing technologies. The improvements made during the advanced imaging and data acquisition technologies research project have led to an 58% increase in photolog use (routes viewed) and 51% increase in savings since full implementation was realized in 2006. ConnDOT's 500 total users (including projected standalone use) save the state an estimated $2 million per year in costs associated with avoided field trips. This delivers an impressive 3:1 benefit/cost ratio, based on the annual operating budget for this Department function. Photolog has become a mainstream tool used daily by all Department Bureaus and other agencies and organizations with a framework now firmly in place to maintain use and allow for growth as the Department changes over time.
		14. Please describe the potential extent of implementation in terms of geography, organization type (including other branches of government and private industry) and size, or other relevant factors. How broadly might the technology be deployed? HD and the DigitalHIWAY system can be deployed by any organization that collects its own images and data using automated vehicle technology.
Market Readiness (30 points)	*The TIG selection process will favor technologies that can be adopted with a reasonable amount of effort and cost, commensurate with the payoff potential.*	15. What actions would another organization need to take to adopt this technology? HD deployment requires a significant Information Technology commitment in the form of storage space and bandwidth and the initial purchase of photolog vehicle HD camera and computer hardware and software. DigitalHIWAY needs to be acquired with the appropriate licensing and the appropriate modules need to be installed.
		16. What is the estimated cost, effort, and length of time required to deploy the technology in another organization? From the Connecticut experience, states and other organizations need approximately two years to acquire the equipment and services necessary to implement vehicle system hardware updates. Simultaneously software modifications can be made and the DigitalHIWAY System installed and tested prior to rollout. Cost to perform HD upgrades in Connecticut was $250,000. Cost to port to the DigitalHIWAY System varies by module.

		17. What resources—such as technical specifications, training materials, and user guides—are already available to assist deployment? A report, specifications, training materials and limited user guides are available for Connecticut's system(s).	
		18. What organizations currently supply and provide technical support for the technology? The Connecticut Department of Transportation and DigitalHIWAY developer David Burns.	
		19. Please describe any legal, environmental, social, intellectual property, or other barriers that might affect ease of implementation. Standard intellectual property rights issues for copyrighted software would need to be addressed. No social or environmental barriers would affect this implementation.	
Submit to AASHTO Contact		***Keith Platte*** ***Phone: 202.624.7830*** ***Fax: 202.624.5469*** ***kplatte@aashto.org***	***American Association of State Highway & Transportation Officials*** ***444 North Capitol Street N.W., Suite 249*** ***Washington, DC 20001***

Figure 1: 2007 ConnDOT HD Photolog Image

Figure 2: 2007 ConnDOT HD Photolog Image

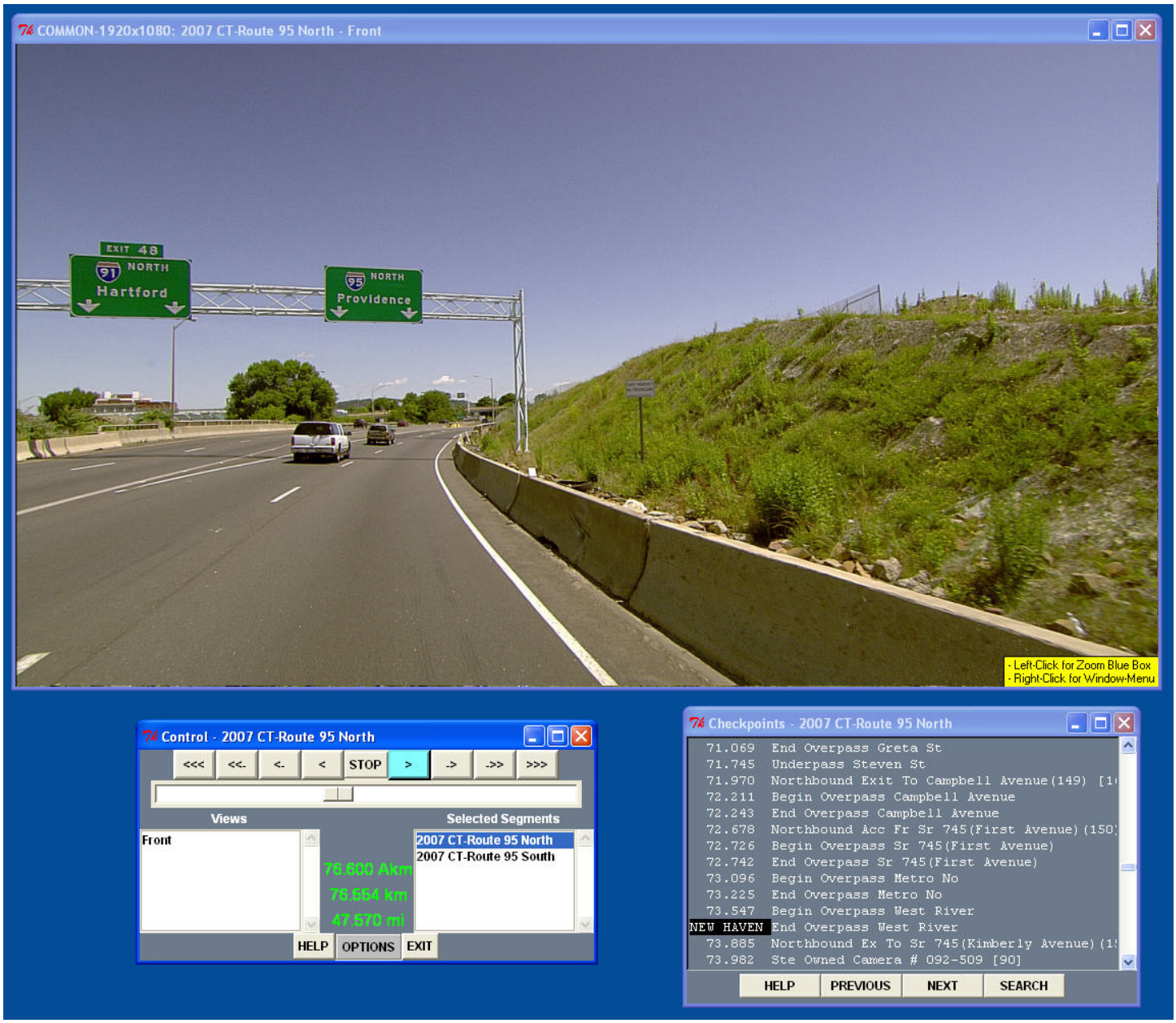


Figure 3: DigitalHIWAY and ConnDOT HD Photolog Image

AASHTO Technology Implementation Group

Nomination of Technology Ready for Implementation

2007 NOMINATIONS DUE BY FRIDAY, SEPTEMBER 7, 2007

<table>
<tr><td rowspan="8">Sponsor</td><td rowspan="8">Nominations <u>must</u> be submitted by an AASHTO member DOT willing to help promote the technology.</td><td colspan="3">1. Sponsoring State DOT: Missouri Department of Transportation</td></tr>
<tr><td colspan="3">2. Name: Wil Stalcup</td></tr>
<tr><td colspan="3">Title: Physical Laboratory Director</td></tr>
<tr><td colspan="3">Mailing Address: P.O. Box 270,
1617 Missouri Blvd.</td></tr>
<tr><td>City: Jefferson City</td><td>State: Mo</td><td>Zip Code: 65109</td></tr>
<tr><td>E-mail:
William.Stalcup@modot.mo.gov</td><td>Phone: 573-751-1036</td><td>Fax: 573-751-8682</td></tr>
<tr><td colspan="3">3. Date Submitted: 09/07/2007</td></tr>
<tr><td colspan="3">4. Is the Sponsoring State DOT willing to promote this technology to other states by participating on a Lead States Team supported by the AASHTO Technology Implementation Group?
Please check one: ☒ Yes ☐ No</td></tr>
<tr><td rowspan="3">Technology Description (10 points)</td><td rowspan="3">The term “technology” may include processes, products, techniques, procedures, and practices.</td><td colspan="3">5. Name the technology: Automated Concrete Evaluation System (ACES)</td></tr>
<tr><td colspan="3">6. Please describe the technology: The ACE system uses a high precision, two-dimensional computer-controlled stage to move the concrete sample under a research grade microscope. The image acquisition system consists of a digital color camera, a digital image acquisition interface, and a 3.2 GHz tower PC. Customized image processing and pattern recognition software has been developed to identify air voids and extract void characteristics. These characteristics are used to calculate the concrete microscopical properties of interest. All these system components are linked via a graphical user interface which aids the operator in the image acquisition, analysis, and review processes. The ACE system is designed to automatically scan and acquire imagery of a concrete sample. The acquired imagery is then stored on the analysis computer and may be written to a DVD. This latter option allows the acquired imagery to be transferred to another computer for automated analysis. In this way, a single computer workstation may be dedicated to the sample scanning and image acquisition process, while previously acquired imagery can be transferred to and processed on any other available computer.</td></tr>
<tr><td colspan="3">7. If appropriate, please attach photographs, diagrams, or other images illustrating the appearance or functionality of the technology. (If electronic, please provide a separate file.)
Please check one: ☒ Yes, images are attached. ☐ No images are attached.</td></tr>
<tr><td>State of Development (30 points)</td><td>Technologies must be successfully deployed in at least one State DOT. The TIG selection process will favor technologies that have advanced beyond the research stage, at least to the pilot deployment stage, and preferably into routine use.</td><td colspan="3">8. Please describe the history of the technology’s development.
The initial concept was developed between 1998 through 2001. The first generation system of the ACES was developed during this timeline. This included a prototype that included software and hardware development. The concept was refined to determine if an automated system was capable of confirming visual interpretations of the manual method. Since 2001, the Missouri Department of Transportation and National Nuclear Security Administration’s Kansas City Plant, operated by Honeywell Federal Manufacturing & Technologies, have collaborated on three CRADA’s (Cooperative Research and Development Agreements) to develop a fully automated machine vision system to perform the analysis of the air void structure of concrete according to the ASTM linear traverse method. The first two CRADA’s were focused on the development of a prototype system, designated ACES, for Automated Concrete Evaluation System. This prototype included a computer controlled two-dimensional stage and sample holder, a vision system consisting of a microscope, a digital black-and-white camera and analog frame grabber, a personal computer, and customized software to perform the image acquisition, analysis, and reporting. Initial evaluations of the accuracy of the ACE system relative to experienced human operators at MoDOT were quite positive. However, ongoing validations to baseline performance of the software against actual manually derived results provided data indicating that additional software developments were required to ensure that the results provided by the ACE System are consistent with those obtained manually. As a result, a third CRADA was initiated to improve the performance of the ACE system to consistently apply the ASTM linear traverse method and to improve the accuracy of the system relative to the results obtained by human experts. In 2003, MODOT expanded the scope of this effort by initiating and leading a national, pooled fund effort under sponsorship by the Federal Highway Administration. This pooled fund effort included 13 state transportation departments (Arkansas, California, Colorado, Illinois, Indiana, Iowa, Minnesota, Missouri, Montana, Nebraska, Ohio, Virginia, and Wisconsin</td></tr>
</table>

		9. For how long and in approximately how many applications has your State DOT used this technology? The research for the concept of image anaylsis of hardened concrete was completed in December 2006. The technology is currently in the pilot deployment stage. The Missouri Department of Transportation is evaluating the test results from several construction projects to determine reliability and adaptability for project testing. This will also provide forensic capability on existing concrete pavements. The department is using this pilot deployment testing of the ACES, along with other concrete testing to develop performance based specifications for future use.
		10. What additional development is necessary to enable routine deployment of the technology? The deployment of this technology will need training program that includes sample preparation, and adjustment of software program parameters. The training will also need to include an understanding of the equipment hardware and how to operate it.
		11. Have other organizations used this technology? Please check one: ☐ Yes ☒ No If so, please list organizations and contacts.

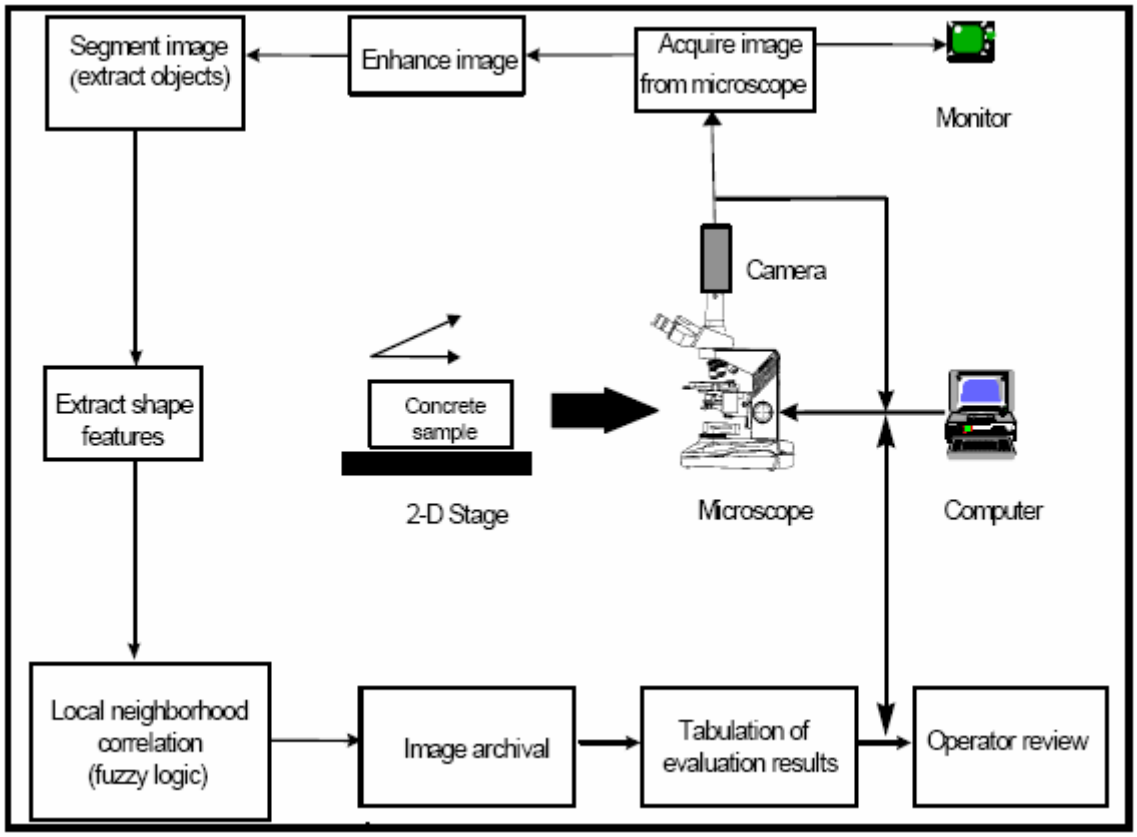
Organization	*Name*	*Phone*	*E-mail*

Payoff Potential (30 points)	*Payoff is defined as the combination of broad applicability and significant benefit or advantage over other currently available technologies.*	12. How does the technology meet customer or stakeholder needs in your State DOT or other organizations that have used it? The overall results of this work indicate that the repeatability, accuracy, and overall assessment quality of the NG-ACE system in conducting the ASTM C457-98 linear traverse method are comparable to results obtained by manually (human-based) conducting the ASTM C457 linear traverse method. The system hardware and software presently can be deployed and customized to meet the specific needs of other users within the transportation industry.
		13. What type and scale of benefits has your DOT realized from using this technology? Include cost savings, safety improvements, transportation efficiency or effectiveness, environmental benefits, or any other advantages over other existing technologies. This improved process will save time and enhance the evaluation process for air-void analysis of hardened concrete. Many will realize a significant savings in the hardened concrete evaluation process. Those and other potential applications for this prototype system include: · Scanning and evaluation services provided to state transportation departments · The evaluation of concrete properties for other local, state, and Federal agencies · The evaluation of concrete properties by research organizations including academia and private industry · The evaluation of concrete properties for the construction industry · Manufacture of multiple units of the prototype for individual use for all of the above-mentioned organizations. The development the NG-ACE system, which would accurately determine the microscopical properties of hardened concrete, would serve as a significant benefit not only to highway agencies, but also to the general, highway construction industry. Implementation of such an automated system would save time and effort and would eliminate the need for highly skilled and trained personnel required of the current manual methods. The system would also provide accurate and repeatable results. The strong need for a system, as described, has been demonstrated by the past efforts and continued interest of those in the concrete industry to develop an accurate, automated system using image analysis techniques.

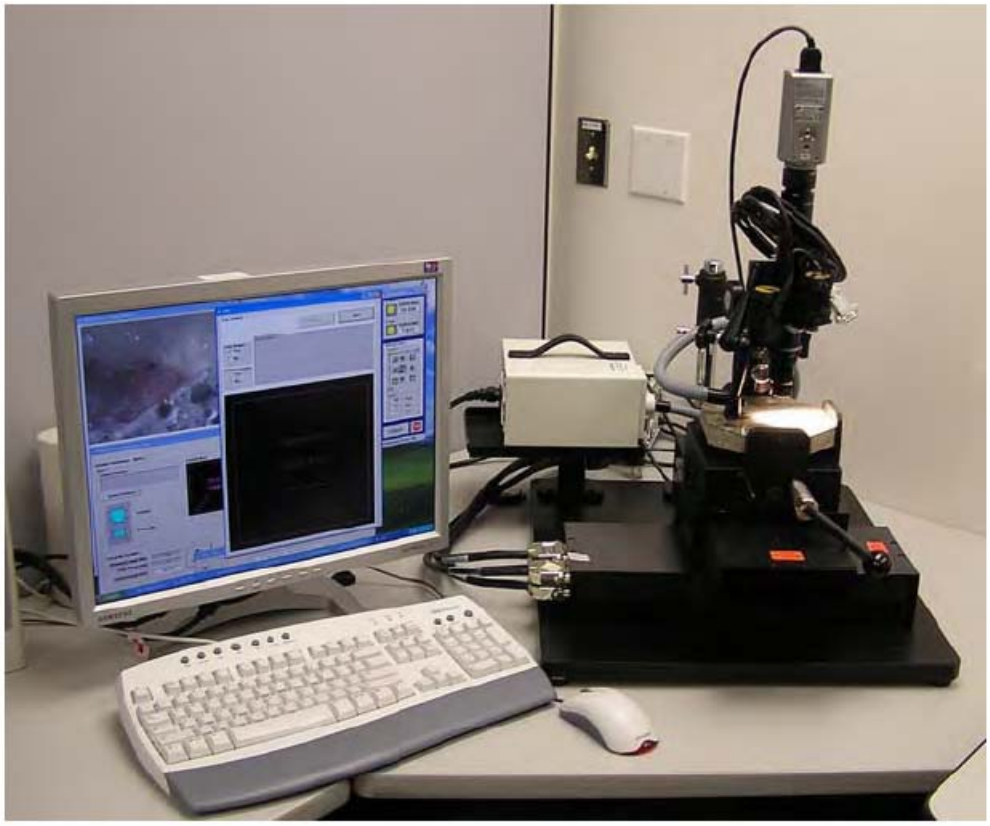
		14. Please describe the potential extent of implementation in terms of geography, organization type (including other branches of government and private industry) and size, or other relevant factors. How broadly might the technology be deployed? The technology that has been developed has improved the Department of Energy's (DOE) ability to perform core surveillance of the weapons stockpile and has provided FM&T personnel with enhanced knowledge and experience which can be used in developing and integrating similar systems for DOE Programs. A variety of industries could benefit from the technology developed under this CRADA. These would include: · Construction industry, for the evaluation of concrete quality for buildings and roadways. · Software industry, through the modification and application of the software techniques developed under this CRADA for other imaging, surface profiling, and pattern recognition applications. · Medical industry, through the modification of the prototype system for use with microscope slides, or the use of the developed imaging and recognition techniques for the analysis of medical imagery. · Federal agencies to include the FAA (for quality analysis of concrete used for runways) and the DOD (evaluation of materials for hardened facilities).
Market Readiness (30 points)	*The TIG selection process will favor technologies that can be adopted with a reasonable amount of effort and cost, commensurate with the payoff potential.*	15. What actions would another organization need to take to adopt this technology? Training into the capabilities of the software and hardware and apply it to the intended use. They would then need to apply it to their operations.
		16. What is the estimated cost, effort, and length of time required to deploy the technology in another organization? The basic NG-ACE system components and estimated component costs are provided below (prices as of November 2006). A more detailed equipment specification is available upon request. · Stage – Aerotech, 2D Linear Stage and controller $21,236 · Camera - Sony DFW-X710, or equivalent $1,900 · (Inspection grade or Industrial inspection microscope – check on proper terminology) · Lens, Illumination, Stand $1,307 · Concrete Sample Mount $12,800 · Isolation table $2,500 · PC $2,500 · Sample scanning, data analysis, and reporting software $20,000 · System integration, test, and validation (at KCP) $5,000 · Shipping, system set up, and training at customer site $15,000 The total cost for the hardware for the NG-ACE system , including analysis software, system integration and setup at the customer's site, and training is approximately $70,000. Individual components may be purchased or provided by the customer for integration into the NG-ACE system, as long as those components meet the quoted NG-ACE specification.

		17. What resources—such as technical specifications, training materials, and user guides—are already available to assist deployment? Those deploying this technology would need to have an understanding of the following: · ASTM C 457 · Surface preparation of hardened concrete samples for testing · Understanding of geological terminology to identify minerals · Software program developed by Honeywell for deployment of ACES Draft procedures for operation have been developed. Honeywell is working with MoDOT to refine and finalize those procedures into a document that can be used as a training and implementation tool.	
		18. What organizations currently supply and provide technical support for the technology? Technical support is provided by Chris Baumgart of the Honeywell Federal Manufacturing & Technologies, located in Kansas City, Missouri.	
		19. Please describe any legal, environmental, social, intellectual property, or other barriers that might affect ease of implementation. The only identifed issue concerns the ownership of intellectual property. This effort was funded using federal pooled funds, thus it must comply with federal regulations regarding any possible assignment of intellectual rights. No environmental or social risks have been identified with this work.	
Submit to AASHTO Contact		***Keith Platte*** ***Phone: 202.624.7830*** ***Fax: 202.624.5469*** ***kplatte@aashto.org***	***American Association of State Highway & Transportation Officials*** ***444 North Capitol Street N.W., Suite 249*** ***Washington, DC 20001***

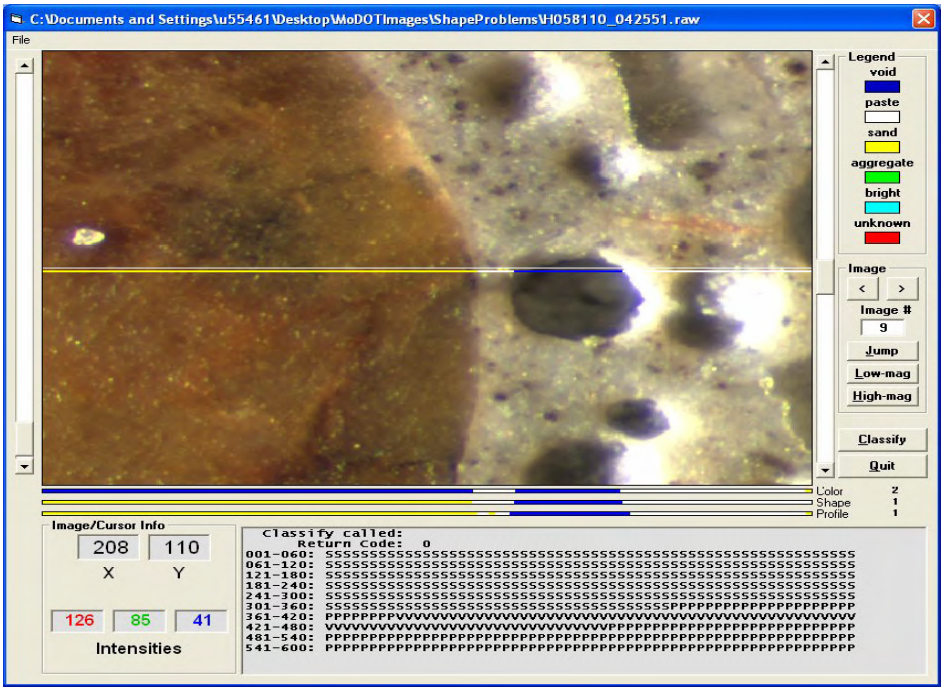
AASHTO Technology Implementation Group
Nomination of Technology Ready for Implementation
2007 Missouri Department of Transportation Nomination Attachments



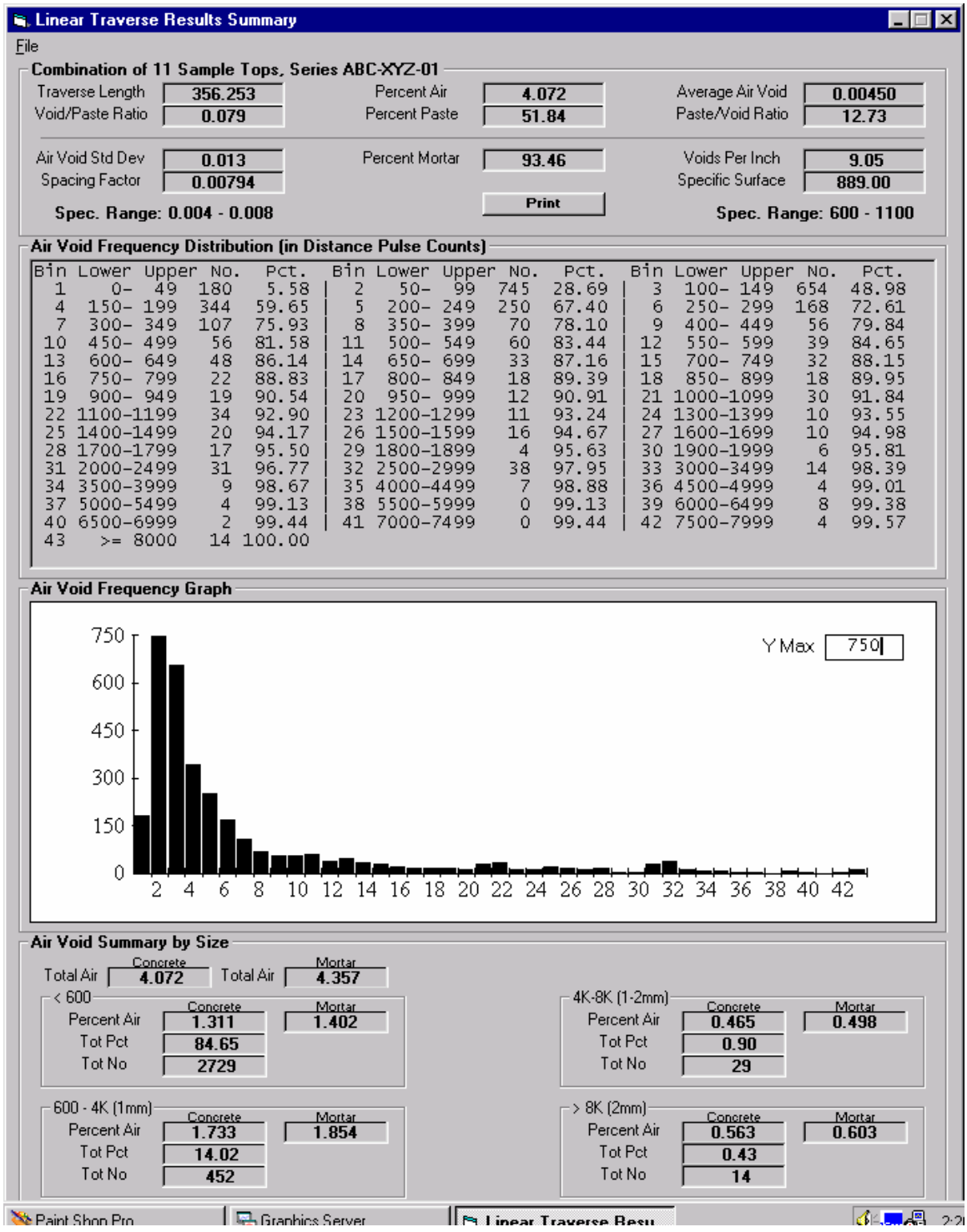
Visual overview of the ACE system operation.



NG-ACE configuration showing the computer, computer-controlled stage, sample mount, digital camera, and lighting (bridge mount not shown).



An example screen capture of the test specimen



Example of a Final Report from a Test Sample

AASHTO Technology Implementation Group

Nomination of Technology Ready for Implementation

2007 NOMINATIONS DUE BY FRIDAY, SEPTEMBER 7, 2007

Sponsor

Nominations must be submitted by an AASHTO member DOT willing to help promote the technology.

1. Sponsoring State DOT: Florida

2. Name: Mario A Paredes

Title: Corrosion Research Engineer

Mailing Address: 5007 NE 39th Avenue

City: Gainesville	State: Florida	Zip Code: 32615
E-mail: mario.paredes@dot.state.fl.us	Phone: 352-955-6691	Fax: 352-955-6689

3. Date Submitted: 09/06/2007

4. Is the Sponsoring State DOT willing to promote this technology to other states by participating on a Lead States Team supported by the AASHTO Technology Implementation Group?

Please check one: ☒ Yes ☐ No

Technology Description (10 points)

The term "technology" may include processes, products, techniques, procedures, and practices.

5. Name the technology: Electrical Indication of Chloride Penetration Resistance by Surface Resistivity of Water Saturated Concrete.

6. Please describe the technology:

Surface Resistivity (SR) of saturated concrete is an NDT testing technique that has been correlated to both ASTM C-1202 (AASHTO T277) (Graph 1) and to concrete chloride diffusion tests (ASTM C1556 at 364 and 1092 days) (Graph 2). Test does not have labor and time intensive specimen preparation steps like RCP and RMT and the actual procedure is very quick (< 2 minute). SR is simple and the most economical test compared to other electrical indicators used as electrical indicator of permeability. SR does not have problems with specimen heating or epoxy disbodment so it is more reliable. SR can replace the RCP test (see table 1). In addition preliminary tests show that SR test method has half the coefficient of variation of the RCP test and therefore is more reliable.

7. If appropriate, please attach photographs, diagrams, or other images illustrating the appearance or functionality of the technology. (If electronic, please provide a separate file.)

Please check one: ☒ Yes, images are attached. ☐ No images are attached.

State of Development (30 points)

Technologies must be successfully deployed in at least one State DOT. The TIG selection process will favor technologies that have advanced beyond the research stage, at least to the pilot deployment stage, and preferably into routine use.

8. Please describe the history of the technology's development.

Test was first explored in large FHWA funded project back in 1997 titled "Corrosion Inhibitors in Concrete". Test was performed at the same time and same ages as RCP test to explore if correlation held. In 2001 a project was conducted by FDOT to test SR vs RCP in a large quantity of field specimens (>500). Correlation indicated that SR gives the same information (See Graph 3). In 2005 test was allowed in our specifications as an option beside RCP. Starting July 2007, RCP was completely removed and only SR is used to characterize mix designs for approval.

9. For how long and in approximately how many applications has your State DOT used this technology?

Since 1997 when it was first explored the use of the test, SR has been used in all research projects to charaterize the chloride penetration resistance of all HPC.

10. What additional development is necessary to enable routine deployment of the technology?

Conduct ASTM C 802 "Practice for Conducting an Interlaboratory Test Program to Determine the Precision of Test Methods for Construction Materials". Not enough laboratories exist currently that have the meter, so the precision has not been conducted.

11. Have other organizations used this technology? Please check one: ☒ Yes ☐ No

If so, please list organizations and contacts.

Organization	*Name*	*Phone*	*E-mail*
Tennessee DOT	Edward Wasserman		Ed.Wasserman@state.tn.us>
Virginia DOT	Celik Ozyildirim		celik@vdot.virginia.gov

Payoff Potential (30 points)	*Payoff is defined as the combination of broad applicability and significant benefit or advantage over other currently available technologies.*	12. How does the technology meet customer or stakeholder needs in your State DOT or other organizations that have used it? Because SR is a NDT, it allows permeability characterization vs time with the same samples to full hydration (Graph 4). It reduces the amount of space required for specimen curing since the same specimen can be tested at different ages.	
		13. What type and scale of benefits has your DOT realized from using this technology? Include cost savings, safety improvements, transportation efficiency or effectiveness, environmental benefits, or any other advantages over other existing technologies. RCP and RMT take 3 days to perform with all the procedures for specimen preparation before test. Now with SR we only need about 3 minutes per specimen. We can do a lot more specimens per day.	
		14. Please describe the potential extent of implementation in terms of geography, organization type (including other branches of government and private industry) and size, or other relevant factors. How broadly might the technology be deployed? Can be used in all states that need a quick test method for electrical indication of concrete chloride penetration resistance.	
Market Readiness (30 points)	*The TIG selection process will favor technologies that can be adopted with a reasonable amount of effort and cost, commensurate with the payoff potential.*	15. What actions would another organization need to take to adopt this technology? Simply buy instrument.	
		16. What is the estimated cost, effort, and length of time required to deploy the technology in another organization? Cost: Instrument between $5500 to $7000. Effort: It depends on whether testing organization would like to verify correlation for themselves before embarking in the use of the test, but If no verification is required about 20 minutes would be enough to get familiar with instrument and setting spacing in probe and device. Length of time: Setting spacings in probe, adding new tips, saturating tips would require about 1 day.	
		17. What resources—such as technical specifications, training materials, and user guides—are already available to assist deployment? FDOT specifications are available. Table relating SR to RCP (table 1) and permeability characterization.	
		18. What organizations currently supply and provide technical support for the technology? Just FDOT, State Materials Office.	
		19. Please describe any legal, environmental, social, intellectual property, or other barriers that might affect ease of implementation. None.	
Submit to AASHTO Contact		***Keith Platte*** ***Phone: 202.624.7830*** ***Fax: 202.624.5469*** ***kplatte@aashto.org***	***American Association of State Highway & Transportation Officials*** ***444 North Capitol Street N.W., Suite 249*** ***Washington, DC 20001***

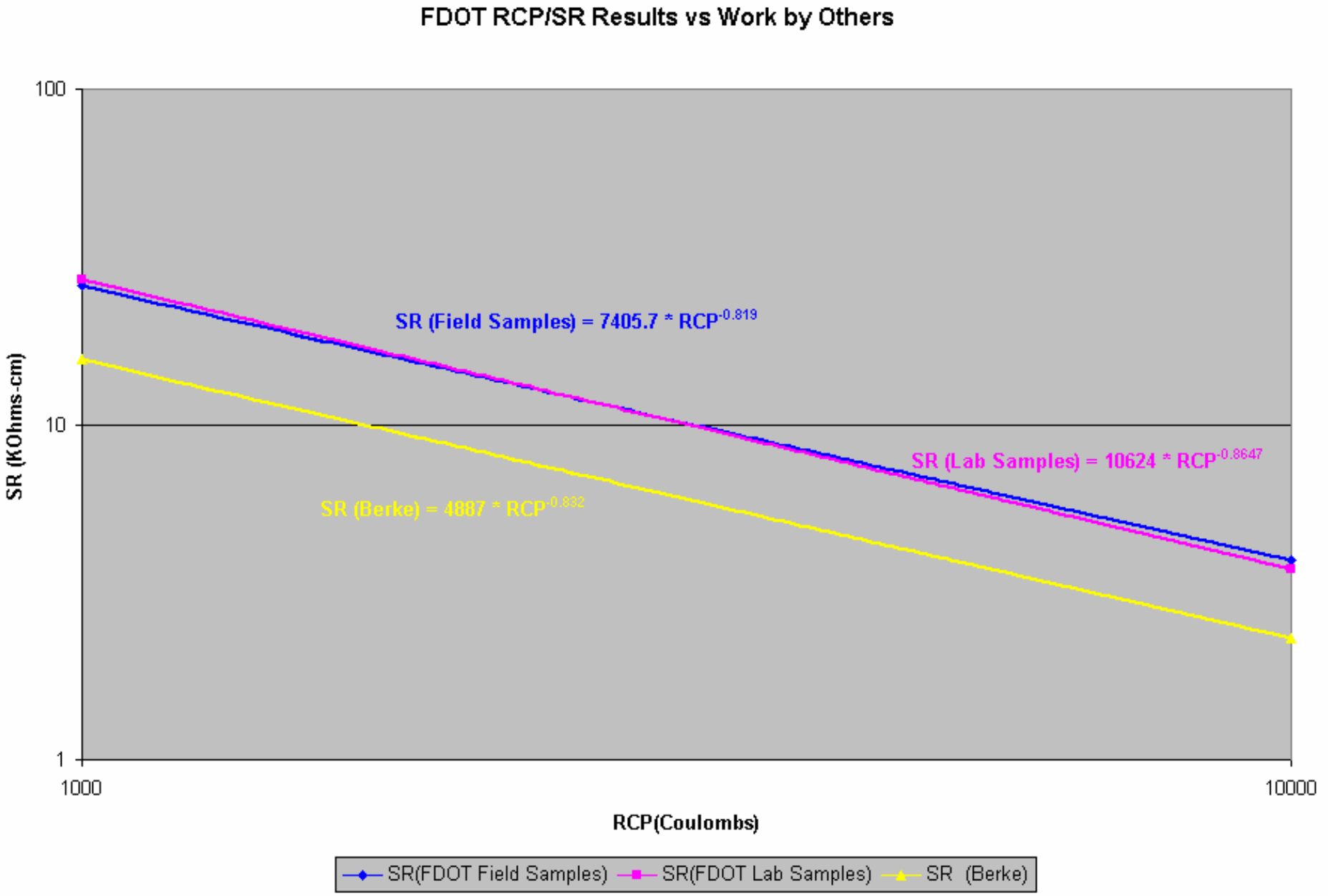

FDOT RCP/SR Results vs Work by Others
100
10
1
SR (KOhms-cm)
SR (Field Samples) = 7405.7 * RCP-0.819
SR (Lab Samples) = 10624 * RCP-0.8647
SR (Berke) = 4887 * RCP-0.832
1000
10000
RCP(Coulombs)
SR(FDOT Field Samples)
SR(FDOT Lab Samples)
SR (Berke)

Figure 1

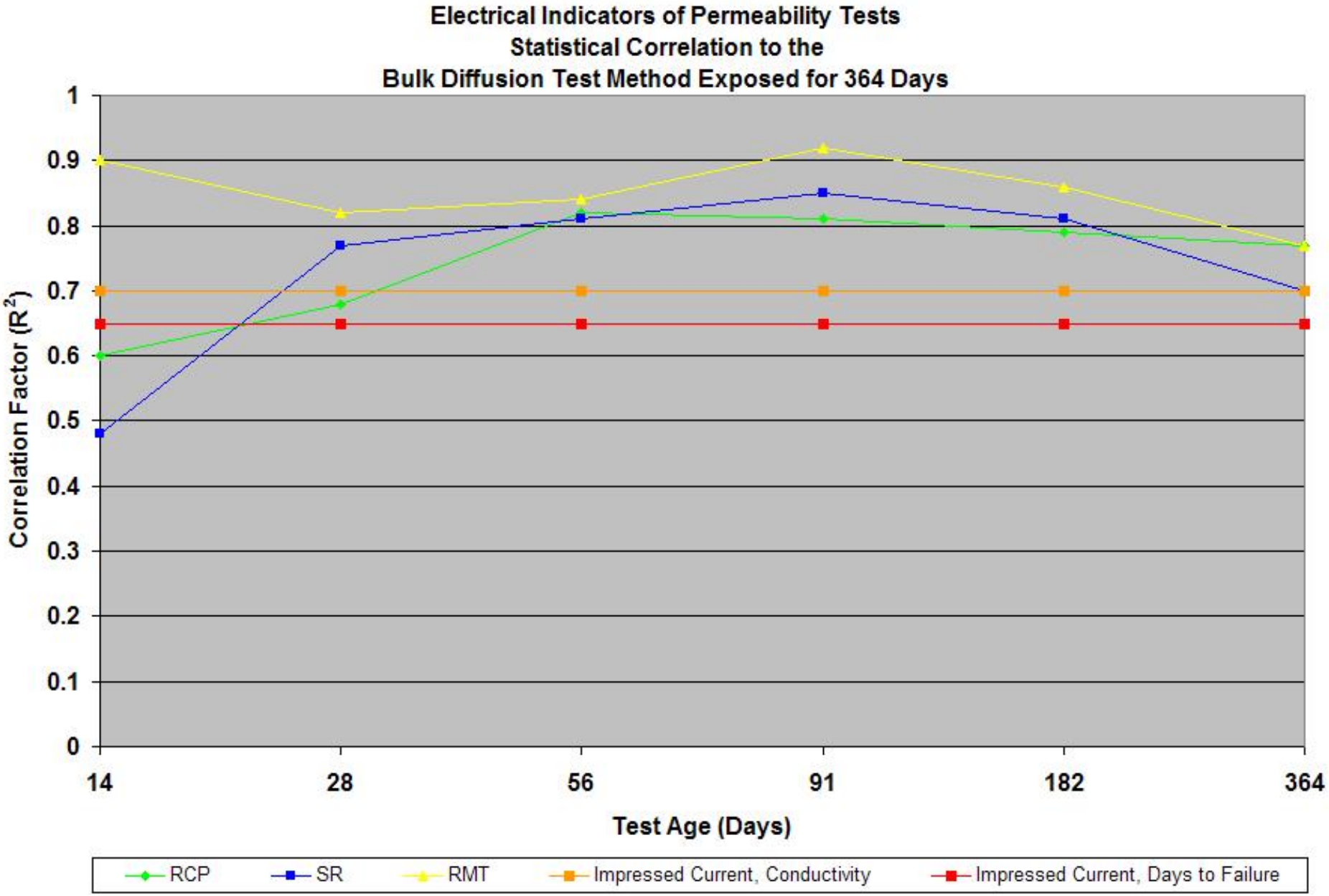

Electrical Indicators of Permeability Tests
Statistical Correlation to the
Bulk Diffusion Test Method Exposed for 364 Days
Correlation Factor (R^2)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
14
28
56
91
182
364
Test Age (Days)
RCP
SR
RMT
Impressed Current, Conductivity
Impressed Current, Days to Failure

Figure 2

Table 1, SR Permeability Classification vs. RCP

RCP versus Surface Resistivity				
Chloride Ion Permeability	RCP Test Charged Passed (coulombs)	Surface Resistivity Test		
		4 X 8 Cylinder (Kohm-cm) a=1.5 k=1.8 (Measured)	6 X 12 Cylinder (KOhm-cm) a=1.5 k=1.41 (Measured)	Semi-Infinite Slab (Real)
High	>4,000	< 12	< 9.5	< 6.7
Moderate	2,000-4,000	12 - 21	9.5 - 16.5	6.7 - 11.7
Low	1,000-2,000	21 - 37	16.5 – 29	11.7 - 20.6
Very Low	100-1,000	37 - 254	29 – 199	20.6 - 141.1
Negligible	<100	> 254	> 199	> 141.1

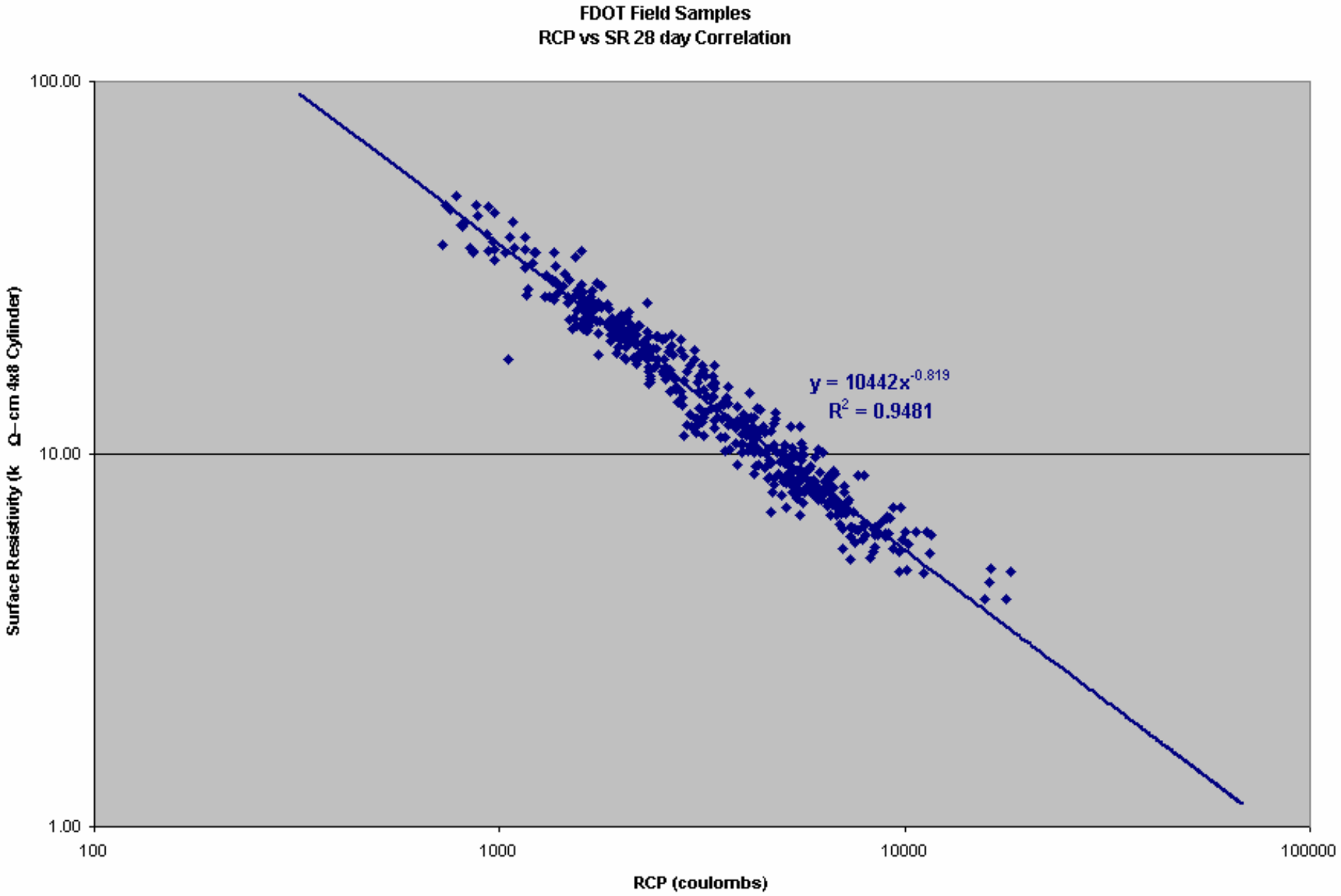

FDOT Field Samples
RCP vs SR 28 day Correlation
100.00
10.00
1.00
Surface Resistivity (k Ω– cm 4x8 Cylinder)
y = 10442x-0.819
R2 = 0.9481
100
1000
10000
100000
RCP (coulombs)

Figure 3

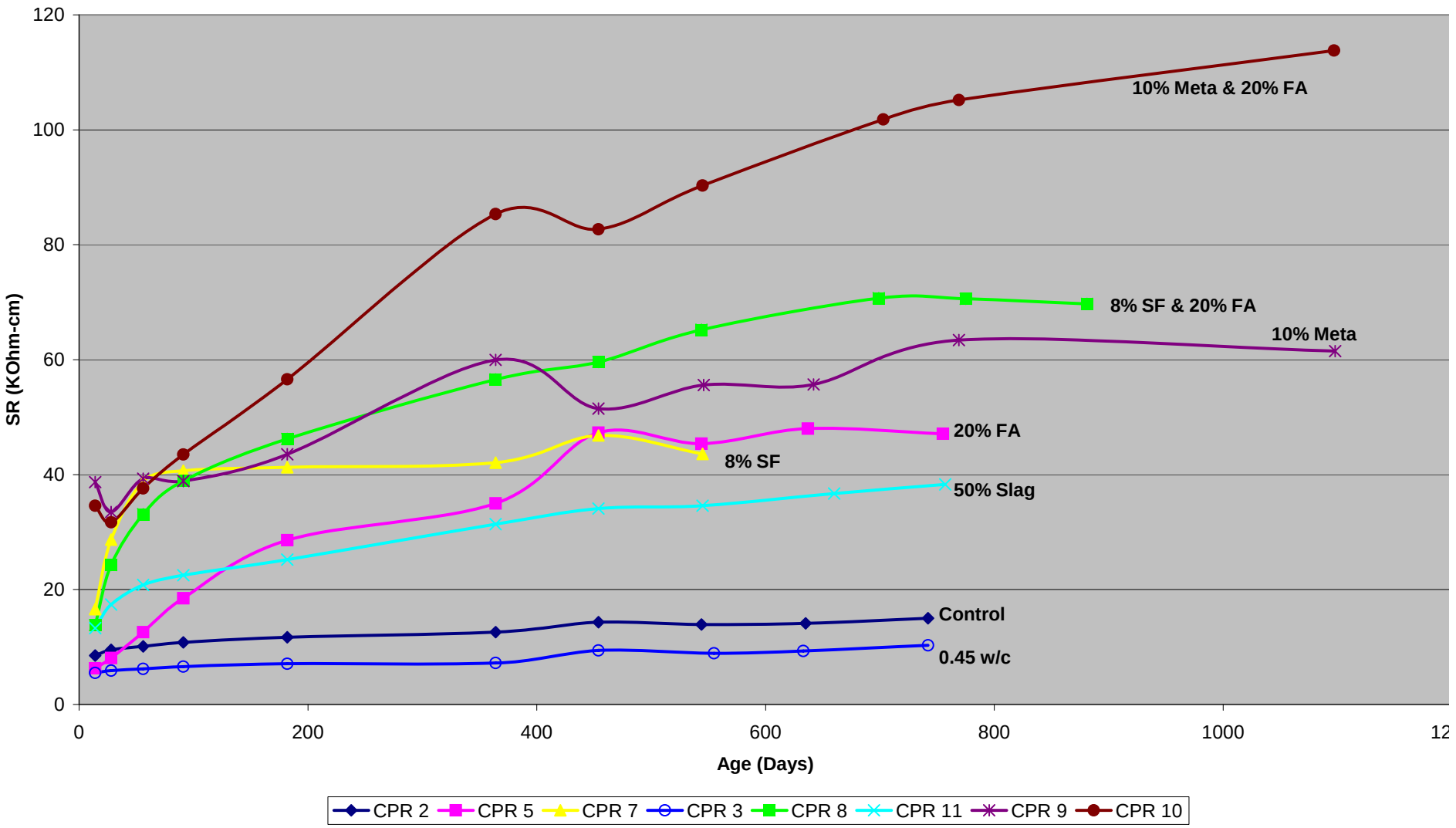

Surface Resistivity
Type I/II cement, 0.35 w/c, #57 stone and 752 lbs of cementitious
SR (KOhm-cm)
Age (Days)
0
20
40
60
80
100
120
0
200
400
600
800
1000
10% Meta & 20% FA
8% SF & 20% FA
10% Meta
20% FA
8% SF
50% Slag
Control
0.45 w/c
CPR 2
CPR 5
CPR 7
CPR 3
CPR 8
CPR 11
CPR 9
CPR 10

Figure 4

AASHTO Technology Implementation Group

Nomination of Technology Ready for Implementation

2007 NOMINATIONS DUE BY FRIDAY, SEPTEMBER 7, 2007

<table>
<tr><td rowspan="9">Sponsor</td><td rowspan="9">Nominations <u>must</u> be submitted by an AASHTO member DOT willing to help promote the technology.</td><td colspan="3">1. Sponsoring State DOT: Iowa</td></tr>
<tr><td colspan="3">2. Name: Peggi Knight</td></tr>
<tr><td colspan="3">Title: Director of the Office of Transportation Data</td></tr>
<tr><td colspan="3">Mailing Address: 800 Lincolnway</td></tr>
<tr><td>City: Ames</td><td>State: IA</td><td>Zip Code: 50010</td></tr>
<tr><td>E-mail: peggi.knight@dot.iowa.gov</td><td>Phone: 515-239-1530</td><td>Fax: 515-817-6645</td></tr>
<tr><td colspan="3">3. Date Submitted: September 7, 2007</td></tr>
<tr><td colspan="3">4. Is the Sponsoring State DOT willing to promote this technology to other states by participating on a Lead States Team supported by the AASHTO Technology Implementation Group?
Please check one: ☒ Yes ☐ No</td></tr>
<tr><td colspan="3"></td></tr>
<tr><td></td><td></td><td colspan="3">5. Name the technology: Linear Referencing System (LRS)</td></tr>
<tr><td>Technology Description (10 points)</td><td>The term “technology” may include processes, products, techniques, procedures, and practices.</td><td colspan="3">6. Please describe the technology:

A location referencing method (LRM) is a "way to identify a specific location with respect to a known point." A location referencing system (LRS) is "a set of office and field procedures that include a highway location reference method" (Baker, W. and W. Blessing. (1974). Highway Linear Reference Methods, Synthesis of Highway Practice 21. National Cooperative Highway Research Program. National Academy Press. Washington, D.C.).

Combining information from different data sources within a department of transportation has been an information processing concern. Spatial data, whether in the form of a mile marker, literal description or other location component, has varied in the many different databases used by the DOT over the years. Since a vast majority of the data collected by the DOT is referenced to the Earth in some manner, the use of spatial location and Geographic Information System products is the logical choice to accomplish this integration. The DOT Linear Reference System (LRS) is a project to align the linear reference points in all DOT databases so information from crash statistics, pavement management and other business data can be accurately mapped and data more easily analyzed. Through this integration, the LRS improves data integration and access, improves accuracy, minimizes redundancy in DOT databases, minimizes data maintenance activities and includes all public roads.

An improved road network is very important in many areas. Safety professionals make extensive use of the road network to plan and execute engineering, enforcement, education and emergency response treatments for safety problems. Routing and Navigation utilize the road network to solve the problem of shortest path to a selected destination from current vehicle position. Tying the data together from throughout all areas of the DOT via location improves our ability to manage our road systems. Through the investment in the LRS, the Iowa DOT has been able to provide a base for the Emergency Response System for the City of Des Moines, IA and surrounding communities.

The Iowa LRS was designed using the results of the National Cooperative Highway Research Program (NCHRP) 20-27(2) project. The NCHRP 20-27(2) linear LRS data model was developed in response to a growing awareness of the need to integrate increasing amounts of linearly-referenced data used by the transportation community (Vonderohe, A.P., Chou, C.L., Sun, F., and T.M. Adams. (1997). "A Generic Data Model for Linear Referencing Systems", Research Results Digest 218, National Cooperative Highway Research Program, Transportation Research Board, Washington, D.C., August, 28 pp.).

The Iowa DOT has made a significant investment of resources to bring the LRS into production. It is the desire of the Iowa DOT personnel to help other states avoid the duplication of effort involved in creating a LRS.</td></tr>
</table>

Iowa DOT LRS Overview

The LRS integrates disparate roadway data using the data's linear locations as a common link. A linear location is described in terms of a linear referencing method (LRM). Therefore, in order to achieve full data integration and accessibility, the system must have functions available that can dynamically transform a location described in terms of one LRM into another LRM. For example, an event described in reference to a milepoint may be easily transformed to an improvement project station reference.

LRS Components

The LRS is designed as a three-tier distributed system composed of clients, the application, and data stores, all of which are logically connected via a network. The application tier contains programs that implement the linear transform, linear overlay, and data staging operations that are part of the LRS application.

The LRS may become the focus of several client systems that require the transformation, overlay, and staging services of the LRS. These systems can be developed to interoperate with the LRS application tier through the network. External applications interoperate by passing LRM data over the network. The LRS API described in this document is an interoperable component that runs against the business logic.

Client Applications Tier

The client applications tier is composed of GeoMedia clients and other applications that can communicate with the business and database tiers. Examples of non-GeoMedia clients that can access the other layers are Oracle Forms, SQL*Plus, and other command-line interfaces, and interoperable systems that are specifically designed to access the LRS functionality across the network.

Application Tier
The application tier is composed of a set of Java classes and stored procedures that implement the major functions of the LRS. These procedures include the code that performs linear transformations, linear overlay, and staging functions.

Database Tier

The database tier is Oracle Spatial with Oracle Workspace Manager. Oracle spatial allows geometries and LRS business data to be stored, edited and selected. Oracle Workspace Manager gives the ability to keep a history of the network.

LRS Subsystems

The LRS has several subsystems, each providing some element of linear location reference required by the Iowa DOT. Each subsystem can be independently managed and maintained as a set of asynchronous processes. The datum and route subsystems are the essential, underlying linear location control for the Iowa DOT.

1. Datum – Provides the most stable description of a linear location over time in a simple form to which all LRM location forms can transform. The key components of datum include anchor sections and anchor points. The anchor section is the primary object that all other subsystems will reference, either directly or indirectly, via the route management system. Anchor points define the ends of anchor sections.

2. Route – Provides the underlying network and posted routes to which most LRMs are dependent. Transport nodes and links capture the Iowa DOT navigable network. Transport nodes exist at standard vehicular turning points; transport links indicate basic traffic flow (i.e., one way or bidirectional travel).

3. LRS Milepoint – Provides a continuous location reference. A LRS milepoint is the accumulated distance, in miles, from the beginning to the end of a route within a specified transportation system. Typically, the measurement begins at the first road intersection prior to a state, county, or municipal line. As a result, the same route can have different milepoint values based on the extent of the transportation system.

4. Reference Post – Provides localized, but consistently placed points of reference from which to measure a linear location. The reference post LRM uses the mile marker posts along the primary routes. Note that the LRS does not allow using the post values as a representation of accumulated distance; this subsystem applies the posts and relative offsets to locate events. For example, the accumulated distance of 10.06 is not the same location as reference post 10, offset 6 miles.

5. Project Station – Provides location reference with regard to roadway engineering stationing. The stationing LRM is composed of project sections. Project sections are defined by the beginning and end of an improvement project. Each project section has a beginning station value and an ending station value. These values are used to interpolate positions of station posts or events along the project section. The smaller the project section, the more accurate the position of a station post or event. Each new road improvement project, even if in the same location, has a new set of project sections and begin/end stationing values. This Linear Reference Method has not currently been deployed.

6. Coordinate Route – Provides the ability to use coordinate route data and transform it to a linear location. This is done by snapping the x,y location to the cartography, and using the cartography datum relationship to assign it a true linear location.

7. Literal – Provides a consistent method for literal description location use. A literal description is an observational account of a location using existing route names or roadway features. Roadway intersections are the most common reference feature, but others have substantial potential, as almost any physical roadway feature or landmark may be used as long as it is under Iowa DOT jurisdiction. For example, a pavement section location may be described as “on IA 45 at Maple Ave, plus 100 meters towards Skunk River Bridge, for 1200 meters”.

Changes generated in one of the subsystems can affect other subsystems. These affects are managed as events that can be captured and used by other subsystems. As these subsystems exist within the LRS schema, database triggers and referential integrity constraints can be used to provide the firing mechanisms for triggers.

System Interface

The LRS API provides the functional interfaces needed to integrate linear data with different LRMs. The API enables data staging, and provides the underlying information and control necessary for transformation and overlay operations to be performed on different LRMs. The API provides the following functions:

• Utility functions provide the means for controlling linear operations (transformation and overlay), as well as, general system settings.

• Linear location transformation provides functions to transform one linear reference event to another—specifically, one with a different LRM.

• Linear overlay provides functions for linear overlay operations, i.e., determining the portion of an event that is either in common or different from another event. Three types of linear overlay operations are supported: difference, intersection, and union.

• Linear data staging provides the means by which existing LRS, legacy system, and centerline data may be integrated with the LRS. Additionally, the LRS API provides functional interfaces to manage system and user preferences and to obtain system information.

		7. If appropriate, please attach photographs, diagrams, or other images illustrating the appearance or functionality of the technology. (If electronic, please provide a separate file.) Please check one: ☒ Yes, images are attached. ☐ No images are attached. • Data model • Screen shots of maintenance application
State of Development (30 points)	*Technologies must be successfully deployed in at least one State DOT. The TIG selection process will favor technologies that have advanced beyond the research stage, at least to the pilot deployment stage, and preferably into routine use.*	8. Please describe the history of the technology's development. In 1995, Iowa DOT adopted its Geographic System Strategic Plan. Based on this guidance, the Office of Transportation Data created an LRS Team and hired a full-time GIS coordinator. At the time, transportation data was stored throughout the agency in various stand-alone legacy systems and was referenced using a number of linear referencing methods (LRM). In response to the agency's desire to integrate this data, the LRS Team recommended the LRS project. The objectives of the initiative include: • Integrate Iowa DOT's legacy referencing models (e.g., mileposts, stationing, reference post, etc.); • Maintain existing linear datum; • Ensure LRM data integrity; • Enable maintenance of LRMs over time based on defined standards; • Integrate linear locations defined for all modes of transportation (e.g., roadway, rail, air, water, transit, and pedestrian); • Integrate spatial data with linear-referenced data; • Resolve temporal data integrity issues; • Provide data customers with data access and reporting tools; and • Develop an LRS that is scalable to all road systems, modes, and information systems. The project began in 1999 with the development of conceptual, logical, and physical designs. The design is based on the National Cooperative Highway Research Program (NCHRP) 20-27(2) research. In April 2001 a pilot study was used to validate these designs. The LRS was developed to facilitate easy collection and location of features in the field, integrate data using multiple referencing methods and simplify data maintenance and access within all divisions of the Iowa DOT. The LRS will also improve the accuracy of features referenced to the road network, facilitate data sharing between agencies, improve emergency response and allow for informed decisions to be made.
		9. For how long and in approximately how many applications has your State DOT used this technology? Iowa Linear Referencing System went into production in the fall of 2006 after multiple years of development. The following applications utilize the LRS for location information: • The 5 year program uses the LRS in a production system to locate planned Iowa DOT transportation projects. • Iowa DOT's Geographic Information Management System (GIMS) is going through a redesign and will use a datum reference to store the location of its business data along the LRS. GIMS will be in a production environment in the spring of 2008. • With the current implementation of TRADAS (Traffic Data Analysis System) for traffic data maintenance and analysis, the LRS transport nodes will be used to locate both short term and permanent count locations. • The LRS was used to supply 30 counties of data to the Census Bureau for its 2010 census. The data met the new tiger line requirements and passed the statistical tests. • We are working with the largest metropolitan area in Iowa to jointly maintain their emergency response system using components of the LRS. • CTAMS Web (Coordinated Transportation Analysis and Management System) is a web-based interface which uses the LRS to combine roadway inventory, crash, 5 year program and pavement management, and includes the structure inspection reports (through a link to Electronic Records Management System) and videolog. • CTAMS Analyst runs inside GeoMedia and contains a link to all the spatial data that we have in the Geodata Library and any business data that has gone through the LRS staging process. After the business data has gone through the staging process it has a common location and can be analyzed and combined spatially.

- The centerlines and route names produced by the LRS have been shared with other counties.
- Iowa DOT has multiple pilot projects that will use the LRS to locate their business data. These pilots include sign inventory, culvert locations, snow run locations and ITS locations.
- For the reference post LRM, milepost locations are required, therefore they can then be used for accurate mapping of the Milepost locations. Many applications, both internal and external to the DOT, use these locations to map their data.

10. What additional development is necessary to enable routine deployment of the technology?
The application is currently deployable using the Iowa DOT data model. Because each state has their own business rules for how they create and store data, each state may prefer to make some changes to the data model to accommodate those differences.

11. Have other organizations used this technology? Please check one: ☒ Yes ☐ No
If so, please list organizations and contacts.

Organization	*Name*	*Phone*	*E-mail*
Des Moines, IA	Paul Bushore	515-283-4060	PMBushore@dmgov.org
Emmet County	Roger Patocka	712-362-4846	patocka32@yourstarnet.net
US Census Bureau	Craig Best	913-551-6833	craig.duane.best@census.gov
Iowa Center for Transportation Research and Education	Zach Hans	515-233-7300	zhans@iastate.edu

Payoff Potential (30 points)

Payoff is defined as the combination of broad applicability and significant benefit or advantage over other currently available technologies.

12. How does the technology meet customer or stakeholder needs in your State DOT or other organizations that have used it?
The LRS meets customer and stakeholder needs by providing:
- ease of data integration;
- a highly accurate statewide roadway centerline network;
- locatable features along all public roads in the state (114,000 miles);
- less redundancy in data collection and maintenance;
- better use of data storage resources; and
- greater access for local governments to accommodate their needs while conserving resources.

The LRS' statewide roadway network will provide the backbone for emergency response systems, homeland defense applications and census updates from a single source. In addition, this network will:
- provide the ability to navigate routes;
- establish consistent route names, including the capacity for route aliases;
- maintain temporal information, allowing for historical data to be maintained;
- incorporate state-of-the-art technology.

The LRS has been designed to accommodate the capabilities of adding point addressing, address ranges, and private street and alley locations..

		13. What type and scale of benefits has your DOT realized from using this technology? Include cost savings, safety improvements, transportation efficiency or effectiveness, environmental benefits, or any other advantages over other existing technologies. The ability to tie databases together from throughout the agency has been a huge benefit. The ability to analyze data together improves our management of the transportation system. Additional benefits being derived are based upon the increased temporal and spatial accuracies. Business units using the LRS are able to snap data to centerlines that are digitized at an accuracy level greater than a 1:1500 scale. The temporal resolution in the LRS is 1 day. Cost savings are being realized by allowing supported LRMS to be used multiple times to integrate data that is gathered. Supported LRMs are Coordinate Route, Milepoint, Reference Post(mile post) and Literal Description. Prior to deployment of the LRS, joining data from, for example, pavement management and roadway inventory involved a laborious process that had to be repeated each year. The Linear Referencing System (LRS) also tracks when linear information changes, so even road alignment changes, such as bypasses or other modifications, can be reflected and incorporated into analysis. This allows us to locate crashes where they actually occurred, even if the road alignment has changed. This is important for safety analysis when looking at crash statistics and locations that span multiple years.
		14. Please describe the potential extent of implementation in terms of geography, organization type (including other branches of government and private industry) and size, or other relevant factors. How broadly might the technology be deployed? There is no limit to any transportation agency making use of the Iowa DOT LRS. The technology would work in all states. Some modification may be necessary in the data structure. In Iowa, the extent of spatial implementation is all 114,000 miles of public roads in the state, and the extent of the temporal data is for the primary system from 2001 to current and for the local roads 2002 to current. The Iowa DOT envisions Counties and Cities, which are capable of understanding the technology and have the resources available to utilize the software, maintaining their area's data. This could eventually include up to 99 counties and 950 cities maintaining their data directly in the system.
Market Readiness (30 points)	*The TIG selection process will favor technologies that can be adopted with a reasonable amount of effort and cost, commensurate with the payoff potential.*	15. What actions would another organization need to take to adopt this technology? An organization adopting this technology would need to look at each tier and decide which Iowa business rules in each tier apply to them. Database Tier Organizations would be required to have Oracle, Oracle Spatial and software. Staff would need to learn and understand how the database model relates and functions. Application Tier Organizations would be required to have Oracle Workspace Manager and Bentley's LDMx software. Organizations also need to review their LRS business rules and compare them with Iowa's rules. If these rules are similar, code changes could be minimal. If business rules do not match, the tier may need to be modified. Client Application Tier Organizations would be required to have GeoMedia Professional to use Iowa's LRS maintenance client. If an organizations business rules are similar to Iowa, code changes could be minimal. If business rules do not match this tier may need to be modified. Linear networks would need to be added to the database, by digitizing or bulk imports.

		16. What is the estimated cost, effort, and length of time required to deploy the technology in another organization? Cost, effort and length of time to deploy this technology varies based on how the organizations business rules compare to Iowa's and how complete the organizations business data is. By adopting Iowa's LRS system a substantial cost savings can be gained compared to developing a new LRS model.	
		17. What resources—such as technical specifications, training materials, and user guides—are already available to assist deployment? There is an extensive library of documents detailing the development of the LRS beginning with a LRS team report with recommendations for the entire development process. This library contains all of the information used by Iowa and the consultants under contract to develop the system using a conceptual, logical, physical design process. Use cases, based upon the Rational software development process, are available for components of the LRS Maintenance Tool. Training material on how to use LRS data and processes for staging business data in Geomedia by doing LRM transformations is also available. In addition, numerous presentations are available that explain the LRS and its potential uses.	
		18. What organizations currently supply and provide technical support for the technology? Bentley Systems, Inc., Intergraph Corporation, and Oracle.	
		19. Please describe any legal, environmental, social, intellectual property, or other barriers that might affect ease of implementation. The development contract states that with agreement of Bentley and the Iowa DOT that the LRS design and the LRS maintenance application can be distributed, free of charge, to every State, their agencies and political subdivisions.	
Submit to AASHTO Contact		***Keith Platte*** ***Phone: 202.624.7830*** ***Fax: 202.624.5469*** ***kplatte@aashto.org***	***American Association of State Highway & Transportation Officials*** ***444 North Capitol Street N.W., Suite 249*** ***Washington, DC 20001***

Iowa DOT LRS Physical Re-Design Model

12-17-2002

Custom Oracle Datatypes

LRSX_Segment
LRSX_Segmetic_Array
LRSX_Cord

Segmental LRM

Datum SubSystem

Route Management SubSystem

Stationing LRM

Literal LRM

Route SubSystem

Reference Post LRM

LRS Components

PK for F2

To Improvement_Proj_Phase

From LRS_Object_Experience

To Improvement_ Project_Phase

To General_Stage

To LRS_Change_Event

To Improvement_Proj_Phase

Note: This set of tables will be created for each route System shown in the tabs. The table name will be prefixed by the route Systemtem name (e.g., State_Assgnd_Rtes)

Iowa LRS Complex Entities

```
Data 1    Command          Tname     Option    Column Name      Datatype  Default   Comma  Column Name 2    Datatype 2          Default 2
/* --- Extended_Column --- */  Alter table              ANCHOR_Pt              Add (     GEOMETRY_DATUM          MDSystem.SDO_GEOMETRY                ,
        GEOMETRY_GA_TW              MDSystem.SDO_GEOMETRY                )
/* --- Extended_Column --- */  Alter table              CENTERLINE             Add (     GEOMETRY_GA_TW          MDSystem.SDO_GEOMETRY

/* --- Default_Values --- */   Alter table              Improvement_Proj_State Modify (  Subproject_Key          default 0  ,            Selected_Alternative          default 0
/* --- Custom_Type3 --- */     start mk_coredb_objects                  idot.geoanalytics.com
/* --- Custom_Type2 --- */     start mk_lrs_objects                     idot.geoanalytics.com
/* --- Custom_Type1 --- */     start mk_lrs_schema                      idot_dat temp
/* --- Default_Values --- */   Alter table              TRANSPORT_LINK Modify (  DISTANCE               default 0.0
/* --- Extended_Column --- */  Alter table              TRANSPORT_LINK Add (     GEOMETRY_GA_TW          MDSystem.SDO_GEOMETRY                ,
        Confl_ANCHOR_SECTION    TDSystem.LRSX_Confl
/* --- Extended_Column --- */  Alter table              TRANSPORT_NODE         Add (     GEOMETRY_GA_TW          MDSystem.SDO_GEOMETRY

/* --- Extended_Column --- */  Alter table              ANCHOR_SECTION         Add (     GEOMETRY_GA_TW          MDSystem.SDO_GEOMETRY                ,
        GEOMETRY_DATUM          MDSystem.SDO_GEOMETRY
/* --- Default_Values --- */   Alter table              ANCHOR_SECTION         Modify (  DATUM_DISTANCE                  default 0.0
/* --- Terminate2 --- */       exit
/* --- Terminate1 --- */       start drop_mstr_rt_tables
/* --- Route_Schema7 --- */    start mk_Rtes                    idot.geoanalytics.com unofficial
/* --- Route_Schema6 --- */    start mk_Rtes                    idot.geoanalytics.com institution
/* --- Route_Schema5 --- */    start mk_Rtes                    idot.geoanalytics.com private
/* --- Route_Schema4 --- */    start mk_Rtes                    idot.geoanalytics.com e911
/* --- Route_Schema3 --- */    start mk_Rtes                    idot.geoanalytics.com municipal
/* --- Route_Schema2 --- */    start mk_Rtes                    idot.geoanalytics.com county
/* --- Route_Schema1 --- */    start mk_Rtes                    idot.geoanalytics.com state
/* --- Route_Schema8 --- */    start mk_ramp_Rtes               idot.geoanalytics.com pilot
```

Created: 1/12/2002, 12:35:47 PM

Feature Class - Long Tern Transaction Management

When LRS tables are secured by Geomedia's Transaction Manager (GTM), the original tables are dropped and replaced by Long Term Transaction tables (LT40) tables. Historic and Live views are defined by default and provide a complete history and current snapshot of the data, respectively. These views are for the use of users and applications. The Auxilary (Aux) table supports... This process is shown below and will be applied to every table in the LRS.

Original Table - Includes the fields that define the LRS object, as well as, those fields required for Effective Dating and Lineage

Secured by GTM

Table Dropped and Replaced by LT table

GTM - Secured Table Structures and Views

Historic View Created by GTM

Live View Created by GTM

'Live' View
The Live view of the Feature class is persisted to the user by default. It is identical to the non-secured table, and it is data that is current as of today. Temporal filters can be applied to get a view of the given data at a different point in time.

Historic View
The Historic View Contains entire history of the feature. Temporal filters, Effective date filters and Lineage queries will be performed against this table.

Lineage Table - Part of the Effective Date and Lineage Solution. There will be lineage table for every table in the LRS

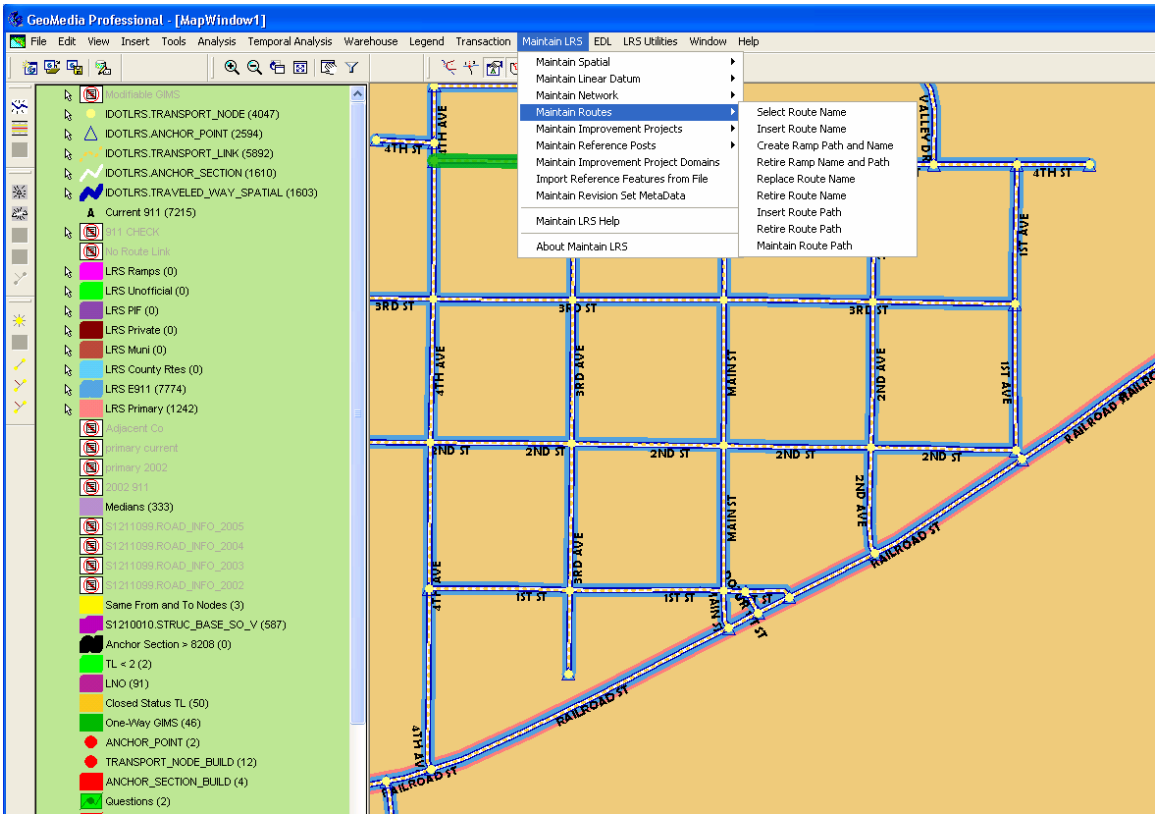
Auxilary Table

Key

Sheet Map

11	1	6
12	2	7
13	3	8
14	4	9
15	5	10

LRS Components | Datum | Route SubSystem | Route Mgmt | Stationing | Base Map | Reference Post | Segmental LRM | Literal LRM


GeoMedia Professional - [MapWindow1]
File Edit View Insert Tools Analysis Temporal Analysis Warehouse Legend Transaction Maintain LRS EDL LRS Utilities Window Help
Maintain Spatial
Maintain Linear Datum
Maintain Network
Maintain Routes
Maintain Improvement Projects
Maintain Reference Posts
Maintain Improvement Project Domains
Import Reference Features from File
Maintain Revision Set MetaData
Maintain LRS Help
About Maintain LRS
Select Route Name
Insert Route Name
Create Ramp Path and Name
Retire Ramp Name and Path
Replace Route Name
Retire Route Name
Insert Route Path
Retire Route Path
Maintain Route Path
IDOTLRS.TRANSPORT_NODE (4047)
IDOTLRS.ANCHOR_POINT (2594)
IDOTLRS.TRANSPORT_LINK (5892)
IDOTLRS.ANCHOR_SECTION (1610)
IDOTLRS.TRAVELED_WAY_SPATIAL (1603)
Current 911 (7215)
LRS Ramps (0)
LRS Unofficial (0)
LRS PIF (0)
LRS Private (0)
LRS Muni (0)
LRS County Rtes (0)
LRS E911 (7774)
LRS Primary (1242)
Medians (333)
Same From and To Nodes (3)
Anchor Section > 8208 (0)
TL < 2 (2)
LNO (91)
Closed Status TL (50)
One-Way GIMS (46)
ANCHOR_POINT (2)
TRANSPORT_NODE_BUILD (12)
ANCHOR_SECTION_BUILD (4)
Questions (2)
4TH ST
3RD ST
2ND ST
1ST ST
4TH AVE
3RD AVE
2ND AVE
1ST AVE
MAIN ST
RAILROAD ST
ALLEY

AASHTO Technology Implementation Group

Nomination of Technology Ready for Implementation

2007 NOMINATIONS DUE BY FRIDAY, SEPTEMBER 7, 2007

Sponsor	*Nominations must be submitted by an AASHTO member DOT willing to help promote the technology.*	1. Sponsoring State DOT: Michigan Department of Transportation		
		2. Name: Kevin Kennedy		
		Title: Capital Preventive Maintenance Engineer		
		Mailing Address: 8885 Ricks Road PO Box 30049		
		City: Lansing	State: MI	Zip Code: 48909
		E-mail: kennedyk@michigan.gov	Phone: 517-322-6043	Fax: 517-322-5664
		3. Date Submitted: 09/07/2007		
		4. Is the Sponsoring State DOT willing to promote this technology to other states by participating on a Lead States Team supported by the AASHTO Technology Implementation Group? Please check one: ☒ Yes ☐ No		
Technology Description (10 points)	*The term "technology" may include processes, products, techniques, procedures, and practices.*	5. Name the technology: The URETEK Method and Deep Injection Process		
		6. Please describe the technology: High Density Polymer injection for concrete lifting, soil stabilization and infrastructure rehabilitation. Low viscosity liquid polymer components are injected directly beneath the slab and/or at depth through small 5/8" holes in concrete. The low viscosity material enables the polymer to permeate out 4' to 6'. Chemical reaction between the components results in an expanding high density hydro-insensitive material that exerts an upward force that lifts, densifies, and stabilizes soils. This patented material has a water insoluble diluent which permits the formation of polyurethanes in excess water providing polyurethane foam with improved dimensional stability properties. The URETEK Method applied directly underneath the concrete slab lifts and underseals the panels while filling any voids formed at the interface of its underside and the base material. Precise control of the injection process, along with laser level monitors enable the panel lift to be accurately controlled. Deep Injection Process employs a high density expanding polymer to fill, densify, and stabilize low-density compressible soils to depths of 30 feet and beyond. A Dynamic Cone Penetrometer test is used to test soils before and after application.		
		7. If appropriate, please attach photographs, diagrams, or other images illustrating the appearance or functionality of the technology. (If electronic, please provide a separate file.) Please check one: ☒ Yes, images are attached. ☐ No images are attached.		
State of Development (30 points)	*Technologies must be successfully deployed in at least one State DOT. The TIG selection process will favor technologies that have advanced beyond the research stage, at least to the pilot deployment stage, and preferably into routine use.*	8. Please describe the history of the technology's development. URETEK Finland began work with special formulations of high-density polymers. A limited number of specialized structural resin components were selected from a wide cross-section of possible blended characteristics. URETEK 486 - our brand name -was selected for this unique system of lifting and undersealing concrete. URETEK advanced the equipment technology of total proportion and injection control of the product. After years of experimental development and technique modification, The URETEK Method™ was patented in the United States (U.S. Patent No. 4,567,708) and other countries around the world. URETEK Italy further developed the process of polymer injection at depth to achieve soil densification and increase the bearing capacity of foundation soils, now known as the URETEK Deep Injection process. In 2003, the URETEK's Deep Injection™ patent was issued in the United States and Canada (U.S. Patent No. 6,634,831 B2). URETEK has worked extensively with BaySystems/Bayer to further develop the URETEK 486 material to include a water insoluble diluent which permits the formation of the expanding polymer in excess water environments, called URETEK 486 STAR (U.S. Patent No. 6,521,673).		
		9. For how long and in approximately how many applications has your State DOT used this technology? The current technology was used on one project in 2007.		

10. What additional development is necessary to enable routine deployment of the technology? The specification has been developed and the technology is approved for use as an emerging technology. Monitoring of existing job(s) for performance will be required for the fix to be moved from an emerging technology to a standard fix.

11. Have other organizations used this technology? Please check one: ☒ Yes ☐ No
If so, please list organizations and contacts.

Organization	*Name*	*Phone*	*E-mail*
TX DOT	not available		
AL DOT	not available		
NJ DOT	not available		
AZ DOT	not available		
CALTRANS	not available		

Payoff Potential (30 points)

Payoff is defined as the combination of broad applicability and significant benefit or advantage over other currently available technologies.

12. How does the technology meet customer or stakeholder needs in your State DOT or other organizations that have used it? The technology provided a relatively inexpensive and quick fix with minimal disruption to traffic and resulted in a better riding pavement for the customer.

13. What type and scale of benefits has your DOT realized from using this technology? Include cost savings, safety improvements, transportation efficiency or effectiveness, environmental benefits, or any other advantages over other existing technologies. The fix was cost effective and minimized user delays and resulted in an improved pavement.

14. Please describe the potential extent of implementation in terms of geography, organization type (including other branches of government and private industry) and size, or other relevant factors. How broadly might the technology be deployed? The URETEK Method and Deep Injection process are ideal for highways, bridge approach/departure slabs as well as taxiways, runways and tunnels with settlement problems caused by poor base and sub-base soil compaction. The URETEK Method alone can remedy concrete problems such as sunken or pumping highways, roads and runways, water ponding in roads and streets, pavement drainage issues, bridge approach/departure slab misallignment. The greatest advantage to using The URETEK Method and Deep Injeciton process is the speed of application and night work availability, rehabilitating concrete transportation assets in hours, and virtually eliminating closures and downtime.

Market Readiness (30 points)

The TIG selection process will favor technologies that can be adopted with a reasonable amount of effort and cost, commensurate with the payoff potential.

15. What actions would another organization need to take to adopt this technology? They would have do to some field investigations to ensure that it is the proper fix for the pavement being considered.

16. What is the estimated cost, effort, and length of time required to deploy the technology in another organization? Development should have minimial costs and the technology can be implemented quickly. Costs would depend on the amount of field investigation required but should be comparable to other projedcts. The specification used by MDOT can be adapted to meet an organization's need.

17. What resources—such as technical specifications, training materials, and user guides—are already available to assist deployment? In addition to an extensive proprietary safety manual, on site and regional training of our operations personnel is continuously performed. This process is proprietary and would not be performed by State personnel.

		18. What organizations currently supply and provide technical support for the technology? URETEK USA, Inc. and BaySystems/Bayer	
		19. Please describe any legal, environmental, social, intellectual property, or other barriers that might affect ease of implementation. Proprietary and Patented Process and Patented Material.	
Submit to AASHTO Contact		***Keith Platte*** ***Phone: 202.624.7830*** ***Fax: 202.624.5469*** ***kplatte@aashto.org***	***American Association of State Highway & Transportation Officials*** ***444 North Capitol Street N.W., Suite 249*** ***Washington, DC 20001***


JACKSON USA, INC.
The JACKSON Method

AASHTO Technology Implementation Group

Nomination of Technology Ready for Implementation

2007 NOMINATIONS DUE BY FRIDAY, SEPTEMBER 7, 2007

<table>
<tr><td rowspan="8">Sponsor</td><td rowspan="8">Nominations <u>must</u> be submitted by an AASHTO member DOT willing to help promote the technology.</td><td colspan="3">1. Sponsoring State DOT: Michigan DOT</td></tr>
<tr><td colspan="3">2. Name: Bob Parsons</td></tr>
<tr><td colspan="3">Title: Public Involvement and Hearings Officer</td></tr>
<tr><td colspan="3">Mailing Address: P.O. Box 30050</td></tr>
<tr><td>City: Lansing</td><td>State: MI</td><td>Zip Code: 48909</td></tr>
<tr><td>E-mail:
parsonsb@michigan.gov</td><td>Phone: 517-373-9534</td><td>Fax: 517-373-9255</td></tr>
<tr><td colspan="3">3. Date Submitted: 09/07/2007</td></tr>
<tr><td colspan="3">4. Is the Sponsoring State DOT willing to promote this technology to other states by participating on a Lead States Team supported by the AASHTO Technology Implementation Group?
Please check one: ☒ Yes ☐ No</td></tr>
<tr><td rowspan="3">Technology Description (10 points)</td><td rowspan="3">The term “technology” may include processes, products, techniques, procedures, and practices.</td><td colspan="3">5. Name the technology: CommentWorks</td></tr>
<tr><td colspan="3">6. Please describe the technology: CommentWorks is a commercial, off-the-shelf support product that uses state-of-the-art, web-based information technology to improve and increase the productivity of the labor-intensive process of accepting and analyzing public comments and integrating those comments into projects and programs. CommentWorks is an internet-based software product that is specifically designed to assist organizations with collecting, tracking, analyzing, documenting, and responding to comments on projects of all kinds, such as proposed policy/procedure changes, and integrating these comments into their project and programmatic decisions. It includes a configurable web-form site for the submission of comments including answers to an on-line project-specific questionnaire. Comments received through this web form are loaded into the CommentWorks database along with and comments received by other means including the government rule-making portals.

CommentWorks data are provided simultaneously and in real time through a client-specific secure internet site to authorized CommentWorks users on the project team (including client staff, contractor staff, and key stakeholders as specified by the purchaser of CommentWorks). CommentWorks includes analytical tools to search, sort, and review and categorize comments by topic or issue, and prepare reports of public concerns. CommentWorks allows side-by side review of similar comments and provides an area to summarize or craft a response to comments by issue area.

Because the system is hosted on ICF’s or a customer’s servers and accessed through the internet, public and project team access requires only a web browser – no matter where members of the project team are physically located. Thus CommentWorks supports the timely integration of critical information to the key decision-makers on a project as soon as it is available.</td></tr>
<tr><td colspan="3">7. If appropriate, please attach photographs, diagrams, or other images illustrating the appearance or functionality of the technology. (If electronic, please provide a separate file.)
Please check one: ☒ Yes, images are attached. ☐ No images are attached.</td></tr>
<tr><td rowspan="2">State of Development (30 points)</td><td rowspan="2">Technologies must be successfully deployed in at least one State DOT. The TIG selection process will favor technologies that have advanced beyond the research stage, at least</td><td colspan="3">8. Please describe the history of the technology’s development. The first version of CommentWorks was developed for specific internal regulatory development and NEPA projects in the mid-1990s. In 2000, ICF International developed the first commercial version of the software. In 2007, ICF released CommentWorks version 4.0. In 2005 MDOT received an envronmental streamlining grant from the Federal Highway Administration to test the technology on environmental clearance.</td></tr>
<tr><td colspan="3">9. For how long and in approximately how many applications has your State DOT used this technology? MDOT used the technology for 2 years to collect and manage public comments on three planning studies including the State Long Range Planning Study</td></tr>
</table>

		10. What additional development is necessary to enable routine deployment of the technology? .None
		11. Have other organizations used this technology? Please check one: ☒ Yes ☐ No If so, please list organizations and contacts.

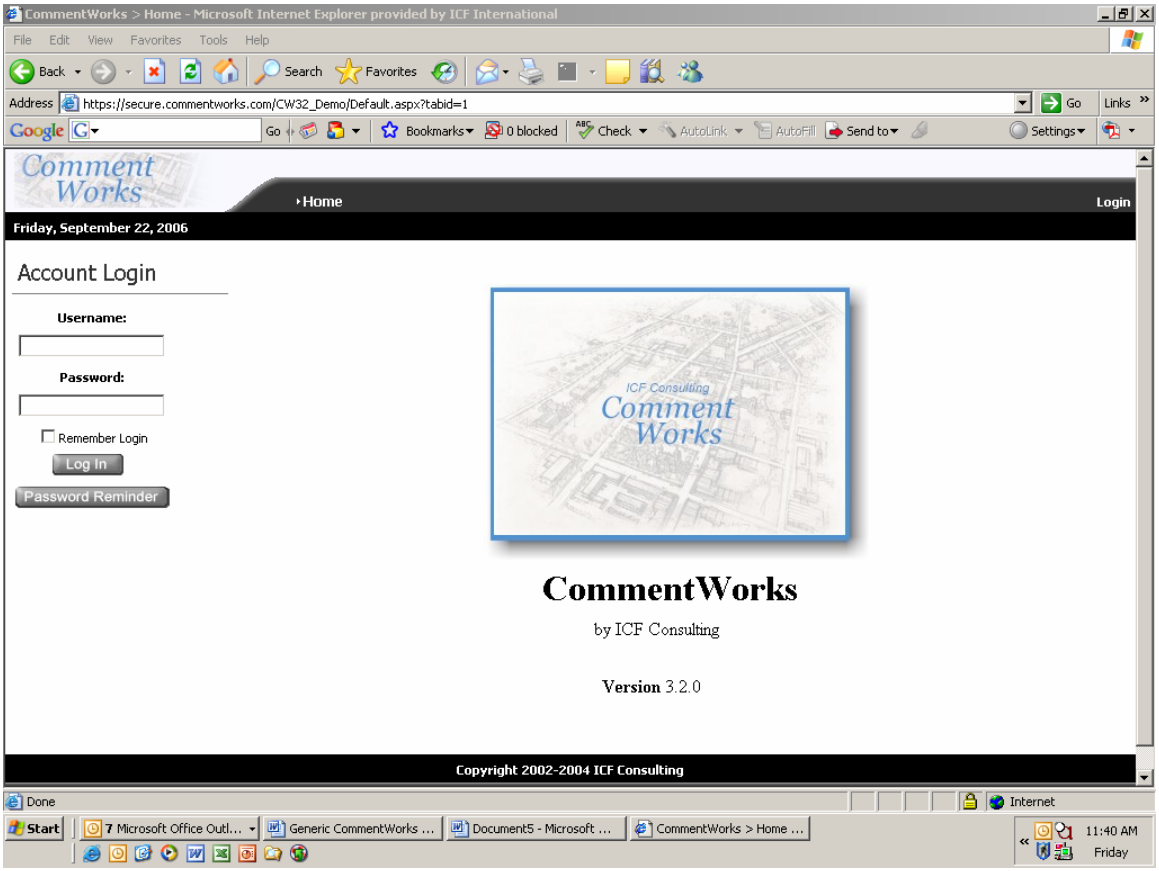
Organization	*Name*	*Phone*	*E-mail*
US DOT/FMCSA	Nathaniel Jackson	202 366-1225	nathaniel.jackson@fmcsa.dot.gov
US FTC	Jeffrey Nakrin	202-326-2314	jnakrin@ftc.gov
US DHS/TSA	Greg Moxness	571 227-1002	greg.moxness@dhs.gov
US DHHS/FDA	Erik Mettler	301-827-5259	erik.mettler@fda.gov
Others			Upon request

Payoff Potential (30 points)	*Payoff is defined as the combination of broad applicability and significant benefit or advantage over other currently available technologies.*	12. How does the technology meet customer or stakeholder needs in your State DOT or other organizations that have used it? CommentWorks makes it easy to collect public comments using a internet-based comment form linked to a project web site. CommentWorks also facilitates the parsing, sorting, and distribution of public comments into issue or subject areas so that project specialists can readily focus on comments that relate to their area of expertise. CommentWorks also supports submission of public comments at kiosk computers that can be set up at public meetings. CommentWorks also can produce and export a mailing list of public commenters. Furthermore, MDOT found it an innovative tool for reaching traditionally under-represented stakeholders by partnering with local libraries. During MDOT's State Long-Range Planning process, libraries encouraged their patrons to complete on-line questionnaires when using their computers to access the Internet, resulting in more than 1,700 completed questionnaires.
		13. What type and scale of benefits has your DOT realized from using this technology? Include cost savings, safety improvements, transportation efficiency or effectiveness, environmental benefits, or any other advantages over other existing technologies. Expanded, streamlined, more transparent, orderly, and thorough public involvement on projects. Our CommentWorks initiative has proven the broad applicability of Internet-based comment/response systems for engaging the public in transportation decisions. Whether a simple comment form or a multi-faceted questionnaire, CommentWorks is an effective communications tool for linking the public with transportation planners.
		14. Please describe the potential extent of implementation in terms of geography, organization type (including other branches of government and private industry) and size, or other relevant factors. How broadly might the technology be deployed? CommentWorks has been deployed for specific projects that garner anywhere from 100 to 40,000 public comments, and for enterprises that have used in on over 50 different projects that each elicited from 10 to 25,000 projects. CommentWorks has been used by many different state and federal government organizations and their private contractors and, because it is web-based, is not geographically constrained.
Market Readiness (30 points)	*The TIG selection process will favor technologies that can be adopted with a reasonable amount of effort and cost,*	15. What actions would another organization need to take to adopt this technology? Determine their needs for public comment collection, analysis, and documentation (ICF can assist in this effort), solicit a proposal for the required sollution through AASHTO, who has a standing contract with ICF. The degree of effort required of an organization interested in adopting the technology will depend a great deal on whether the organization desires to install and run the software themselves or allow ICF to provide a fully hosted and supported solution.

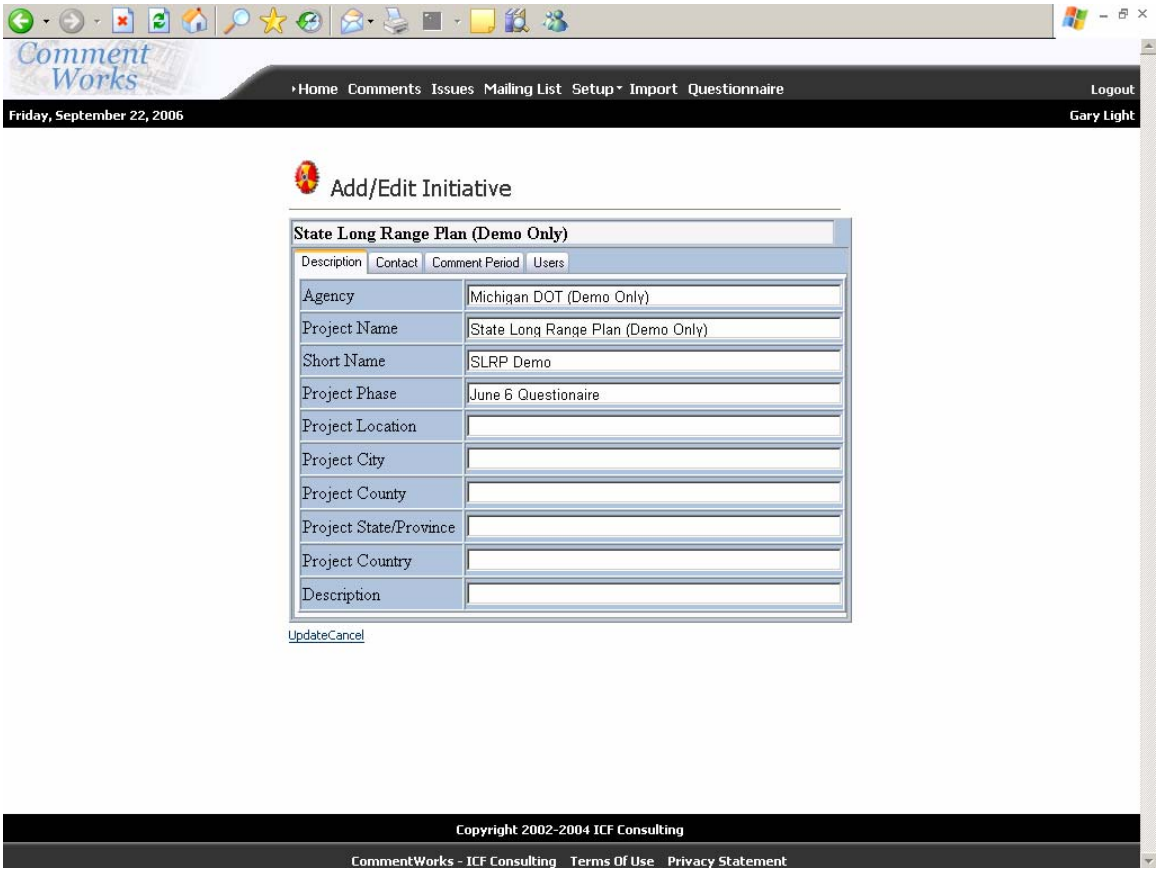
		16. What is the estimated cost, effort, and length of time required to deploy the technology in another organization? The cost of the software depends primarily on which modules are required (e.g., does the organization already have a system for collecting public comments electronically), the number of users, the duration of use, and whether the organizatoin or ICF is to host the solution. The estimated minimum cost for software subscription, ICF hosting, training, and support is approximately $10,000 to $20,000. For such a scenario, the major effort on the part of the interested organization is determining needs, conducting security review, and inserting appropriate links on project web sites. Many organizations have gotten the technology deployed within a month of initiating the project.	
		17. What resources—such as technical specifications, training materials, and user guides—are already available to assist deployment? ICF offers a wide range of documentation covering minimum hardware and software specifications, a system security plan, and end user training; and also provides maintenance and support services tailored to each customers needs.	
		18. What organizations currently supply and provide technical support for the technology? ICF International	
		19. Please describe any legal, environmental, social, intellectual property, or other barriers that might affect ease of implementation. CommentWorks is a commercial software product owned by ICF International and distributed by license.	
Submit to AASHTO Contact		***Keith Platte*** ***Phone: 202.624.7830*** ***Fax: 202.624.5469*** ***kplatte@aashto.org***	***American Association of State Highway & Transportation Officials*** ***444 North Capitol Street N.W., Suite 249*** ***Washington, DC 20001***

Sample Screens from CommentWorks®

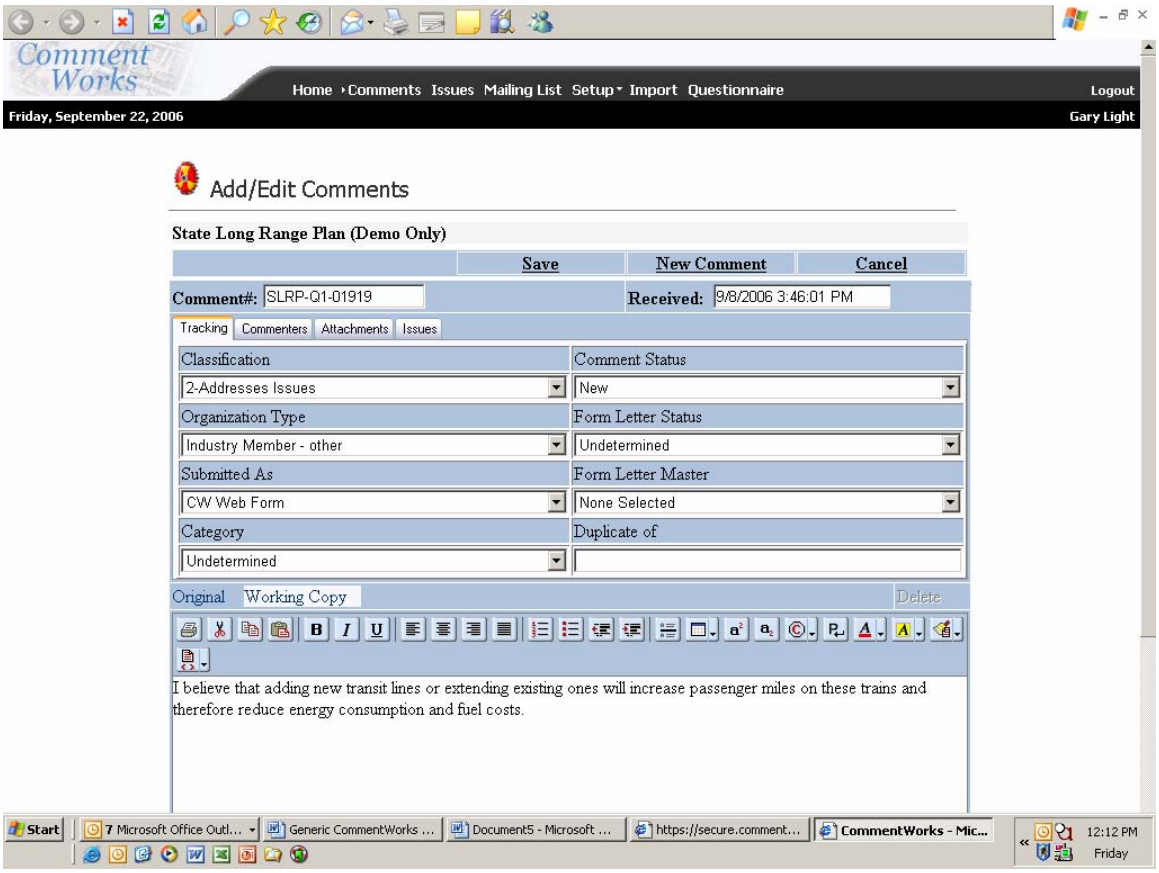
Secure password-protected and encrypted internet access:



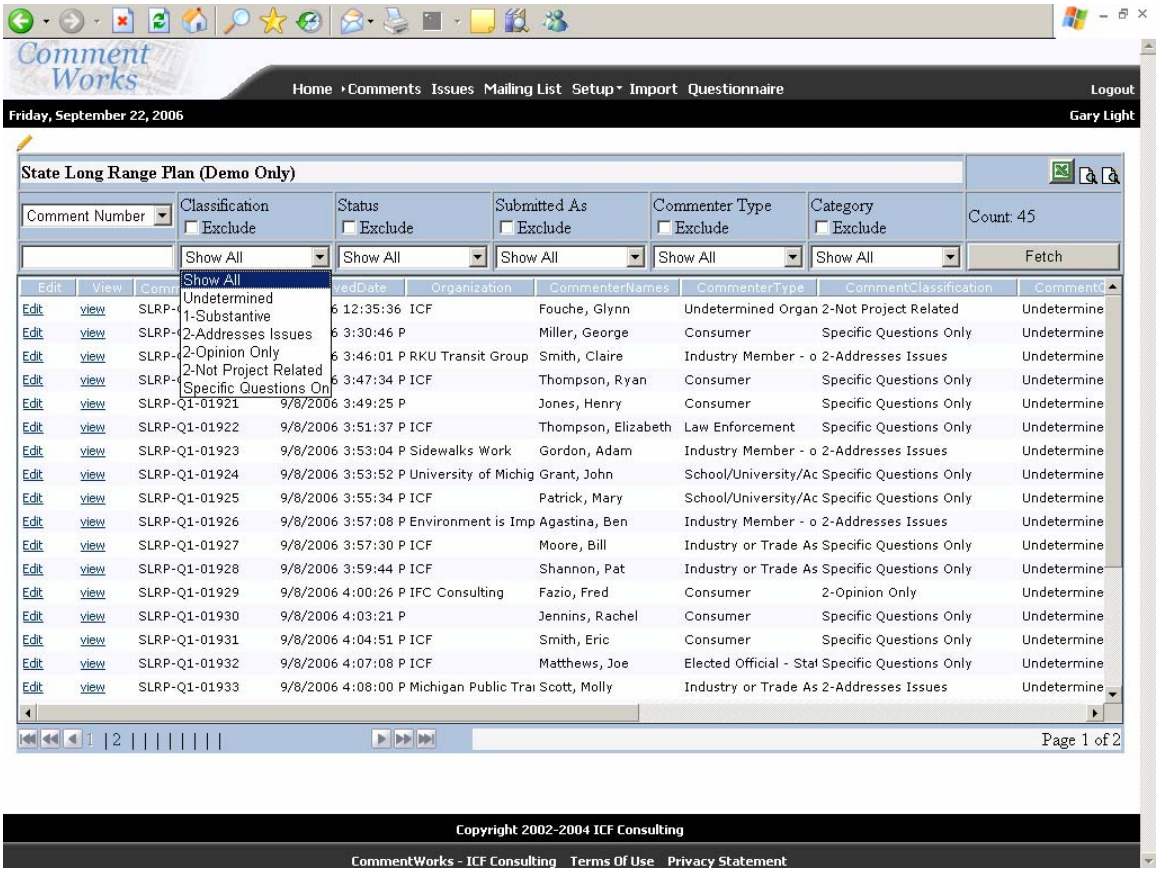
Supports multiple simultaneous projects or “initiatives”:



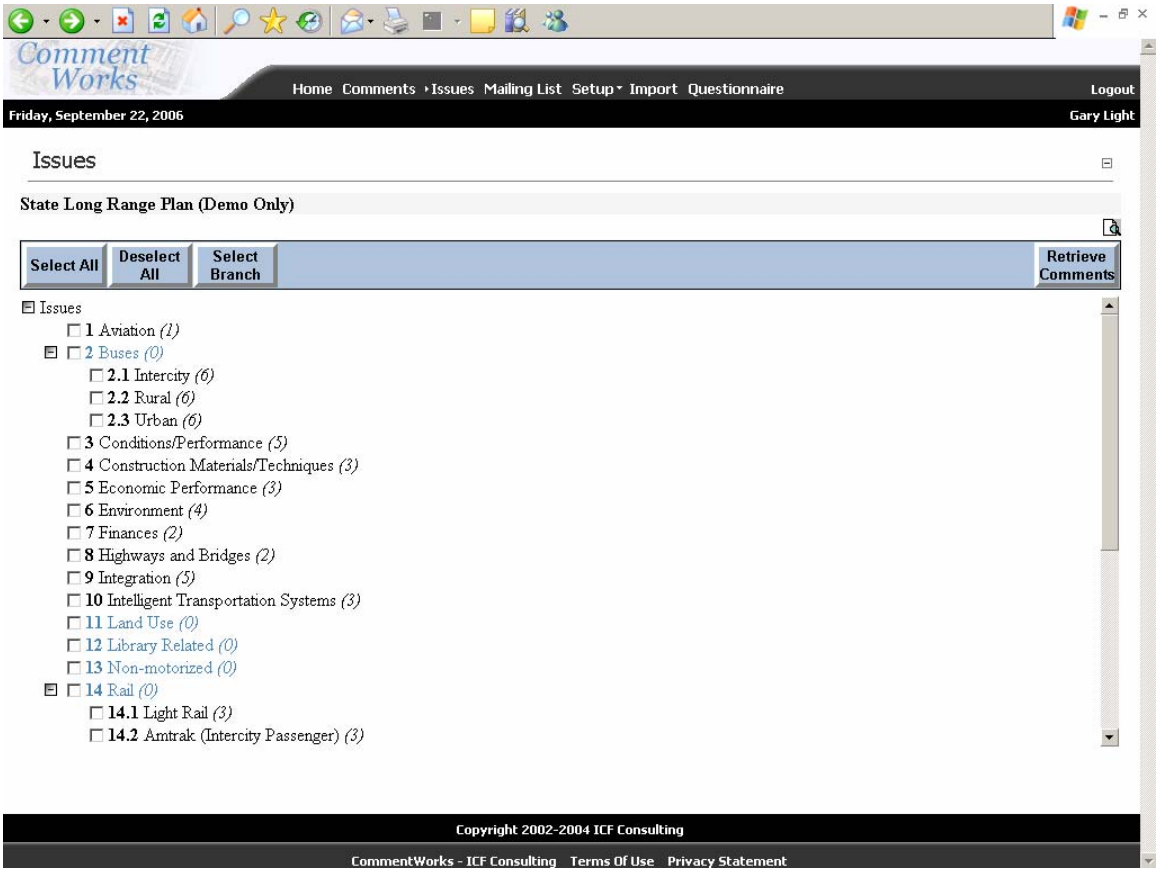
Enter comments or add data to comment records (e.g., form letter reference, file attachments):



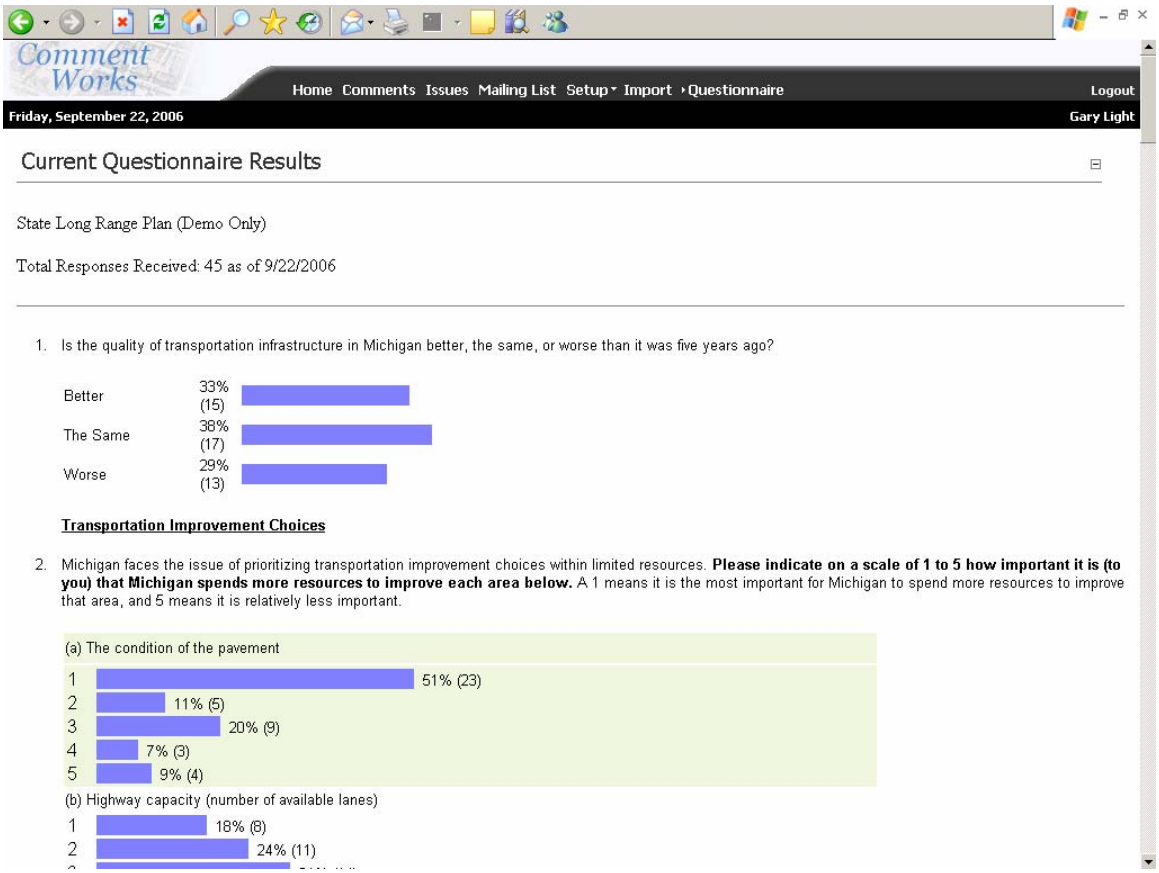
Simple intuitive interface for sorting and searching for comments:



Create dynamic outline of “issue” categories, code comments to issues, and search, count, sort, report, summarize, and respond to comment by issue category:



Use optional on-line form to collect comments and/or responses to specific survey questions:



Michigan Department of Transportation

Help Shape Michigan's Transportation Future!

The Michigan Department of Transportation (MDOT) is updating its statewide long range transportation plan, known as MI Transportation Plan. We appreciate you taking a few minutes to complete the following questionnaire that will help set the direction for transportation decisions and investments through 2030.

Once you have answered all of the questions, click the submit button at the end and your responses and comments will be forwarded to the MI Transportation Plan team for review. This is the first of three questionnaires. We encourage you to return to this site next fall to complete the next questionnaire. Your responses will be strictly confidential. Thank you.

MDOT State Long Range Plan

Commenter:

**First Name:
**Last Name (Surname):
Organization:
Address 1:
Address 2:
*City:
*State/Province: Michigan
*ZIP Code:
Email:

* Required Fields
** Required For Mailing List

Mailing List:
If you would like to receive MI Transportation Plan information, updates and other plan-related materials, please check below before you submit the form. Please sign up only once per household or address.

☐ Sign me up!

---

1. Is the quality of transportation infrastructure in Michigan better, the same, or worse than it was five years ago?

   ○ Better

- ○ The Same
- ○ Worse

Transportation Improvement Choices

2. Michigan faces the issue of prioritizing transportation improvement choices within limited resources. **Please indicate on a scale of 1 to 5 how important it is (to you) that Michigan spends more resources to improve each area below.** A "1" means it is the most important for Michigan to spend more resources to improve that area, and "5" means it is relatively less important.

(a) The condition of the pavement	1 ○ 2 ○ 3 ○ 4 ○ 5 ○
(b) Highway capacity (number of available lanes)	1 ○ 2 ○ 3 ○ 4 ○ 5 ○
(c) Bridge maintenance	1 ○ 2 ○ 3 ○ 4 ○ 5 ○
(d) Availability of transportation options (mode choice)	1 ○ 2 ○ 3 ○ 4 ○ 5 ○
(e) Availability of long-distance transportation options (such as intercity passenger rail and buses)	1 ○ 2 ○ 3 ○ 4 ○ 5 ○
(f) The level of safety on Michigan's highways	1 ○ 2 ○ 3 ○ 4 ○ 5 ○
(g) More sidewalks for pedestrians and lanes and pathways for bicycles	1 ○ 2 ○ 3 ○ 4 ○ 5 ○
(h) Connectivity between different modes of transportation	1 ○ 2 ○ 3 ○ 4 ○ 5 ○
(i) New highways	1 ○ 2 ○ 3 ○ 4 ○ 5 ○
(j) Border security	1 ○ 2 ○ 3 ○ 4 ○ 5 ○
(k) Technology improvements to improve system efficiency	1 ○ 2 ○ 3 ○ 4 ○ 5 ○
(l) Truck/freight movement	1 ○ 2 ○ 3 ○ 4 ○ 5 ○
(m) Access to airports, transit and ferry terminals	1 ○ 2 ○ 3 ○ 4 ○ 5 ○

3. Which of the following transportation improvements do you feel should receive the highest priority? Please rank the following from 1 to 5. "1" means it is the highest priority, and "5" means it is the lowest priority. Do not use each number more than once.

(a) Maintain/preserve existing transportation system	1 ○ 2 ○ 3 ○ 4 ○ 5 ○
(b) Relieve congestion	1 ○ 2 ○ 3 ○ 4 ○ 5 ○
(c) Build new roads/bridges	1 ○ 2 ○ 3 ○ 4 ○ 5 ○
(d) Improve public transit (bus or van)	1 ○ 2 ○ 3 ○ 4 ○ 5 ○
(e) Promote safety	1 ○ 2 ○ 3 ○ 4 ○ 5 ○

Agree-Disagree Statements

Please indicate whether you agree or disagree with the following statements.

4. Improving Michigan's transportation system is critical to improving the economy and job situation in the state.

- ○ Strongly agree
- ○ Somewhat agree
- ○ Somewhat disagree
- ○ Strongly disagree

5. Michigan Department of Transportation uses its transportation funds efficiently and effectively.

- ○ Strongly agree
- ○ Somewhat agree
- ○ Somewhat disagree
- ○ Strongly disagree

6. New roads and bridges should only be built once all other improvement options have been considered.

- ○ Strongly agree
- ○ Somewhat agree
- ○ Somewhat disagree
- ○ Strongly disagree

7. The following is a list of attributes for a future transportation system. Please rank the attributes from 1 to 6. "1" means it is the most important attribute for a future transportation system, and "6" means it is the least important attribute for a future transportation system. Do not use each number more than once.

(a) Affordable	1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○
(b) Choices	1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○
(c) Efficient and Convenient	1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○
(d) Reliable	1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○
(e) Safe	1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○
(f) Sustainable	1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○

8. Do you hope that Michigan's transportation system in 2030 is:

- ○ Much like today
- ○ Somewhat different than today
- ○ Much different than today

Future of Transportation

What do you desire for Michigan's transportation system in 2030? Please indicate the appropriate selection below whether you would like to see more, the same or less of the listed transportation features in 2030.

9. Highway capacity

- ○ More
- ○ The Same

- ○ Less

10. Urban transit (bus systems) capacity

- ○ More
- ○ The Same
- ○ Less

11. Pedestrian trails/facilities

- ○ More
- ○ The Same
- ○ Less

12. Passenger rail connections

- ○ More
- ○ The Same
- ○ Less

13. Airports and air service

- ○ More
- ○ The Same
- ○ Less

LIBRARY ACCESS

Several Michigan libraries are partnering with MDOT to encourage participation in this on-line questionnaire. If your library is one of them included in the following drop-down list, please take another minute to answer a few more questions on traveling too and from the library. This information will be shared with the partnering libraries to help identify and address local transportation concerns. Thank you.

14. Please select the location and name of your participating library from this list.

Allen Park - Allen Park Public Library

15. How far did you have to travel to get to the library?

- ○ Less than 1 mile
- ○ 1 to 2 miles
- ○ 3 to 5 miles
- ○ More than 5 miles

16. How did you access your library today?

- ○ Car

- ○ Public transportation (bus or van)
- ○ Bicycle
- ○ Walk
- ○ From home through the Internet
- ○ From work through the Internet

17. Do you use public transportation (buses, vans, etc.) to get to your public library?

- ○ Never
- ○ Sometimes
- ○ Often
- ○ Always

18. How important is public transportation to your use of the public library?

- ○ Not important
- ○ Somewhat important
- ○ Very important

19. How did you find out about this questionnaire?

- ○ From the library
- ○ From the media (newspaper, radio or television)
- ○ From the Internet
- ○ From other source

20. Which of the following would do the most to improve your ability to get to your public library: Please rank the following from 1 to 4. "1" means it is the highest priority, and "4" means it is the lowest priority. Do not use each number more than once.

(a) Better or more sidewalks	1 ○ 2 ○ 3 ○ 4 ○
(b) Better or more bike paths	1 ○ 2 ○ 3 ○ 4 ○
(c) Improved public transportation	1 ○ 2 ○ 3 ○ 4 ○
(d) Improved roads and streets	1 ○ 2 ○ 3 ○ 4 ○

Thank you for completing our questionnaire and helping to shape Michigan's transportation future!

Additional Comments: (Optional)

Submit Reset

If you have further questions which were not addressed as part of these Web pages, please do not hesitate to contact the MI Transportation Plan team at 1-800-241-1828.

Mailing Address:
Tim Ryan Transportation Planner
Bureau of Transportation Planning
P.O. Box 30050
Lansing, MI 48909

Phone: (517) 241-2245
Email: ryanti@michigan.gov

AASHTO Technology Implementation Group

Nomination of Technology Ready for Implementation

2007 NOMINATIONS DUE BY FRIDAY, SEPTEMBER 7, 2007

Sponsor	*Nominations must be submitted by an AASHTO member DOT willing to help promote the technology.*	1. Sponsoring State DOT: ,Utah Department of Transportation		
		2. Name: Daniel Hsiao PE, SE		
		Title: Senior Project Manager		
		Mailing Address: 4501 S. 2700 W.		
		City: Taylorsville	State: Utah	Zip Code: 84119
		E-mail: dhsiao@utah.gov	Phone: 801-965-4638	Fax: 801-965-4564
		3. Date Submitted: 09/05/2007		
		4. Is the Sponsoring State DOT willing to promote this technology to other states by participating on a Lead States Team supported by the AASHTO Technology Implementation Group? Please check one: ☒ Yes ☐ No		
Technology Description (10 points)	*The term "technology" may include processes, products, techniques, procedures, and practices.*	5. Name the technology: Innovative survey method for new construction project. The file is called Life Dimensional 3D Technology(LD3).		
		6. Please describe the technology: LD3 fuses Light Detection And Ranging (LIDAR) XYZ position coordinates, digital imaging (RGB data) and geophysical information (GPS) into every pixel. This gives each pixel in the scene "intelligence". This intelligent pixel technology (Intelipixel™) allows quick and easy capture of real world scenes into life dimensional computer files (LD3 files) and facilitates smooth and seamless transition of the information into CAD. A new application made available with ISI technology is called, "Desktop Surveying." Desktop Surveying is the ability to perform traditional field survey activities in the office using a desktop computer. Since all survey-related information required for a project is embedded in each Inteli-Pixel, design iterations and decisions can be made in a time/cost efficient manner with high accuracy. Integration with traditional CAD, including AutoCAD, formats is provided by ISI software compatibility, which converts ISI's LD3 files into traditional CAD formats. ISI software tools allow users to identify 3D objects containing GPS and XYZ data with markers at precise points. The marker can be given a name and other attributes assigned, such as description, dates, asset information, etc. This information can then be exported to a database if desired. A user can navigate through the LD3 scene and select data of interest by the click of a mouse using the insert object tool. It is no longer necessary to send a surveyor back to the site to obtain additional survey points. Objects are marked and exported as text files into desired CAD and GIS programs to create 3D line drawings and models. Conversion tools in the software convert the data to any desired project coordinate system.		
		7. If appropriate, please attach photographs, diagrams, or other images illustrating the appearance or functionality of the technology. (If electronic, please provide a separate file.) Please check one: ☒ Yes, images are attached. ☐ No images are attached.		
State of Development (30 points)	*Technologies must be successfully deployed in at least one State DOT. The TIG selection process will favor technologies that have advanced beyond the research stage, at least to the pilot deployment stage, and preferably into routine use*	8. Please describe the history of the technology's development. LD3 Technology offers its clients the very latest in 3D digital imaging and modeling technology. The ISI LD3 Camera captures real world objects and scenes by combining: (1) Light Detection And Ranging (LiDAR) data consisting of XYZ coordinates; (2) Digital photograph data consisting of pixels containing color and grid location; and (3) GPS data consisting of longitude, latitude and altitude. With these components, the LD3 System produces an LD3 scene with intelligence, where each pixel (Inteli-Pixel™) has the visual quality of a digital photograph, an XYZ coordinate and a GPS position. InteliSum is the only company that fuses LiDAR-derived XYZ coordinates, GPS information and RGB data into each and every pixel of its life dimensional imagery. This imagery supports rapid, accurate, cost-effective 3D modeling. As a result, the technology offers 3D models to its clients containing greater detail at lower cost than traditional 3D modeling service providers		
		9. For how long and in approximately how many applications has your State DOT used this technology? Utah Department of Transportation has used LD3 technology for the purpose of survey, design, modeling and animation creation for the last two years for a total of five projects.		

		10. What additional development is necessary to enable routine deployment of the technology? Introducing the unique capabilities of LD3 technology in the planning stages of a project, significantly increases the communication between surveyors, designers, project managers and the client
		11. Have other organizations used this technology? Please check one: ☒ Yes ☐ No If so, please list organizations and contacts.

Organization	*Name*	*Phone*	*E-mail*
URS Corp	Bobby Valentine	719-531-0001	bobby_valentine@urscorp.com
CH2MHILL	Brian Blevins	425-233-3266	
INCA	Michael Root	425-635-1000	
King County	Tim Lane	206-296-3708	
Anderson Engineering	Greg Nelson	801-792-7730	gnelson@andersoneng.com

Payoff Potential (30 points)	*Payoff is defined as the combination of broad applicability and significant benefit or advantage over other currently available technologies.*	12. How does the technology meet customer or stakeholder needs in your State DOT or other organizations that have used it? The use of LD3 technology is cost effective, minimizes need for permitting, promotes safety for survey crews, increases communication through 3D visual; demensionally accurate models, eliminates the need for survey site re-visits and promotes the use of "Desk Top Surveying" (dts) to non surveyors.
		13. What type and scale of benefits has your DOT realized from using this technology? Include cost savings, safety improvements, transportation efficiency or effectiveness, environmental benefits, or any other advantages over other existing technologies. The biggest advantage has been a cost savings. LD3 technology allows users to capture survey and as-built data in a fraction of the time over any current method. It also captures all the metrics of the site so that re-visits are not necessary. The transition to CAD is much faster saving money on CAD creation and the site is in 3D therefor elinminating the need to create a 3D model of the existing conditions since it is already created when the data is captured. Additional adavntages are safety field personnel can capture data remotely and files are a fraction of traditional point clouds which save tons of disk space.
		14. Please describe the potential extent of implementation in terms of geography, organization type (including other branches of government and private industry) and size, or other relevant factors. How broadly might the technology be deployed? The LD3 technology will eventually replace majority of the traditional survey (shoot and measure) for most of the projects. With the visulization strength, the public will "see" the final products in truth demensions before the project starts. It can be implemented to any public work, buildings, and traffice accidents, and crime scene.
Market Readiness (30 points)	*The TIG selection process will favor technologies that can be adopted with a reasonable amount of effort and cost, commensurate with the payoff potential.*	15. What actions would another organization need to take to adopt this technology? The technology can be implemented as easily as implementing a typical survey job. The technology is very intuitive and after a two day training class the users can combine their CAD skills to be very productive immediately.
		16. What is the estimated cost, effort, and length of time required to deploy the technology in another organization? The LD3 type of survey initial costs compare to traditional survey is about 50 percent higher. However, if we add the user's cost and safety factors into the calculation, plus that there is no need to revisit the project site for any "missiong points", LD3 is much cheaper to use. In our experience, it takes six to twelve months to allow engineers to get use to the new technology.
		17. What resources—such as technical specifications, training materials, and user guides—are already available to assist deployment? All specifications and training are readily available. After the agency understanded the function, and reached the comfort level of using LD3. The next step is to purchase the equipment and operate it by in-house people. It will take some time to deploy in-house skill operators. The training is available.

		18. What organizations currently supply and provide technical support for the technology? URS Corp, Anderson Engineering, HDR, H.W. Lochner, Carter Burgess, Federal Highways, PB Americas	
		19. Please describe any legal, environmental, social, intellectual property, or other barriers that might affect ease of implementation. Intelisum Inc. owns the patent of the LD3 technology. That could be the challenge. In UDOT, we negotiated the price and signed a state contract with them. UDOT users do not need to re-negotiate the price each time when we use it. There is no need to go low bid when using existing state contract.	
Submit to AASHTO Contact		***Keith Platte*** ***Phone: 202.624.7830*** ***Fax: 202.624.5469*** ***kplatte@aashto.org***	***American Association of State Highway & Transportation Officials*** ***444 North Capitol Street N.W., Suite 249*** ***Washington, DC 20001***

AASHTO Technology Implementation Group

Nomination of Technology Ready for Implementation

2007 NOMINATIONS DUE BY FRIDAY, SEPTEMBER 7, 2007

<table>
<tr><td rowspan="8">Sponsor</td><td rowspan="8">Nominations <u>must</u> be submitted by an AASHTO member DOT willing to help promote the technology.</td><td colspan="3">1. Sponsoring State DOT: Alaska Department of Transportation & Public Facilities</td></tr>
<tr><td colspan="3">2. Name: Frank T. Richards</td></tr>
<tr><td colspan="3">Title: Statewide Maintenance & Operations Engineer</td></tr>
<tr><td colspan="3">Mailing Address: P.O. Box 112500</td></tr>
<tr><td>City: Juneau</td><td>State: AK</td><td>Zip Code: 99811-2500</td></tr>
<tr><td>E-mail:
frank.richards@alaska.gov</td><td>Phone: 907.465.3906</td><td>Fax: 907.586.8365</td></tr>
<tr><td colspan="3">3. Date Submitted:</td></tr>
<tr><td colspan="3">4. Is the Sponsoring State DOT willing to promote this technology to other states by participating on a Lead States Team supported by the AASHTO Technology Implementation Group?
Please check one: ☒ Yes ☐ No</td></tr>
<tr><td rowspan="3">Technology Description (10 points)</td><td rowspan="3">The term “technology” may include processes, products, techniques, procedures, and practices.</td><td colspan="3">5. Name the technology: Intelligent Specialty Vehicle System</td></tr>
<tr><td colspan="3">6. Please describe the technology: The ISVS is an integrated driver assistance package which allows the operator of a specialty vehicle to operate in zero visibility conditions. The technology consists of four subsystems:
• a positioning subsystem consisting of a dual frequency, carrier phase differential GPS (DGSP) providing position accuracies to better than 5 cm,
• an on-board digital map (a digital geospatial database) which provides roadway information (i.e., lane boundary locations, guard rail positions, etc.) to an accuracy of 10 cm or better,
• a collision avoidance subsystem consisting of a forward looking radar capable of providing range, range rate, and azimuth angle to up to eight targets,
• and a driver interface consisting of a Head-up Display and a tactile seat which indicates lane departure warnings by vibrating the seat on the side to which the lane departure is occurring.

The system provides a virtual, synthetic image of the highway in front of the vehicle; the image is accurately aligned with the physical world by calibration with what is seen through the windshield when visibility is good. Once the calibration is stored the vehicle is ready to operate for the next weather event.

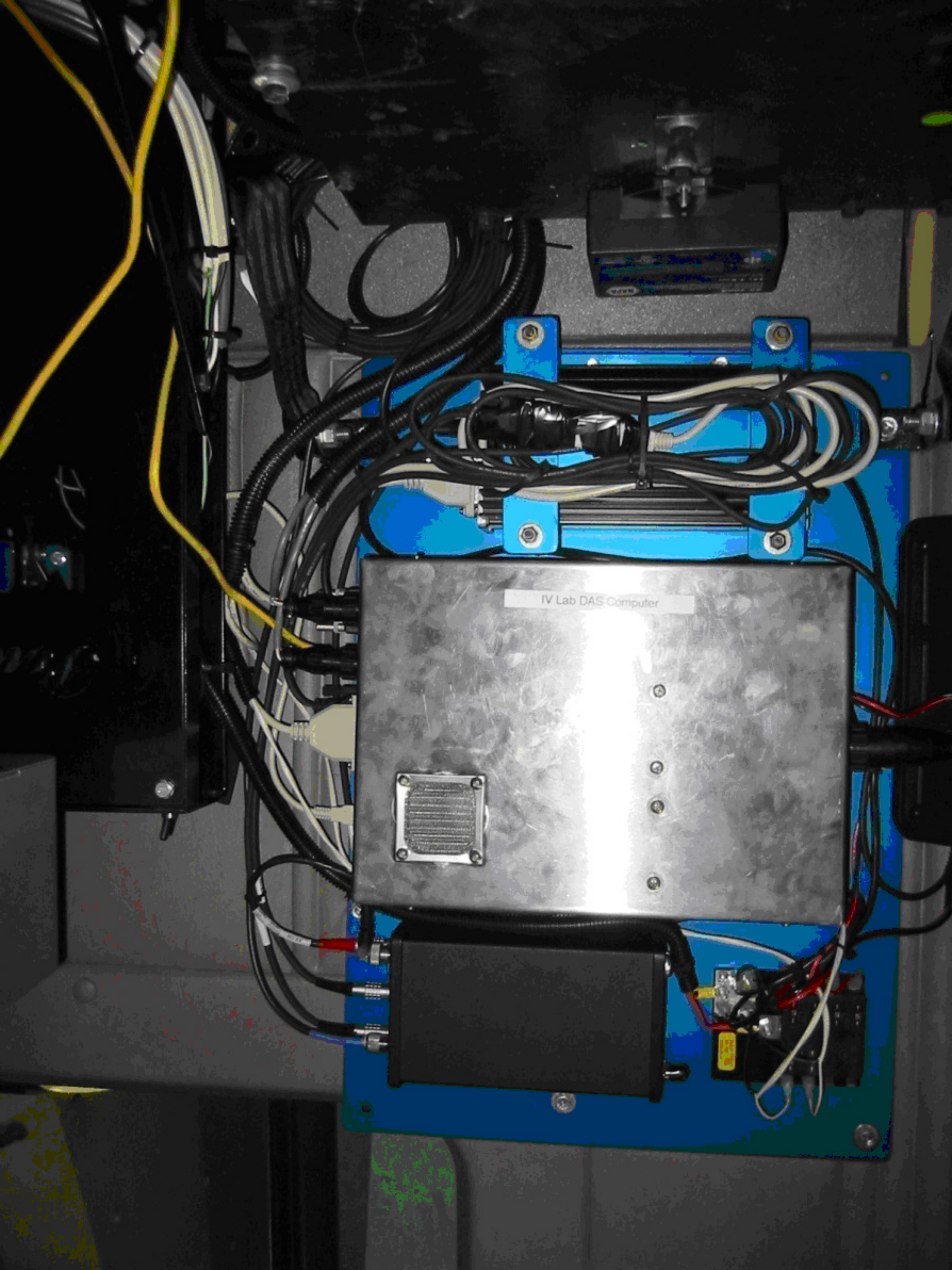
Warnings supplement the virtual image shown in the Head-up Display. Lane departure warnings are indicated by both visual indicators (the lane boundary which is likely to be crossed is rendered in red) and tactile indicators (the side of the seat vibrates on the side of the imminent lane departure). Collision avoidance functionality is also manifest in the Head-up Display; radar information is presented as a white rectangle (an advisory state) at its proper range and azimuth angle if its range is greater than 50 feet or the time to collision is greater than three seconds. If the range is less than 50 feet or if the time to collision is less than 3 seconds, the rectangle is drawn in the color red, indicating a warning. See attached images.</td></tr>
<tr><td colspan="3">7. If appropriate, please attach photographs, diagrams, or other images illustrating the appearance or functionality of the technology. (If electronic, please provide a separate file.)
Please check one: ☒ Yes, images are attached. ☐ No images are attached.</td></tr>
<tr><td rowspan="2">State of Development (30 points)</td><td rowspan="2">Technologies must be successfully deployed in at least one State DOT. The TIG selection process will favor technologies that have advanced beyond the research stage, at least to the pilot</td><td colspan="3">8. Please describe the history of the technology’s development. The ISVS was designed in Minnesota to address snowplow operations in heavy, blowing, and drifting snow. Its first operational test was undertaken under the FHWA’s Intelligent Vehicle Initiative Generation Zero Field Operational test. After initial testing and favorable results in Minnesota during the 2001-2002 winter, Alaska DOT procured two units for testing and operational deployment at Thompson Pass on the Richardson Highway, approximately 25 miles northeast of Valdez.</td></tr>
<tr><td colspan="3">9. For how long and in approximately how many applications has your State DOT used this technology? Alaska DOT now has three vehicles equipped with the ISVS: a snowplow and a snowblower at the Thompson Pass camp east of Valdez, and one snowplow at the Deadhorse (Prudhoe Bay) airport. The department takes delivery of an Aircraft Rescue and Firefighting (ARFF) vehicle the fall of 2007; ISVS will be installed on that vehicle as well. In addition, Minnesota has the ISVS deployed in three plows and a state patrol car which are in continuous service during the winter months where visibility is low due to heavy snowfalls and drifting/blowing snow.</td></tr>
</table>

		10. What additional development is necessary to enable routine deployment of the technology? The existing system has been in service in Mennesota and Alaska for a number of years. In Alaska, the system in Deadhorse is one generation newer than those at the Thompson Pass; the new system uses improved software, and is realized in a much smaller, integrated package. The new generation has proven to be easier to install inside a small cab. Provision of GPS corrections remains as the greatest impediment to routine deployment. Alaska has devoted the VHF frequency of 158.775 MHz for DGPS corrections state-wide. This addresses radio frequencies, but for a wide-scale deployment, a network of GPS base stations is needed. Minnesota, Ohio, and Texas have put into service GPS base station networks with great success, so it is feasible.
		11. Have other organizations used this technology? Please check one: ☒ Yes ☐ No If so, please list organizations and contacts.

Organization	*Name*	*Phone*	*E-mail*
Polk County, MN	Richard Sanders	218.281.3952	sanders.rich@co.polk.mn.us
Minnesota DOT	John Scharffbillig	651.366.5757	john.scharffbillig@dot.state.mn.us

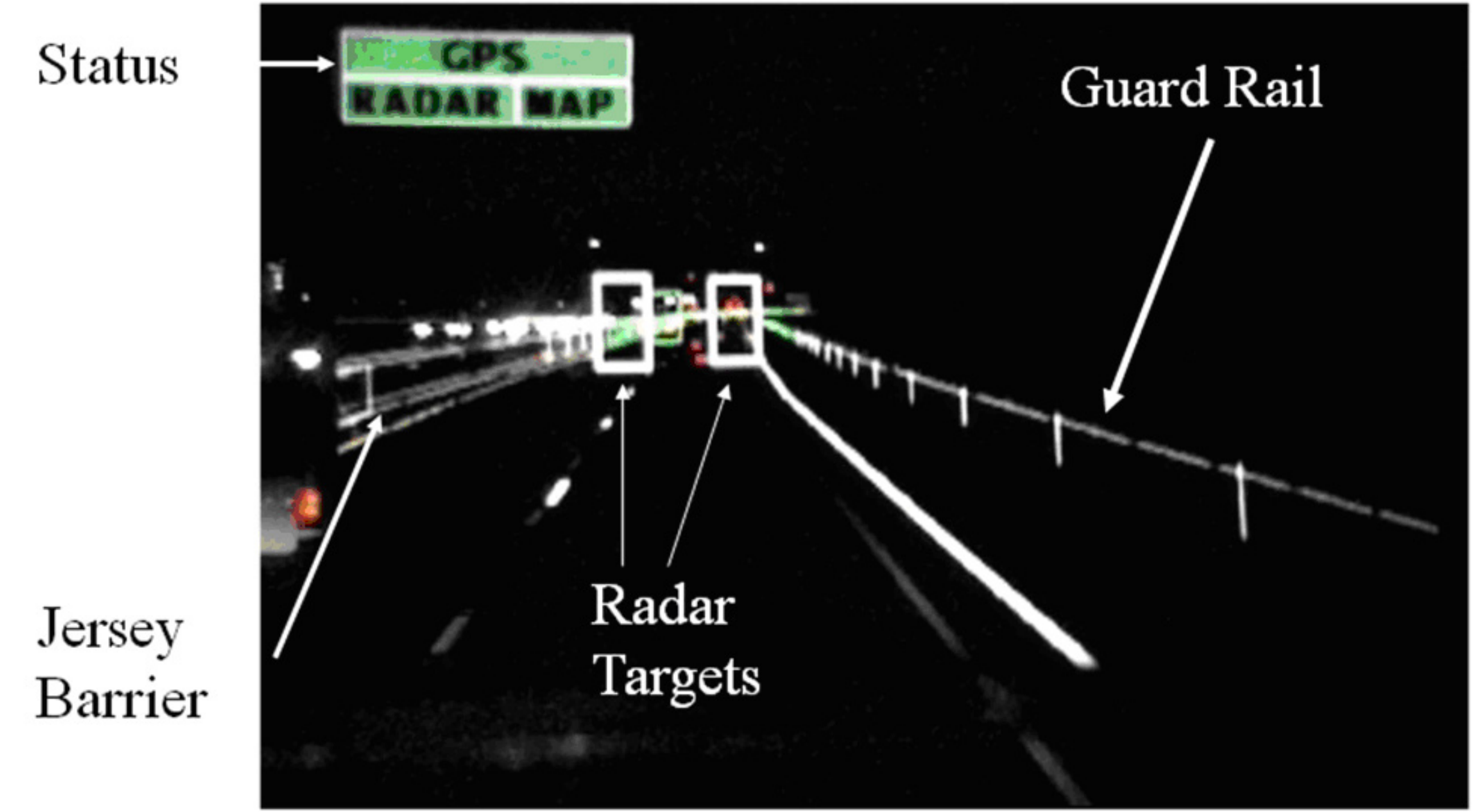
Payoff Potential (30 points)	*Payoff is defined as the combination of broad applicability and significant benefit or advantage over other currently available technologies.*	12. How does the technology meet customer or stakeholder needs in your State DOT or other organizations that have used it? At the very least, ISVS allows an operator to safely return to the shop and/or station should weather or visibility conditions quickly deteriorate. In general, however, ISVS allows a road maintenance organization to clear highways even under conditions where roads would be closed due to difficult road and/or visibility conditions. This capability is extremely important to Alaska, especially on highways adjacent to the Alaska pipeline, where those roads are kept open 24/7 to the extent possible. During the winter of 2006-2007, the Thompson Pass experienced heavier than normal snowfalls, and crews were able to work 24/7 on the pass using the ISVS.
		13. What type and scale of benefits has your DOT realized from using this technology? Include cost savings, safety improvements, transportation efficiency or effectiveness, environmental benefits, or any other advantages over other existing technologies. The system provides the department two primary advantages. First is the ability of the system to allow roads to be cleared in zero or near zero visibility conditions. This has greatly helped us meet the goal of keeping the Thompson Pass section of the Richardson Highway usable to the public, visibility permitting, 24/7. Second, as drivers continue to use the system and gain confidence in it, driver stress, even under these extreme conditions, has decreased. Drivers experience significantly less fatigue when using the ISVS than a previously tested 3M magnet system which only provided an audible lane departure warning and indication of which side of the lane. The accident rates, damage to guardrails and signs appear to be significantly lower. In the past the operator rubbed the snowblower against the guardrail to insure the vehicle was on the highway. The estimated savings to the Valdez District for guardrail replacement for the pass over life cycle is $2M. The guardrail end replacement alone averaged $8K a year. With only two years of data collected the numbers look good. Not a single sign, guardrail or end has been replaced due to snow removal when the ISVS used. The savings to commercial trucking because the pass is open sooner after a weather event is hard to calculate. What if a life is saved because emergency services are able to get to the person sooner or there is no accident because the highway is clear? With only two years of automobile accident data available to compare the accident rate appeared to be down by 50%. About six years of data is necessary to determine the actual change.

		14. Please describe the potential extent of implementation in terms of geography, organization type (including other branches of government and private industry) and size, or other relevant factors. How broadly might the technology be deployed? Ultimately, the ISVS could be deployed on any vehicle which operates under difficult conditions: fog, snow, rain, etc., where visibility is a problem. ISVS is being deployed in Minneapolis on transit buses which operate on narrow shoulders. Two factors are inhibiting a more rapid deployment of the system: (1) cost of components and (2) available networks on which DGPS corrections can be broadcast. Should demand increase, cost will drop, as has been demonstrated on nearly every electronic system ever produced. As mentioned previously, some states in the US have implemented DGPS correction broadcast networks. The technical capability is there; all that is needed is sufficient demand and adequate production volumes to reduce the price for widespread deployment. However, in reality the cost to deploy even a small system is still cost efficent if the highway serviced is essential for private owned and commercial vehicle safety.
Market Readiness (30 points)	*The TIG selection process will favor technologies that can be adopted with a reasonable amount of effort and cost, commensurate with the payoff potential.*	15. What actions would another organization need to take to adopt this technology? Provision of a means to broadcast GPS corrections to roving vehicles. For small deployments, a discrete local GPS base station work adequately; this is the deployment model used in Alaska, where one GPS base station is located in Deadhorse, and the other is in Valdez. Widespread deployment will require a networked approach as used by Minnesota, Ohio, and Texas. Once GPS corrections are needed, the next step is to create the accurate digital maps needed to provide the virtual images and warnings to the driver. These maps can be generated for less than $100 per mile in most cases, which is a very reasonable cost when compared to the cost of a single accident where the State is liable.
		16. What is the estimated cost, effort, and length of time required to deploy the technology in another organization? At small volumes (one or two vehicles at a time), equipment costs are approximately $40K per vehicle. Labor to install equipment adds approximately $5k to the cost (including custom bracketing needed for a new design; fleets of the same vehicle can be done at a considerably lower cost). DGPS base station equipment costs approximately $20K; installation costs can be low (~$1k) with an existing tower and FCC frequency coordination done in house. If a custom tower is need to support the GPS broadcast antenna, costs can exceed $100K.
		17. What resources—such as technical specifications, training materials, and user guides—are already available to assist deployment? Presentations, operational manuals, and an installation guide are presently available. After installation of the equipment and testing the Intelligent Vehicle Lab Staff provided instruction to our equipment operators.
		18. What organizations currently supply and provide technical support for the technology? The Intelligent Vehicles Lab at the University of Minnesota is currently the sole provider of technical support to the in-vehicle system. Most equipment (i.e., DGPS, Radar, displays) are off-the-shelf hardware, and are supported by their respective manufacturers. The Trimble Reference Station was purchased from, installed and commissioned by: Accupoint, Anchorage, 7125 Old Seward Highway, Suite 100, Anchorage, AK 99518-2282. Most Trimble dealers provide these services.
		19. Please describe any legal, environmental, social, intellectual property, or other barriers that might affect ease of implementation. The University of Minnesota Intelligent Vehicles Lab holds a number of patents on this system. Patents include the in-vehicle system, the geospatial database (i.e., digital map), and in-vehicle displays. However, the mission of the Intelligent Vehicles Lab is deployment; licensing this technology should not prove problematic. The selection of the frequency for the reference station broadcase of the correction to the vehicles and its licensing may be an issue depending on the deployment location.
Submit to AASHTO Contact		***Keith Platte*** ***Phone: 202.624.7830*** ***Fax: 202.624.5469*** ***kplatte@aashto.org***
		American Association of State Highway & Transportation Officials ***444 North Capitol Street N.W., Suite 249*** ***Washington, DC 20001***


IV Lab DAS Computer


SAFETY BELT USE
REQUIRED
IN THIS VEHICLE


CAUTION
CAUTION
ON
OFF


Status
GPS
RADAR MAP
Guard Rail
Jersey Barrier
Radar Targets

AASHTO Technology Implementation Group

Nomination of Technology Ready for Implementation

2007 NOMINATIONS DUE BY FRIDAY, SEPTEMBER 7, 2007

<table>
<tr><td rowspan="9">Sponsor</td><td rowspan="9">Nominations <u>must</u> be submitted by an AASHTO member DOT willing to help promote the technology.</td><td colspan="3">1. Sponsoring State DOT: California Department of Transportation</td></tr>
<tr><td colspan="3">2. Name: Mandy Chu</td></tr>
<tr><td colspan="3">Title: Senior Transportation Engineer</td></tr>
<tr><td colspan="3">Mailing Address: 1227 "O" Street, MS-83</td></tr>
<tr><td>City: Sacramento</td><td>State: CA</td><td>Zip Code: 95814</td></tr>
<tr><td>E-mail: mandy_chu@dot.ca.gov</td><td>Phone: 916-654-7656</td><td>Fax: 916-654-9977</td></tr>
<tr><td colspan="3">3. Date Submitted: 09/07/2007</td></tr>
<tr><td colspan="3">4. Is the Sponsoring State DOT willing to promote this technology to other states by participating on a Lead States Team supported by the AASHTO Technology Implementation Group?
Please check one: ☒ Yes ☐ No</td></tr>
<tr><td rowspan="3">Technology Description (10 points)</td><td rowspan="3">The term “technology” may include processes, products, techniques, procedures, and practices.</td><td colspan="3">5. Name the technology: The Responder System</td></tr>
<tr><td colspan="3">6. Please describe the technology:
The Responder System is a communication tool that can improve emergency response times by allowing first responders to expeditiously collect, transmit and share specific, at-scene incident information with Traffic Management Center (TMC) and secondary incident responders.
The system can be characterized as a mobile data terminal; the system includes a rugged Tablet PC, GPS, cellular/satellite modem and a digital camera (See Figure 1 and 2). The Responder System integrates hardware, software and communications to provide incident responders, particularly those in rural areas with sparse communication coverage, with a structured and easy to use means to accurately collect and communicate at-scene information with their managers and TMC. Unique features of the system include the ability for users to capture, annotate and transmit images (See Figure 3 and 4). Using GPS readings, the system automatically downloads local weather data (See Figure 5), retrieves maps and aerial photo, and pinpoints the responder’s location on the maps. By simply clicking on the “Send Email” button, an email message is automatically composed and sent to the TMC operator or other parties (See Figure 6). The system connects to the most efficient and available service (cellular or satellite) on its own; photos and sketches are compressed to minimize transmission time. With an emphasis on ease of use, the system allows responders to concentrate on work at the scene as opposed to burdens them with data input and reporting.
The Responder System has been named a finalist in the 2007 "Best New Service, Product or Application" Category of ITS America's Best of ITS Awards.</td></tr>
<tr><td colspan="3">7. If appropriate, please attach photographs, diagrams, or other images illustrating the appearance or functionality of the technology. (If electronic, please provide a separate file.)
Please check one: ☒ Yes, images are attached. ☐ No images are attached.</td></tr>
<tr><td>State of Development (30 points)</td><td>Technologies must be successfully deployed in at least one State DOT. The TIG selection process will favor technologies that have advanced beyond the research stage, at least to the pilot deployment stage, and preferably into routine use.</td><td colspan="3">8. Please describe the history of the technology’s development.
The Redding Responder Study was initiated as a component of the Redding Incident Management Enhancement (RIME) Program. The goal of the RIME program is to leverage the institutional relationships and technology deployments among emergency service providers to improve public safety in the region. The RIME region, which consists of 19 counties in Northern California, is generally rural, with the exception of several cities such as Redding and Chico. RIME organizations include Caltrans District 2, based in Redding, Norcal Emergency Medical Services, California Department of Forestry and Fire Protection, and other local and state agencies.
The Responder System was funded by Caltrans Division of Research and Innovation (DRI) and contracted with the Western Transportation Institute (WTI) at Montana State University to conduct research and development comprising the study. WTI designed the integrated system, adhering to an “ease of use and usability” philosophy to assist incident responders in expediting incident response times. Caltrans and WTI have collaborated throughout the stages of development, field testing and piloting the device.While the development of system was conducted based on specific needs of Caltrans District 2, consideration was given to prospective needs of other RIME agencies and other Caltrans districts, including those in urban areas.
Research and development of the pilot system was conducted over a two-and-one-half year time period under Phase 1 of the project. The pilot system had shown promise to increase the efficiency of situation assessments and to improve the effectiveness of response activities. Therefore, the main objective of Phase 2, which started in June 2006, is to prepare the system for full corporate deployment.</td></tr>
</table>

		9. For how long and in approximately how many applications has your State DOT used this technology? One of the main tasks in Phase 2 of the project is to test the system in multiple locations and crews in real use situations. Maintenance and TMC staff from D-2 Redding, D-3 Marysville, D-4 San Francisco-Bay Area, and D-10 Stockton have tested and evaluated the system since June 2006. Pilot users have all responded with very positive feedback about the system and have found relatively few flaws. Further testing by staff in D-1 Eureka, D-6 Fresno, D-7 Los Angeles and D-8 San Bernardino has been scheduled for the next 6 - 9 months.
		10. What additional development is necessary to enable routine deployment of the technology? The Responder System developed in Phase 1 had provided a demonstration of functionality and feasibility. Under the current Phase 2 of the project, further development, testing, evaluation and documentation are being done to prepare the system for full corporate deployment. The main objectives of Phase 2 are: 1. Develop business case to determine whether and how to proceed with full deployment 2. Conduct further system development to "harden" system, making it ready for field use 3. Test the system in multiple locations and crews in real use situations 4. Evaluate the system under real use situations Phase 2 will be completed by end of 2008.
		11. Have other organizations used this technology? Please check one: ☐ Yes ☒ No If so, please list organizations and contacts.

Organization	*Name*	*Phone*	*E-mail*

Payoff Potential (30 points)	*Payoff is defined as the combination of broad applicability and significant benefit or advantage over other currently available technologies.*	12. How does the technology meet customer or stakeholder needs in your State DOT or other organizations that have used it? As Caltrans' "first responders" to incidents on the state roadway, maintenance personnel must collect information, determine the appropriate response, and access and manage resources at-scene, all the while providing transportation management services to respond to and recover from the incident. The Responder System provides a excellent communication tool for responders to expeditiously collect and transmit at-scene information back to the TMC. This system is especially valuable in 1) major incidents such as landslides, floods and earthquakes where the damage could be extensive, 2) remote rural areas where communication is often limited to voice and coverage is sparse, and 3) if the first responder is new or inexperienced in responding to certain situations. Quoting from pilot users from the Bay Area: "A picture is worth a thousand words. This system comes in handy and provides good documentation, especially for hazmat." "The system can be used for everyday job such as job planning." Quoting one of the pilot users from Stockton, an urban region: "I used the Responder System to send photos and maps to our dispatch after hours and our dispatcher forwarded the information in an email, to the water district to give them an exact location to pinpoint the location. To try and explain the location over the phone or radio would have been difficult at best. The machine is a very useful tool. As a matter of fact, can I keep it?" (See Figure 7) Quoting from a supervisor from a rural district: "This is an excellent tool." The same supervisor indicated he believed he would use the system "all the time to document accidents" and for "non-Department of Transportation emergencies" (e.g., fires, non-roadway emergencies etc.). He also indicated he would provide one for each superintendent given the opportunity. Quoting from another user in the same district: "I did find the unit has great potential for incident command/notification and public information updating. The local CHP Commander was also very interested in the unit and had asked if the capabilities were there to forward to his superiors during major incidents as well (especially when we are 'under the gun' as to delays in opening major arteries)."

		13. What type and scale of benefits has your DOT realized from using this technology? Include cost savings, safety improvements, transportation efficiency or effectiveness, environmental benefits, or any other advantages over other existing technologies. The Responder System benefits users in terms of situation awareness, and therefore enhances incident management. The system allows responders to expeditiously collect and communicate at-scene information with their TMC and secondary responders in order to help clear incidents more quickly and effectively. Secondary benefits include a systematic methodology for collecting and documenting incidents for future analysis and training. Drawing from a real-life example, a landslide occurred on California SR-70 at 7:40 p.m. on February 25, 2004. The road wasn't cleared until Saturday, February 28. In an apparently simple question and associated problem, the landslide and resulting time to remediate the incident exemplified the issue at the heart of this study: Question: "There's a rock in the road." Problem: How do you convey strategic incident information to someone who isn't at the scene, looking at the rocks beside you? Communication channels in this rural area were non-existent or unusable. The nearest place from which digital photographs could be transmitted was only 1.5 miles from the incident location but the phones lines were out due to bad weather. Photographs taken at the scene were not transmitted to his superintendent and dispatch until the maintenance supervisor returned to his office 55 mountainous miles east of the incident. Communication challenges also occurred while clearing the road. To make arrangements for equipment, the maintenance supervisor had to drive 6 miles southwest to establish a cellular connection every time he needed to make a call. The roadway was not cleared of debris until three days after the incident. This incident demonstrated the resulting delay in remediation, the additional cost in time and effort by maintenance personnel and supervisors as well as cost to taxpayers caused by lack of communication coverage. Maintenance and emergency responders face special challenges when responding to rural transportation incidents. Communication coverage is sparse, erratic and problematic making it difficult to accurately convey the extent of the situation to those involved in managing the incident. It was estimated that with the Responder System, the incident would have been cleared at least 12 hours sooner. Maintenance managers would have been able to focus their efforts more directly on incident clearance than on overcoming communication challenges. A clearer "picture" of the incident would have been sent to the Redding TMC and others within minutes.
		14. Please describe the potential extent of implementation in terms of geography, organization type (including other branches of government and private industry) and size, or other relevant factors. How broadly might the technology be deployed? First responders from other emergency response agencies such as Emergency Medical Services (EMS) and California Highway Patrol (CHP) share similar responsibilities. While their specific needs may differ, a system that allows responders to expeditiously collect and transmit at-scene information would be of great benefit to all. Quoting from a pilot user in the Bay Area, "If all (emergency response) agencies are using the same system, it would be beneficial. It can eliminate much duplications and confusions."
Market Readiness (30 points)	*The TIG selection process will favor technologies that can be adopted with a reasonable amount of effort and cost, commensurate with the payoff*	15. What actions would another organization need to take to adopt this technology? The Responder System has been developed for use in California and additional development would be necessary to meet the needs of another transportation agency. A User Guide and a technical System Management and Maintenance Guide will be produced as part of the deliverables in Phase 2 of the project. However, interested agencies may contact Douglas Galarus of the Western Transportation Institute at Montana State University (Tel: (406) 994-5268; Email: DGalarus@coe.montana.edu) about the Responder technology.

		16. What is the estimated cost, effort, and length of time required to deploy the technology in another organization? The system has been tailored for California use, additional development will be necessary for other areas. It is also assumed that time would be required for deployment, training, etc. Depending on the scale, $100K - $250K might be reasonable cost for bringing up the system in another state. The per-unit hardware cost is projected to be $6000 - $7500, and monthly communication service (cellular and satellite) will run approximately $150.	
		17. What resources—such as technical specifications, training materials, and user guides—are already available to assist deployment? Demonstration CDs are available to anyone who is interested. User Guide and a technical System Management and Maintenance Guide will be produced as part of the deliverables in Phase 2 of the project. However from the beginning of the project, ease of use was repeatedly emphasized by first responders. They made it clear that if the system was not easy to use, it would not be used. A simple and intuitive interface played a significant role in efforts to achieve this requirement and make this project a success. All of our pilot users had received less than 1 hour of training.	
		18. What organizations currently supply and provide technical support for the technology? The technical support for this technology is currently supported by the Western Transportation Institute at Montana State University (Tel: (406) 994-5268; Email: DGalarus@coe.montana.edu)	
		19. Please describe any legal, environmental, social, intellectual property, or other barriers that might affect ease of implementation. The source code for the Responder application has been copyrighted by Montana State University, at the request of the California Department of Transportation. The code is being developed for "shared source" use by Montana State University and the California Department of Transportation, with an eye toward potential "open source" distribution. The intent of both agencies is to facilitate widespread use of the tool by other states and agencies.	
Submit to AASHTO Contact		***Keith Platte*** ***Phone: 202.624.7830*** ***Fax: 202.624.5469*** ***kplatte@aashto.org***	***American Association of State Highway & Transportation Officials*** ***444 North Capitol Street N.W., Suite 249*** ***Washington, DC 20001***

AASHTO Technology Implementation Group
Nomination of Technology Ready for Implementation
2007 Nomination

The Responder System

Figure 1: The Responder System

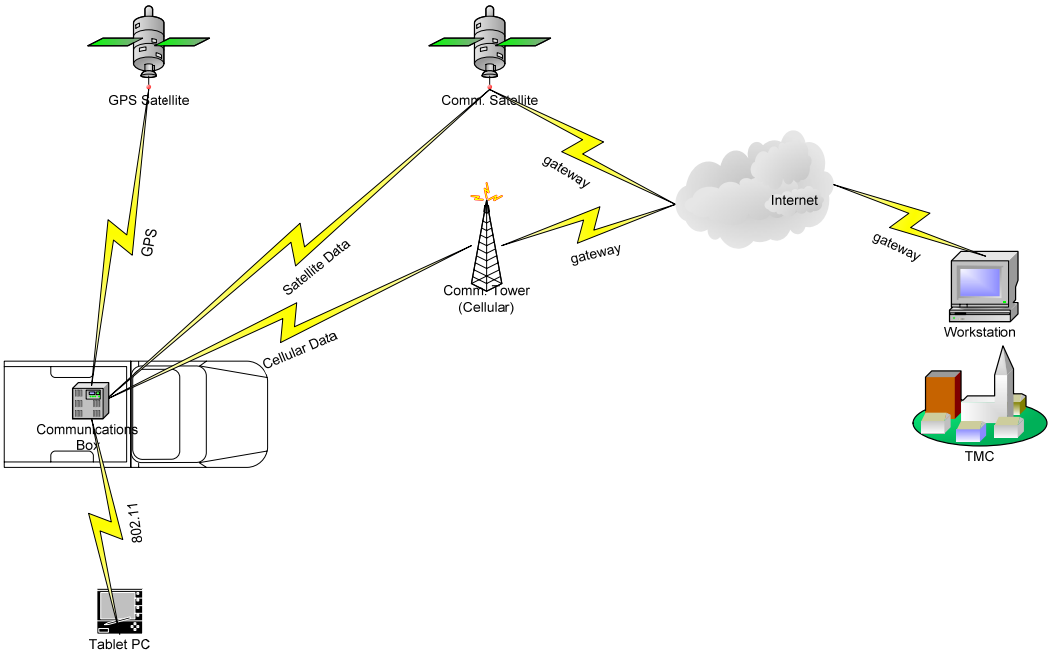


Figure 2: Responder Communication Framework

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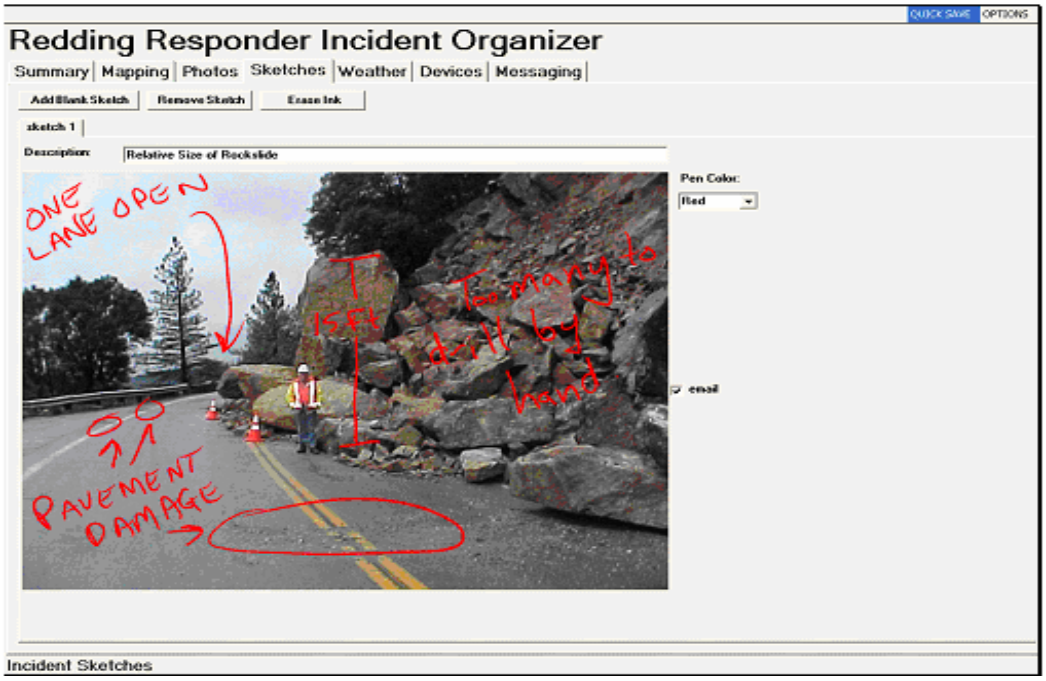

Figure 3: Annotated Photo

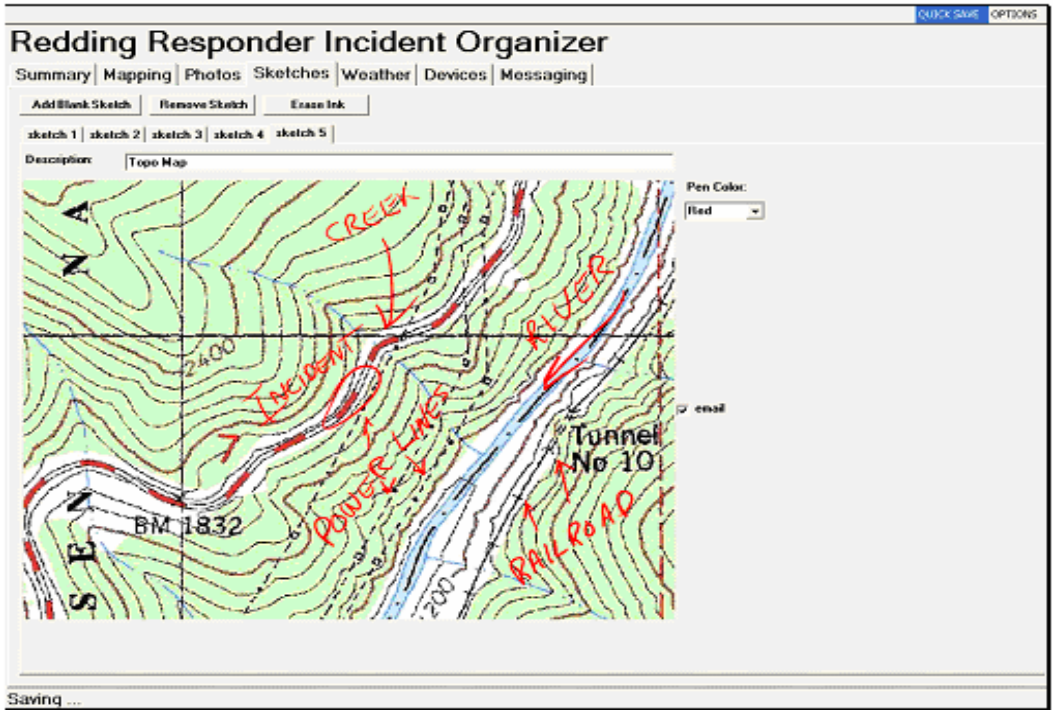

Figure 4: Annotated Map

The Responder System

Figure 5: Weather Information Shown in the Responder Incident Organizer

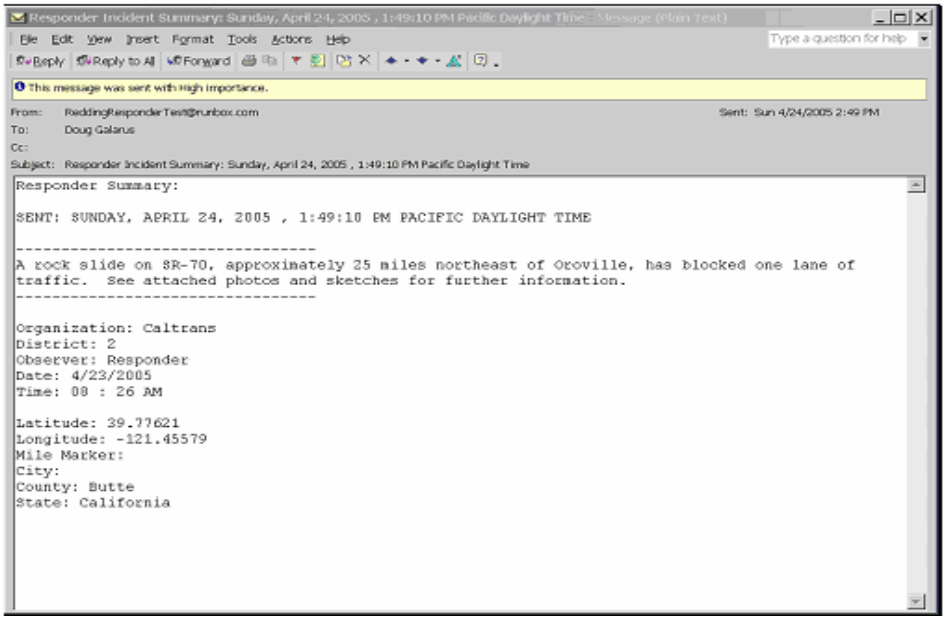

Figure 6: Responder Message Sent to TMC

The Responder System

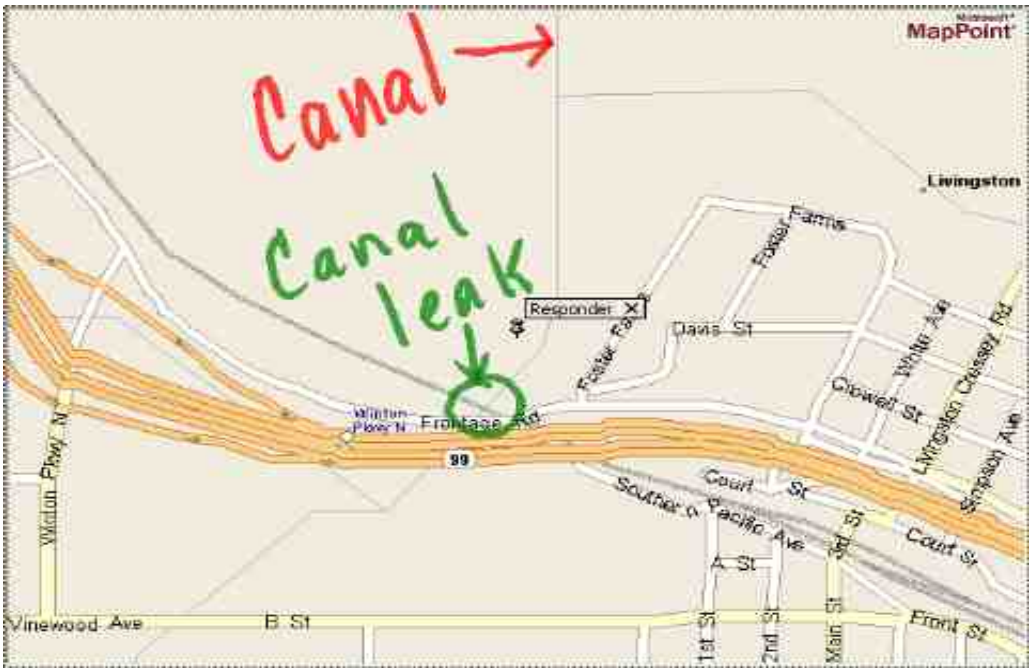

Figure 7: Canal leak example in District 10 – Stockton

Figure 8: Truck spill in Merced

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2007 Nomination

The Responder System

Figure 9: Truck Rollover Incident in District 3 – Sacramento

Figure 10: Truck Rollover Incident – Recovery

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The Responder System

Example of document sent to TMC:

Responder Summary:

Generated: 2/26/2007 , 4:28:38 PM Pacific Standard Time

Location:

Latitude: 37.24412
Longitude: -120.40284
Road / Address: Central Valley
Mile Marker: P.M.8.7, Lingard Rd.
City:
County: Merced
State: California

Description:

N/B Mer 99 Vehicle into sand barrels in median, minor injuries, all lanes were blocked temporarily by debris, we replaced 12 barrels and guardrail crew repaired damaged rails and posts.
Organization: Caltrans
Date: 9/23/2006
District: 10
Time: 07 : 44 AM
Observer: Responder

Photos:

Incident Image: photo 1

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Incident Image: photo 2

Incident Image: photo 3

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Incident Image: photo 4

Incident Image: photo 5

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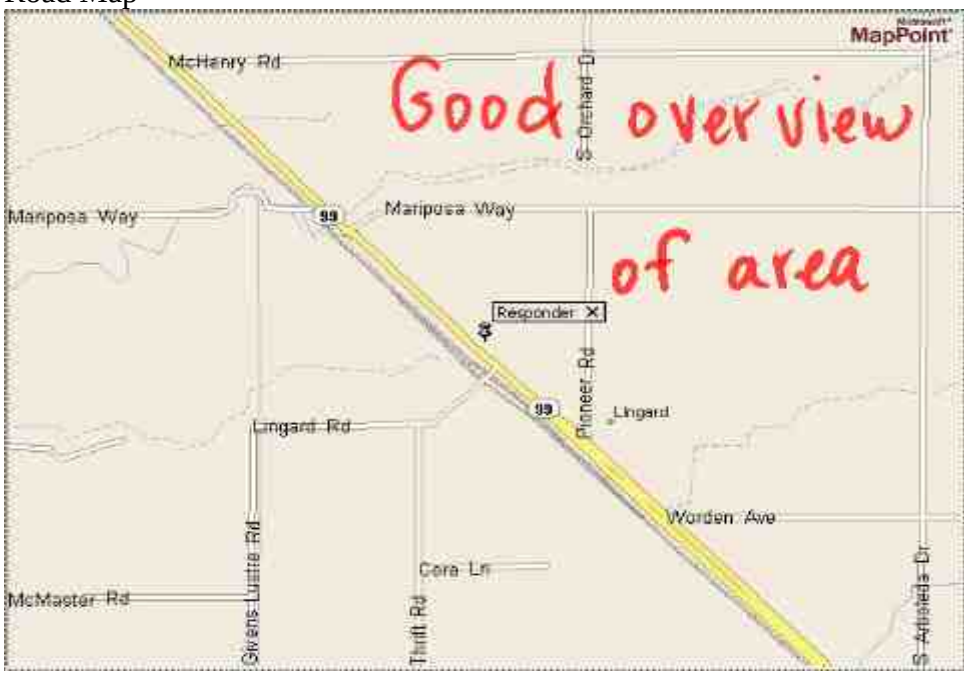
Sketches:

Incident Sketch: sketch 1
Road Map



Incident Sketch: sketch 2
Aerial Photo

AASHTO Technology Implementation Group

Nomination of Technology Ready for Implementation

2007 NOMINATIONS DUE BY FRIDAY, SEPTEMBER 7, 2007

Sponsor	*Nominations must be submitted by an AASHTO member DOT willing to help promote the technology.*	1. Sponsoring State DOT: Texas Department of Transportation
		2. Name: Thomas Bohuslav, P. E. Title: Construction Division Director Mailing Address: 200 East Riverside Drive City: Austin | State: Texas | Zip Code: 78704 E-mail: tbohusl@dot.state.tx.us | Phone: 512-416-2559 | Fax: 512-416-2539
		3. Date Submitted: 08/28/2007
		4. Is the Sponsoring State DOT willing to promote this technology to other states by participating on a Lead States Team supported by the AASHTO Technology Implementation Group? Please check one: ☒ Yes ☐ No
Technology Description (10 points)	*The term "technology" may include processes, products, techniques, procedures, and practices.*	5. Name the technology: Electronic Project Records System (EPRS) Phase I (Electronic Payroll Submission)
		6. Please describe the technology: The Electronic Project Records System (EPRS) is a web based application that was developed in order to improve TxDOT's communications with the contracting community and assist TxDOT staff in sending and receiving information to and from contractors with the development of a standard secure electronic data transmission method. Phase 1 of this project will enable outside contractors to electronically submit their payroll data as required by the Davis-Bacon and Related Acts (DBRA). This data will be digitally signed and securely transmitted to TxDOT where it is stored and reviewed. Digital certificates will be used to identify the transmitter of the data and prevent unauthorized access to the data.
		7. If appropriate, please attach photographs, diagrams, or other images illustrating the appearance or functionality of the technology. (If electronic, please provide a separate file.) Please check one: ☒ Yes, images are attached. ☐ No images are attached.
State of Development (30 points)	*Technologies must be successfully deployed in at least one State DOT. The TIG selection process will favor technologies that have advanced beyond the research stage, at least to the pilot deployment stage, and preferably into routine use.*	8. Please describe the history of the technology's development. This project was proposed and developed by internal TxDOT staff. EPRS Phase 1 was deployed in May 2007 with seminars conducted in six regions of the state in order to present the system to the contracting industry and encourage their participation in using the system. At present, EPRS is in an extended beta-test mode with both our contracting industry and TxDOT staff. The system is fully functional and available on the TxDOT website.
		9. For how long and in approximately how many applications has your State DOT used this technology? We are currently in the beta-test phase of the initial application of EPRS. During this phase, we are seeking comments from both industry and TxDOT staff to identify and initiate any modification necessary prior to closing out the beta-test period.
		10. What additional development is necessary to enable routine deployment of the technology? The system has been fully developed and has been deployed to all users during the extended beta-test period. Full implementation will commence once any system enhancements are identified and implementated. The length of the beta-test period is dependent on the programming time needed for any enhancements implemented.
		11. Have other organizations used this technology? Please check one: ☐ Yes ☒ No If so, please list organizations and contacts.

Organization	*Name*	*Phone*	*E-mail*

Payoff Potential (30 points)	*Payoff is defined as the combination of broad applicability and significant benefit or advantage over other currently available technologies.*	12. How does the technology meet customer or stakeholder needs in your State DOT or other organizations that have used it? The secure electronic transmission of payroll data will save TxDOT a substantial amount of time and money. There are approximately one hundred and twenty area offices in TxDOT all of whom are actively involved in gathering, processing and submitting hard copy payroll data. EPRS Phase 1 will significantly reduce the amount of time spent by TxDOT staff in collecting and reviewing hard copy data. EPRS will use data from payrolls submitted electronically by our contractors to generate various reports to be used by internal staff in monitoring payrolls for DBRA compliance as well as generating survey data for use in developing proposed prevailing wage rates for USDOL approval. Industry will also benefit in the use of EPRS as a result of fewer man-hours spent in the manual processing of payrolls. For those contractors using automated payroll software or systems, their payrolls may be imported directly into EPRS once exported into the specified file format.
		13. What type and scale of benefits has your DOT realized from using this technology? Include cost savings, safety improvements, transportation efficiency or effectiveness, environmental benefits, or any other advantages over other existing technologies. At present, EPRS is in the beta-test phase and has not yet been fully utilized to its capacity. Therefore, no statistics regarding benefits experienced are available.
		14. Please describe the potential extent of implementation in terms of geography, organization type (including other branches of government and private industry) and size, or other relevant factors. How broadly might the technology be deployed? EPRS Phase 1 could be implemented by any governmental entity to assist in ensuring compliance with DBRA compliance associated with the collection and monitoring of weekly contract payroll submissions.
Market Readiness (30 points)	*The TIG selection process will favor technologies that can be adopted with a reasonable amount of effort and cost, commensurate with the payoff potential.*	15. What actions would another organization need to take to adopt this technology? An organization would need a web server running IIS 5.0 or greater and an oracle database backend. Depending on the needs of the organization, code changes may need to be applied, and crystal reports modified. In addition, a method for authenticating and authorizing users for digital certificates would need to be developed, similar to our Central Authentication and Authorization System (CAAS). System requirements for users are comprised of Internet Explorer Version 5.0 or higher and, for users signing and submitting payrolls, Java 2 Runtime Environment.
		16. What is the estimated cost, effort, and length of time required to deploy the technology in another organization? Once the components identified in item 15. above are obtained and functional, the time needed to fully deploy would be comprised of sufficient time to train external customers and internal staff on the use of the system. Instruction to external customers would involve the processes in obtaining the necessary digital certficates and signing and submitting payrolls. TxDOT has chosen to fund the cost of issuing digital certificates to our contractors for use with EPRS. Other organizations may opt to pass this expense on to their users thus minimizing the cost needed to deploy the system.
		17. What resources—such as technical specifications, training materials, and user guides—are already available to assist deployment? The EPRS Phase 1 user guide, which includes information regarding technical specifications and served as the initial training material for deployment, is attached.
		18. What organizations currently supply and provide technical support for the technology? Since EPRS was developed internally, TxDOT staff provide support for the system.

		19. Please describe any legal, environmental, social, intellectual property, or other barriers that might affect ease of implementation. The only possible concern would consist with the use of the digital certificates used to sign and submit payrolls. Use of this type of technology constitutes a legal and binding signature in Texas and conforms to federal requirements (please refer to the attached letter from the USDOL regarding the use of digital signatures). However, while the legal requirements associated with digital signatures may vary according to various state laws, the barriers experienced should be few, if any. No environmental, social, or intellectual property risks have been identified in the development and initial implementation of this system.	
Submit to AASHTO Contact		***Keith Platte*** ***Phone: 202.624.7830*** ***Fax: 202.624.5469*** ***kplatte@aashto.org***	***American Association of State Highway & Transportation Officials*** ***444 North Capitol Street N.W., Suite 249*** ***Washington, DC 20001***

Attachments
(*Select "Tools" and "Unprotect Document" to access the PDF links*)

Included with this document is the "Electronic Project Records System (EPRS) User Guide for Electronic Payroll Submission." Simply double-click on the PDF icon below to access the document.


EPRS Phase 1 User Guide

USDOL approval of digital signatures; simply double-click on the PDF icon below to access the document.


USDOL approval of digital signatures

Electronic Project Records System (EPRS)

User Guide for Electronic Payroll Submission

Version: 1.1

April 19, 2007

Texas Department of Transportation
Information Services Division
Customer and Application Services Section
Application Integration Services Branch

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1. Introduction

1.1. Purpose of EPRS

The payroll portion of the Electronic Project Records System (EPRS) website affords contractors and subcontractors performing on Texas Department of Transportation (TxDOT) projects the ability to submit required weekly payrolls to TxDOT electronically via the Internet. EPRS may be used to:

- Create payroll files on the website.
- Upload and edit payroll files created on the EPRS website or other system.
- Sign then submit payrolls created on the website or other system

1.2. Who Can Use EPRS?

Contractors and subcontractors who are currently working on a TxDOT construction project may use EPRS. A TxDOT issued digital certificate will allow authorized personnel within each company the ability to submit weekly payrolls for any TxDOT projects on which the company is working.

1.3. General Help

The intent of this User's Guide is to provide assistance in processing payroll files. We have also provided a link to Frequently Asked Questions (FAQ) on the website. Many of the available processes are addressed in the FAQ.

The User's Guide is divided into the following groups:

- Preparation before submitting payrolls
- Functional explanation of the website.
- How to get further help.

1.4. Summary of revisions

This is an update to the v.1.0.3 User Guide. There are several changes to this document:

- Added section of preparation before using EPRS,
- Revised wording of several sections,
- Updated screen shots with new pictures, and
- Changed the order of sections so they more closely follow the flow of the website.

1.5. System Requirement

- Internet Explorer Version 5.0 or higher

2. Preparation Before Submitting Payrolls

2.1. TxDOT Digital Certificate

This section is intended as a guide for contractors and subcontractors in obtaining and using digital certificates to sign and submit electronic payroll files to TxDOT using EPRS. Skip to 3.2. Creating a New Payroll Data File if EPRS is used only as an edit tool to create an electronic payroll data file.

2.1.1. Obtaining a Digital Certificate from TxDOT

Digital certificates are issued to authorized individuals within organizations as a means to legally sign electronic documents. Electronic documents signed using the TxDOT issued digital certificates are legally binding. TxDOT takes the following precautionary steps to insure digital certificates are delivered only to their intended recipients:

- TxDOT must collect and validate specific information from the requestor to validate the individual is who they claim to be.
- TxDOT will supply two pieces of information to the requestor and both are required to complete the Digital Certificate Enrollment process
  - ✓TxDOT will provide an electronic email message to the requestor with a digital fingerprint.
  - ✓TxDOT will provide a PIN (Personal Identification Number) to the requestor via telephone or USPS mail.
- Using two different methods to provide the information to the requestor is an industry best practice to insure digital certificates are only issued to the proper individuals.

2.1.1.1. Requesting a Digital Certificate from TxDOT

Payrolls submitted to TxDOT using EPRS must be signed using a TxDOT issued digital certificate. In order to obtain the required digital certificate, complete the Digital Certificate Request (DCR) Form (form number 2196). The form must be signed by the individual requesting the digital certificate and an individual authorized to grant the requestor the authority to sign documents on behalf of the company.

Computer Systems and User Roles

In addition to requesting the digital certificate, the specific computer system and user "roles" must be selected. Roles provide the level of access that the requestor will be granted within the selected system. The DCR Form includes a list of the available computer systems and available user roles. Select the system to access and user role by checking the appropriate box on the form.

Changing Systems and User Roles

In order to change the roles and system access for individuals who have all ready been issued a digital certificate, simply complete the Digital Certificate Change (DCC) Form (form number 2197), making sure to check the appropriate boxes and submit as directed on the form. ***It is not necessary to request a digital certificate when requesting new computer system access or user role for a person that already holds a certificate.***

2.1.1.2. Retrieving Your Digital Certificate Password

Once TxDOT has received and processed your request for a Digital Certificate, you will receive an email containing a link to a TxDOT web site where you will obtain your Digital Certificate. This email will also contain a *digital fingerprint*, which is part of the information necessary to retrieve your Digital Certificate.

By selecting the URL in the email message, the *digital fingerprint* will automatically be sent to the TxDOT web site. Before selecting the link in the email message, please insure that you have received your 4 digit PIN from TxDOT. The email will look similar to Figure 1.

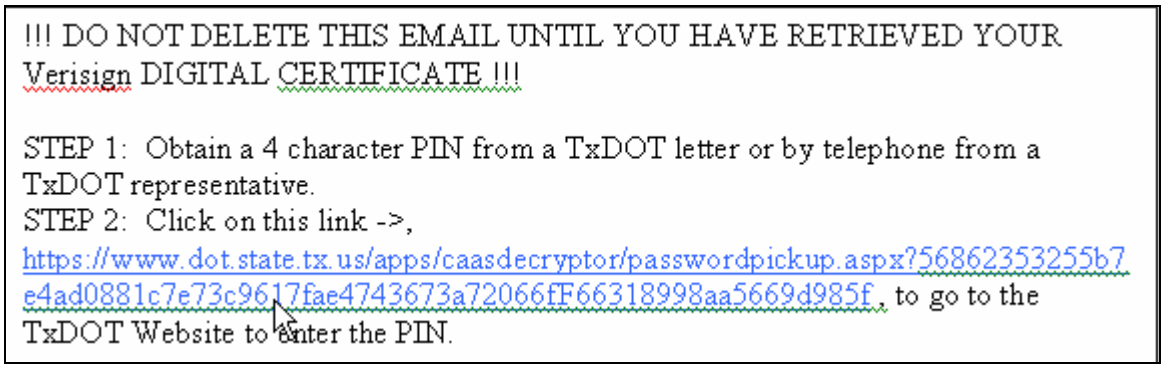


Figure 1 - Sample Email containing link to retrieve TxDOT Digital Certificate

Once you have received your 4 digit PIN from TxDOT, which will be provided either by phone or USPS mail once the DCR is initially processed, select the link in the email message, which will forward you to the VeriSign Password Retrieval Page (see Figure 2). Enter your 4 digit PIN where indicated on this webpage and receive the final password that is required to retrieve your Digital Certificate.

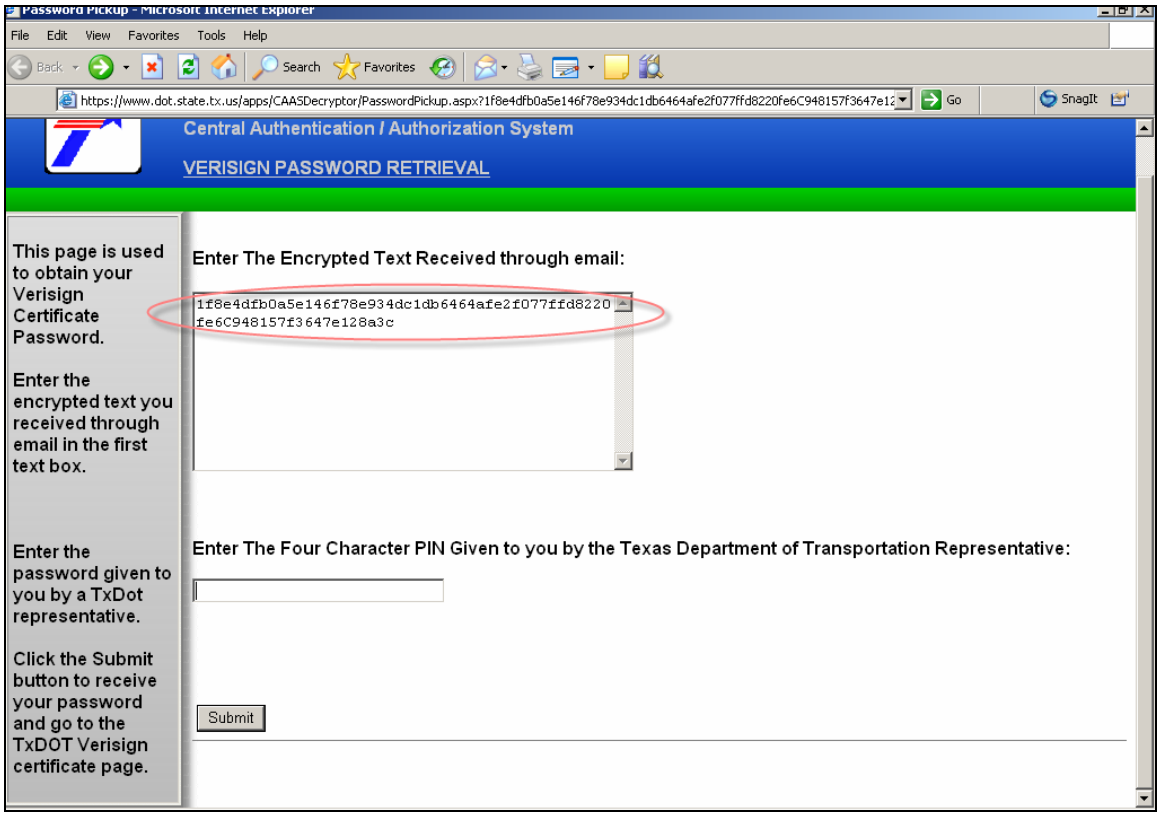


Figure 2 - Password Retrieval Screen

Enter the four-character PIN in the smaller text box and left click the “Submit” button. Remember, the four-character PIN was provided to you by TxDOT, either by phone or via USPS Mail.

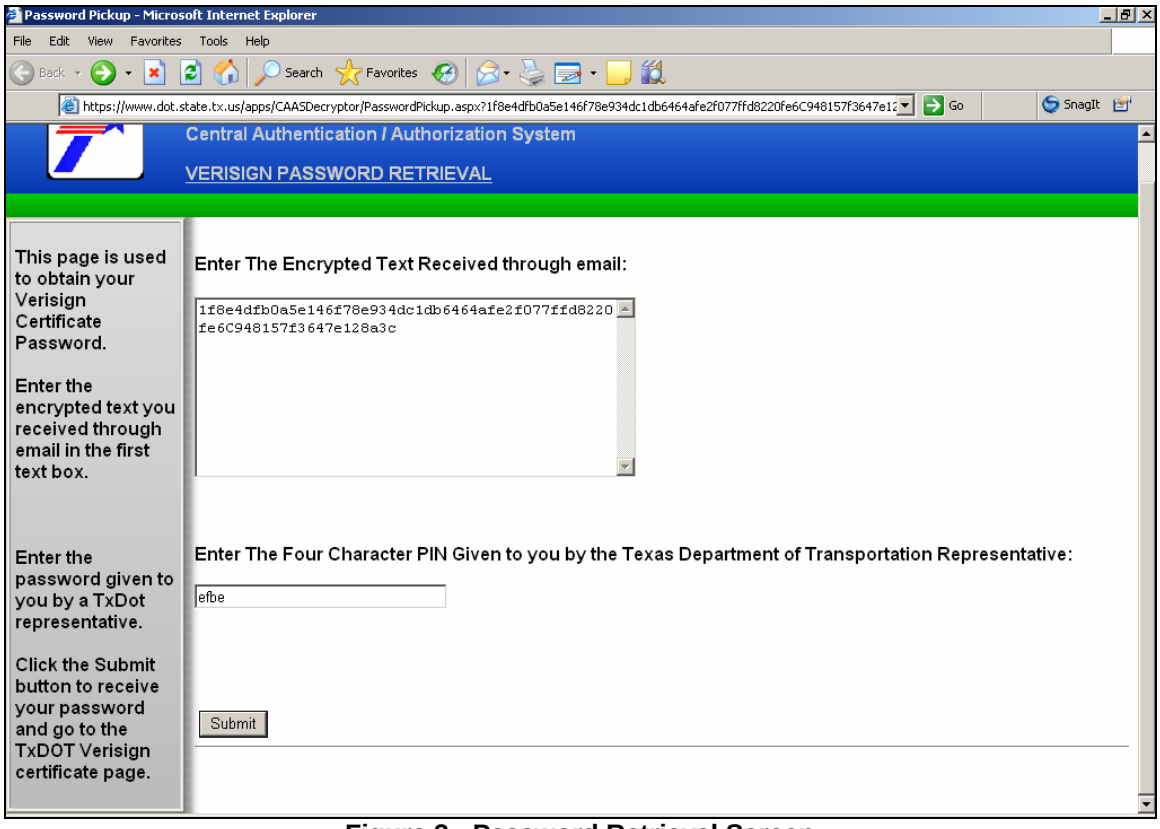


Figure 3 - Password Retrieval Screen

If all the information has been entered correctly, clicking “Submit” will direct you to the TxDOT certificate enrollment page.

2.1.1.3. Digital Certificate Enrollment

The TxDOT Enrollment Page requires three pieces of information to successfully process your enrollment: your password from the previous page, your e-mail address, and a challenge phrase (see Figure 4).

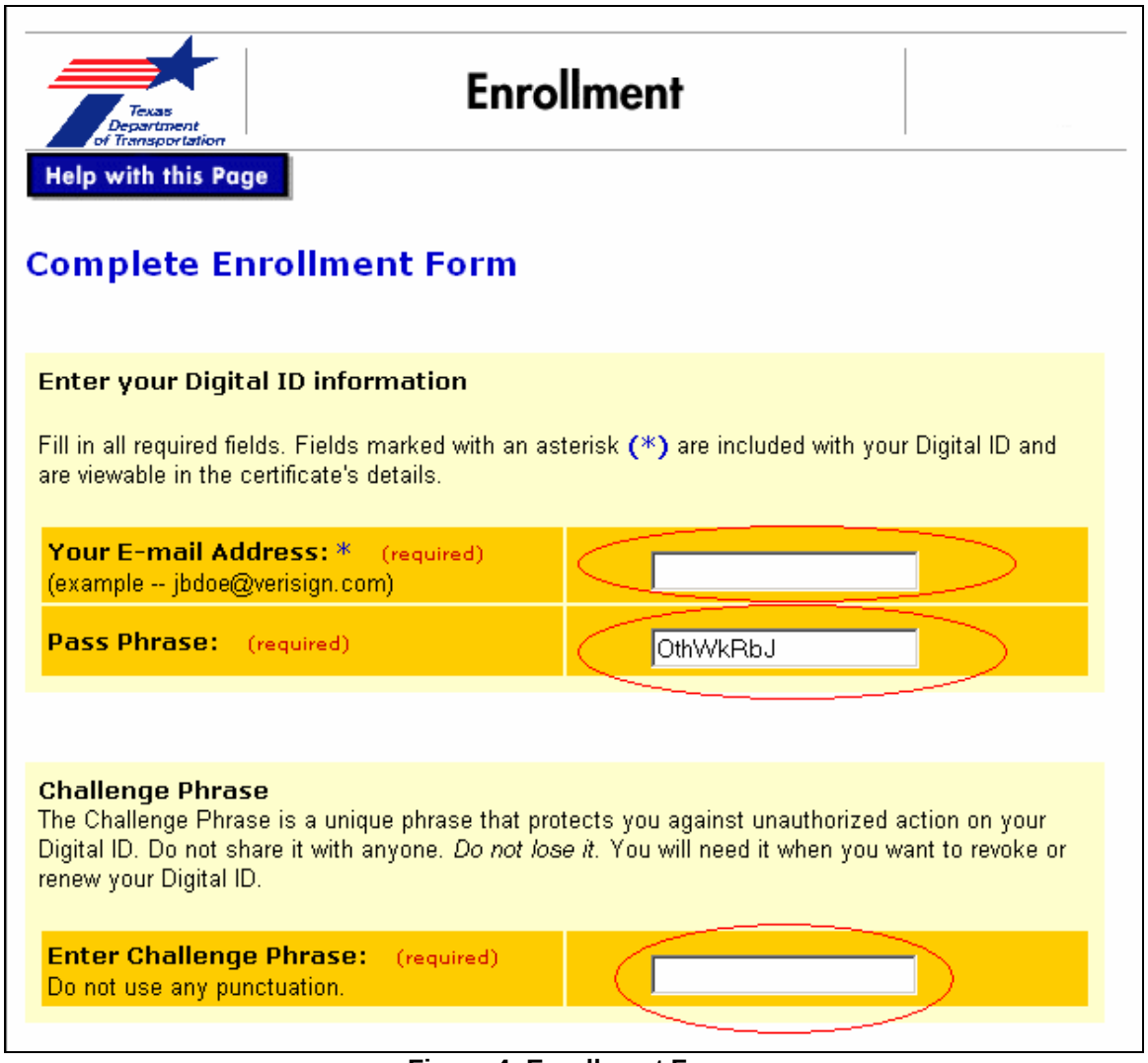


Figure 4: Enrollment Form

First, enter the e-mail address given to the TxDOT representative when requesting a certificate in the "Your E-mail Address:" text box. If the pass phrase is not already present in the pass phrase text box, please contact Gladys Harper (512) 465-7964 or Mark Evans (512) 465-7453 for assistance. Finally, you need to enter a challenge phrase in the "Enter Challenge Phrase" text box.

The challenge phrase is a personal password that you create (it is recommended that this personal password be kept in a safe and secure location). In the event that your certificate is compromised or lost, this challenge phrase will be needed to quickly revoke and prevent misuse of your certificate.

Scrolling down the page there is a section for optional comments and a digital subscriber ID agreement (see Figure 5).

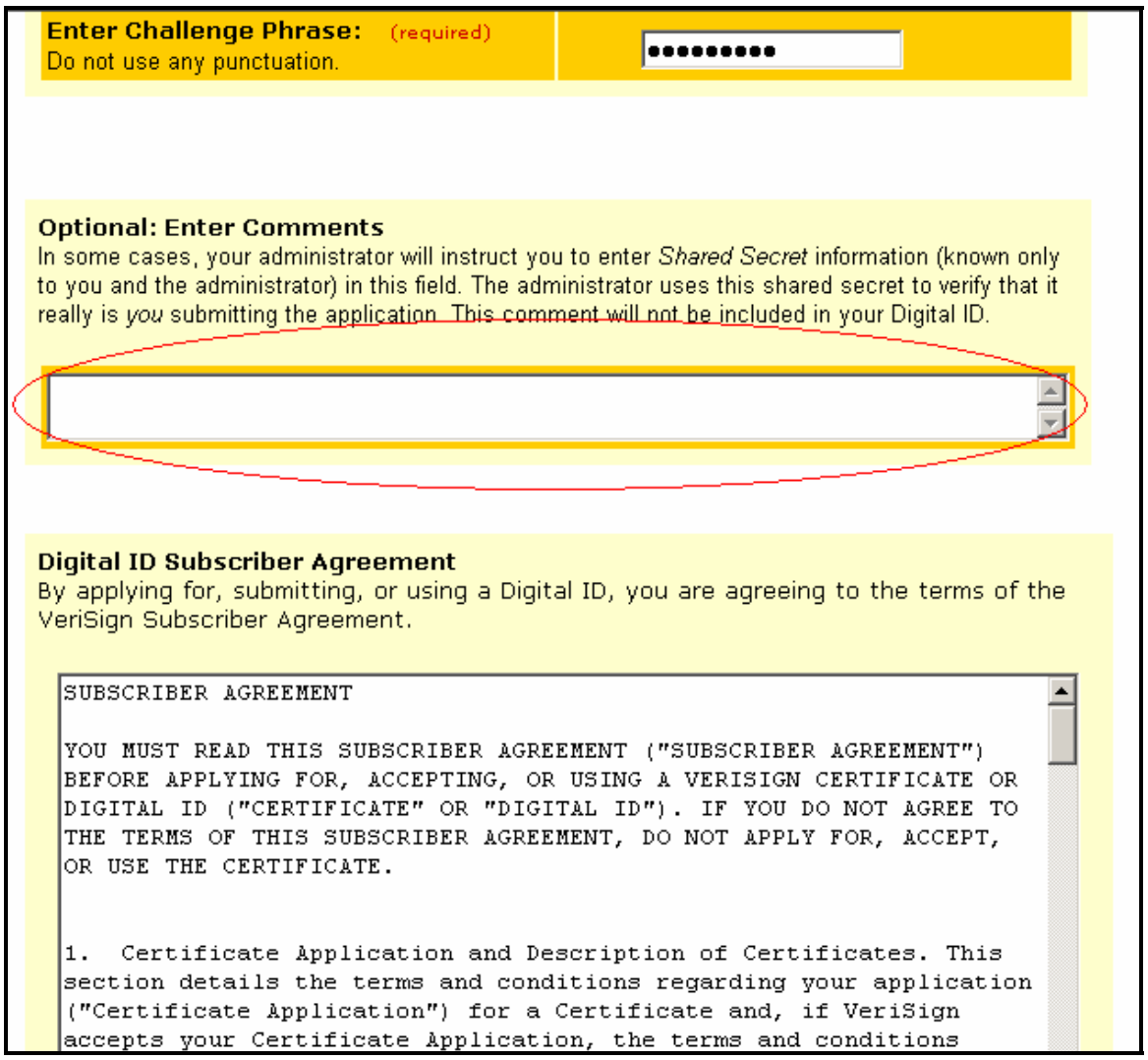


Figure 5: Enrollment Form

Any comments should be typed into the optional comments text box. The Digital ID Subscriber agreement specifies the terms and conditions that apply upon receiving this digital certificate.

Double check that all information you have entered on this page is accurate and then scroll to the bottom of the page and left click the “Submit” button (see Figure 6).

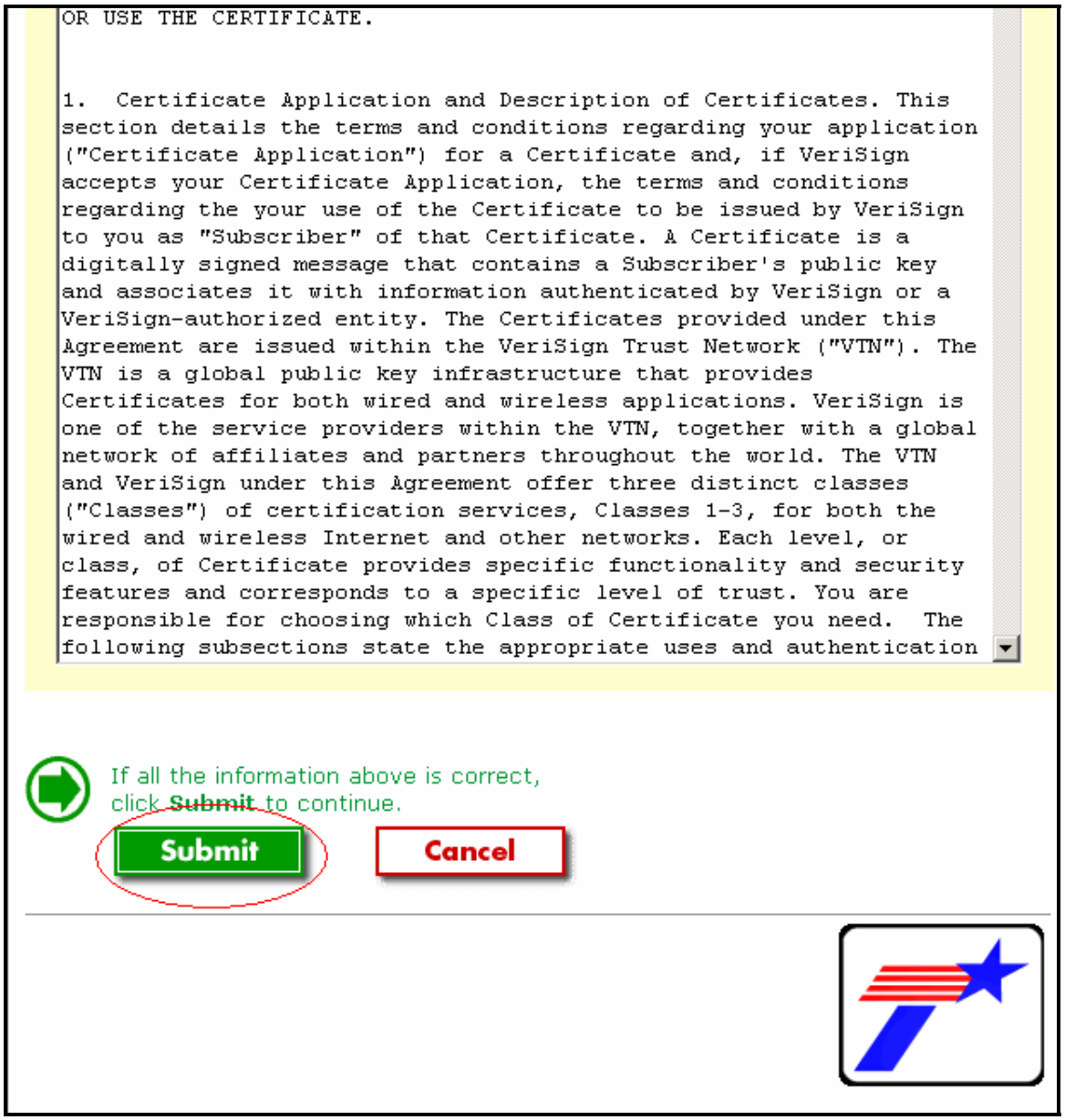


Figure 6: Submit Enrollment Form

After left clicking the “Submit” button a confirmation pop-up window will appear (see Figure 7).

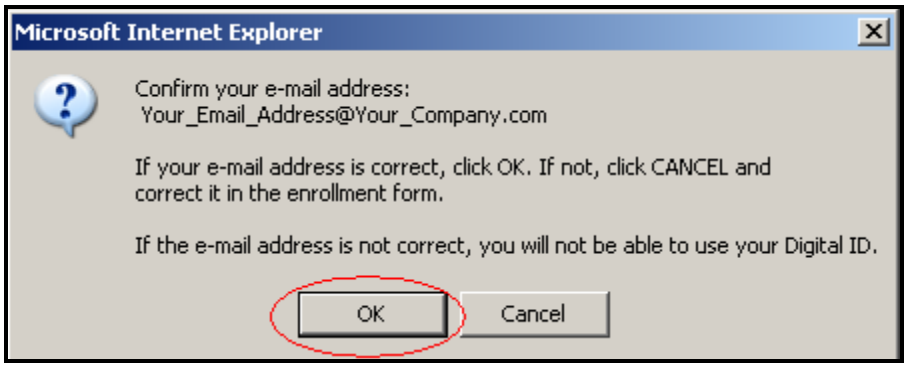


Figure 7: Confirmation Popup Window

Verify that the e-mail address listed in the window is correct. If it is not correct, left click the "Cancel" button and double-check the e-mail address entered on the form; otherwise left click the "OK" button to proceed.

A new window will appear warning you of a potential scripting violation. In this case there is no scripting violation; left click "Yes" to continue (see Figure 8).

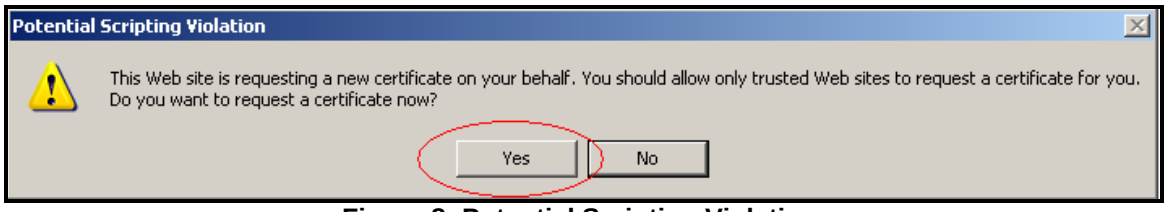


Figure 8: Potential Scripting Violation

The next window presented informs you that Internet Explorer is in the process of installing a certificate. **Do not click "OK" – change the security level of the certificate from medium to high**. To change the security level to high, left click the "Set Security Level" button (see Figure 9 and Figure 10).

Figure 9: Creating a new RSA exchange key

The following new window will then appear:

Figure 10: Creating a new RSA exchange key

Left click on the radio button next to the word “High” and then click the “Next >” button

The next window will prompt you to create a password

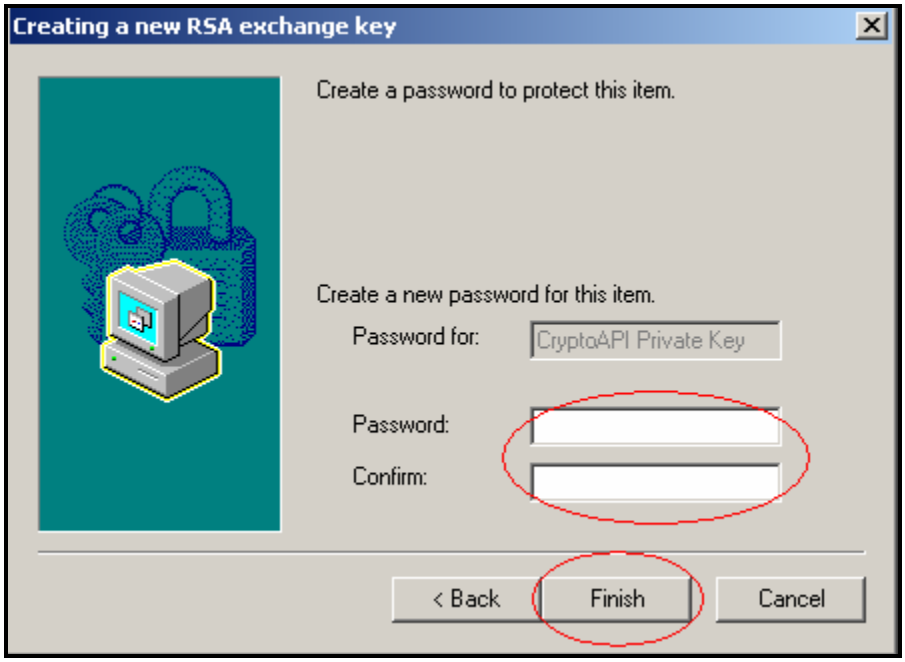


Figure 11: Entering a password to protect private key

Enter a password into the “Password:” and “Confirm:” textboxes. ***Do not lose this password or you will not be able to access EPRS using this digital certificate!*** This password is specific to Internet Explorer and is used to access the EPRS webpage (refer to Figure 57) and export a

digital certificate (refer to Figure 23). Next, left click the "Finish" button. This closes the current window and returns the user back to the original window (see Figure 12).

Figure 12: Finish creating RSA exchange key

Verify that the security level is now set to high. Then left click the "OK" button to continue. While the server is processing your request, the following status message will be displayed:

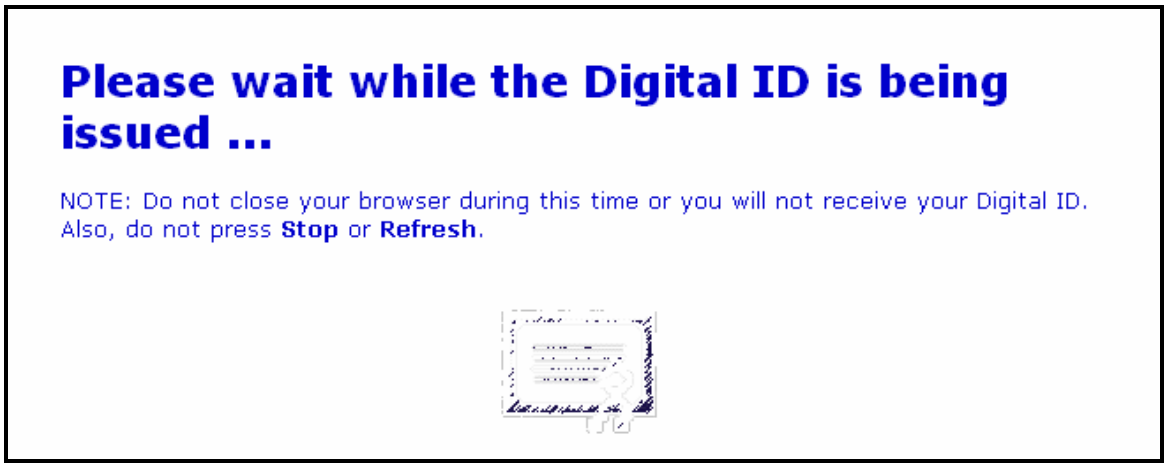


Figure 13: Status Message

If there were no problems, the following screen should be displayed:

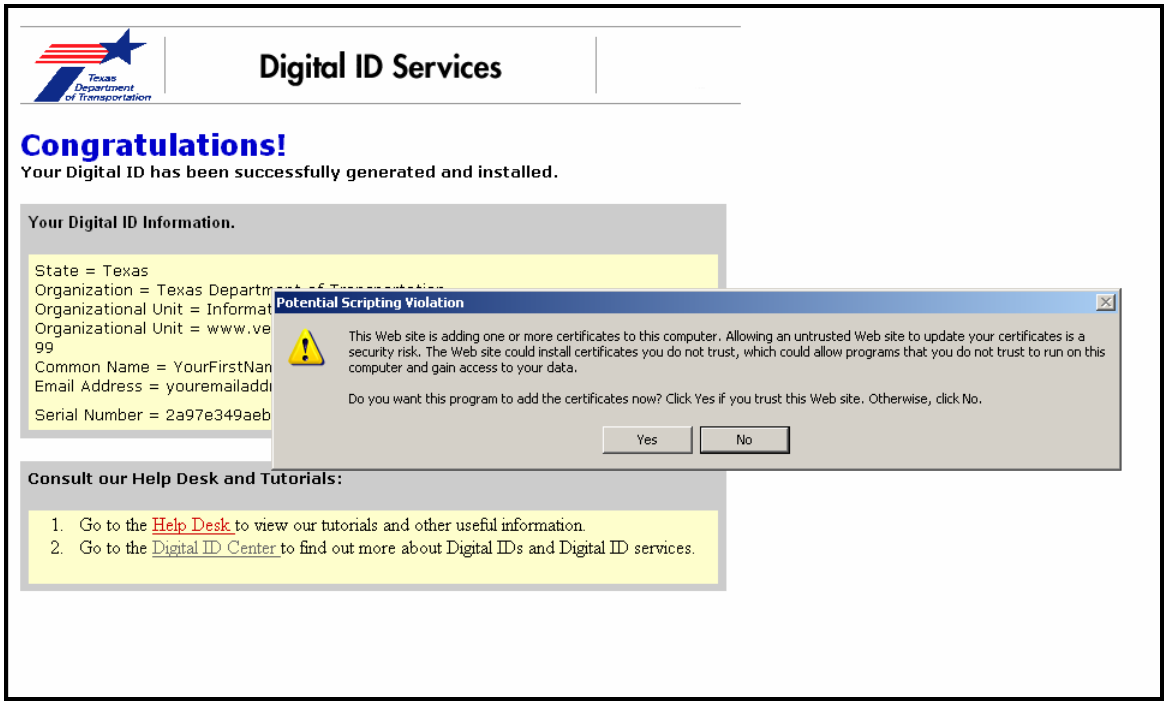


Figure 14: Potential Scripting Violation

Internet Explorer warns that a potential scripting violation is occurring. Left click the "Yes" button to continue (see Figure 15).

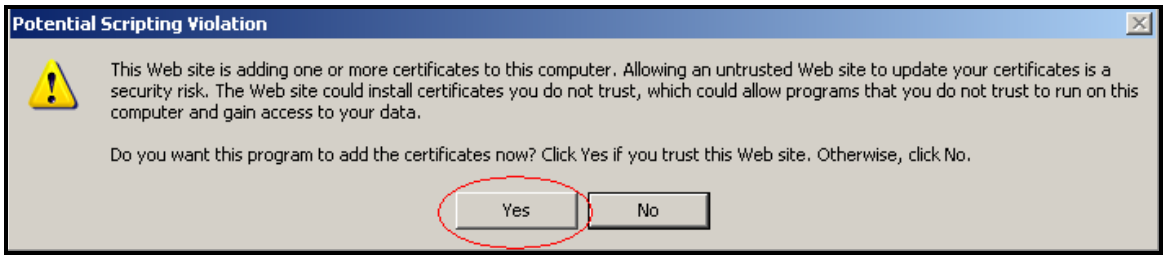


Figure 15: Confirm to add the certificates now

Finally, you should see this screen:

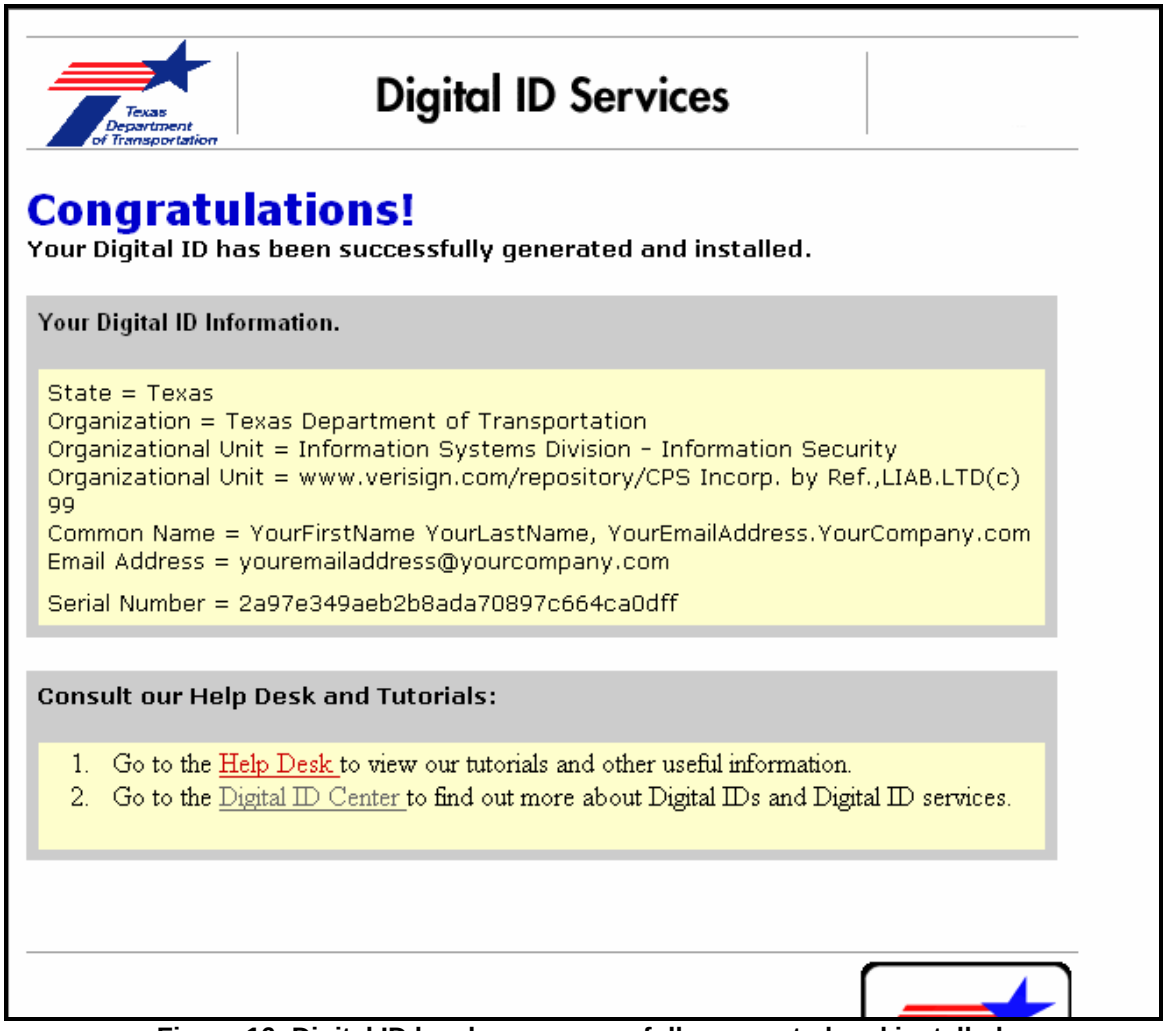


Figure 16: Digital ID has been successfully generated and installed

The Common Name and Email Address will change to match your personal information. Your certificate has now been installed successfully.

You have completed the Digital Certificate Enrollment Process! You now have your digital certificate installed on your computer.

One more step must be completed before the process is finished. You must export the digital certificate to a physical file on your computer. This exported certificate will be used to electronically sign payroll files in TxDOT's EPRS system.

2.1.2. Exporting Digital Certificates

Exporting your digital certificate serves two purposes: it allows you to create a backup copy in case your computer is damaged or replaced, and allows the use of the exported certificate in digitally signing electronic payrolls for submission to TxDOT.

Open Internet Explorer and left click on the “Tools” option on top of the Internet Explorer toolbar. From the drop down list left click on “Internet Options...” (see Figure 17).

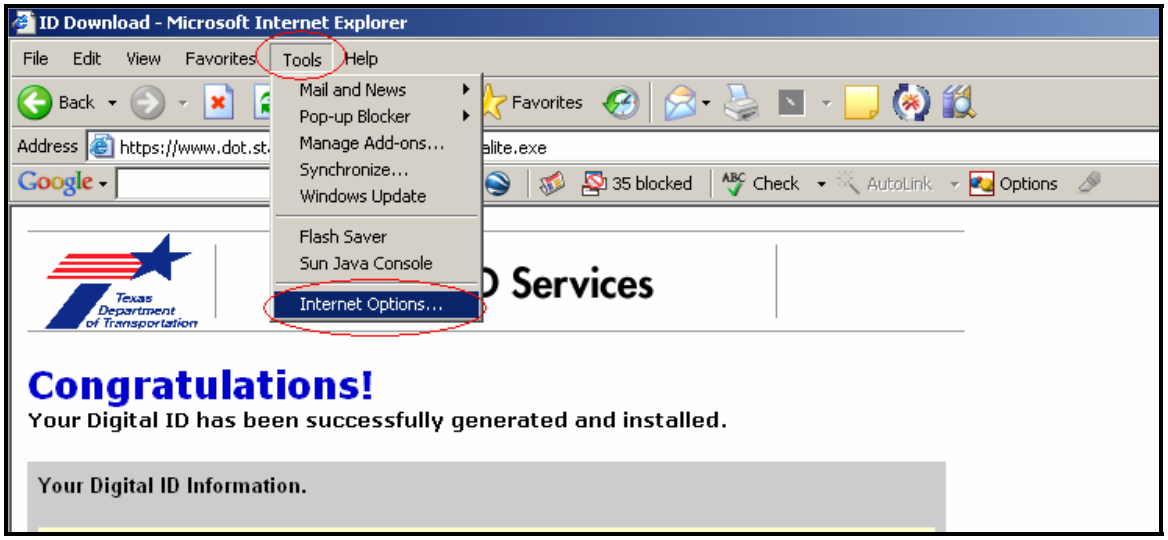


Figure 17: Internet Explorer > Tools > Internet Options

The “Internet Options” window will appear. Next, left click on the “Content” tab and then on the “Certificates...” button (see Figure 18).

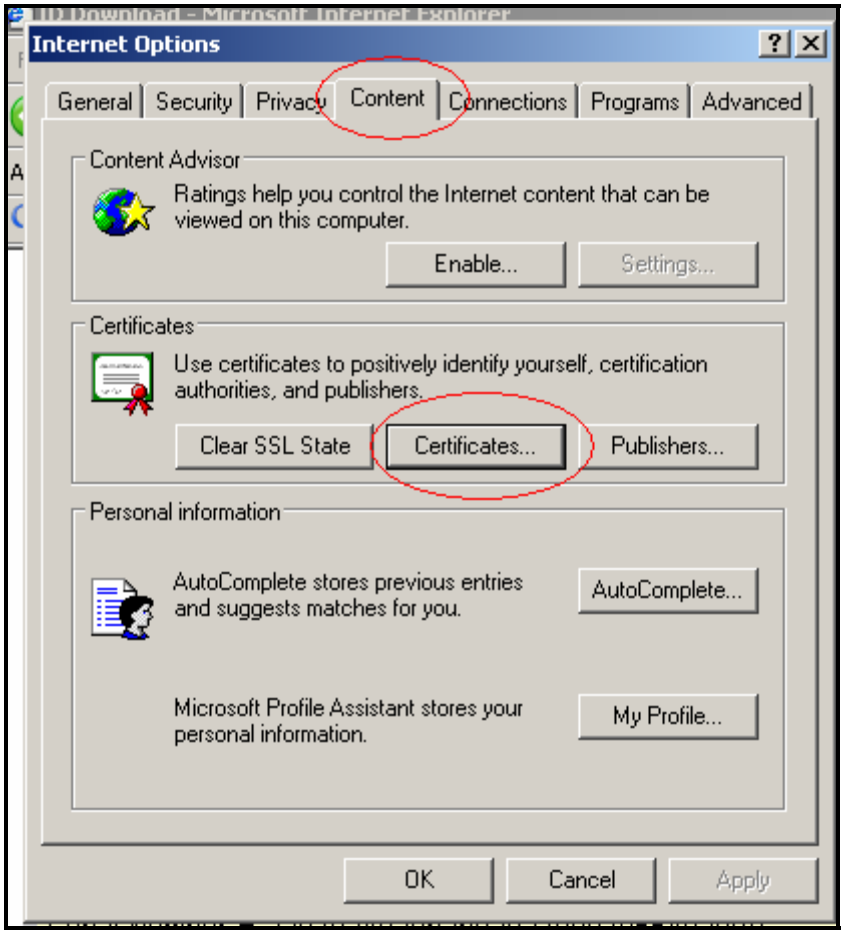


Figure 18: Internet Options

From the “Certificates” window, left click once on the certificate name under the “Issued To:” field. The certificate should become highlighted in blue. Next, left click on the “Export...” button (see Figure 19).

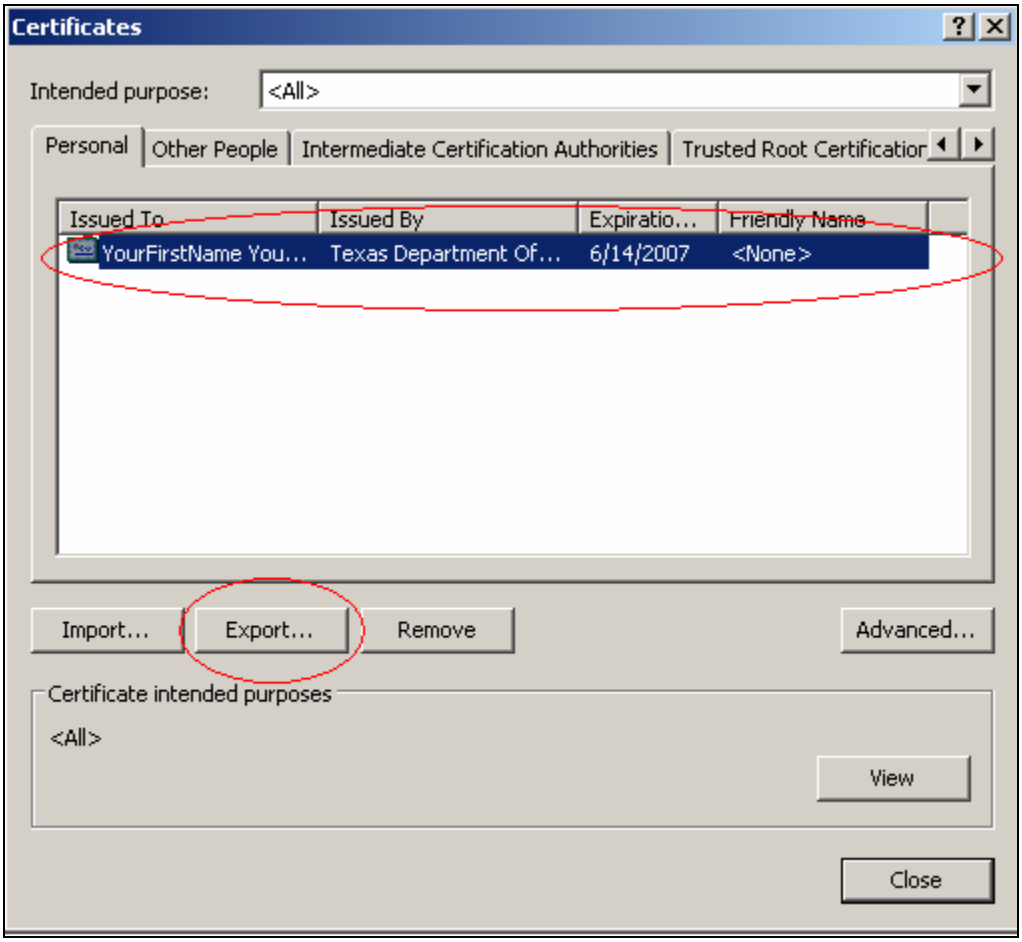


Figure 19: Certificates

The “Certificate Export Wizard” window will be displayed. Left click once on the “Next >” button to continue (see Figure 20).

Figure 20: Welcome to the Certificate Export Wizard

In the next screen, left click on the radio button next to “Yes, export the private key.” Then left click on the “Next >” button (see Figure 21).

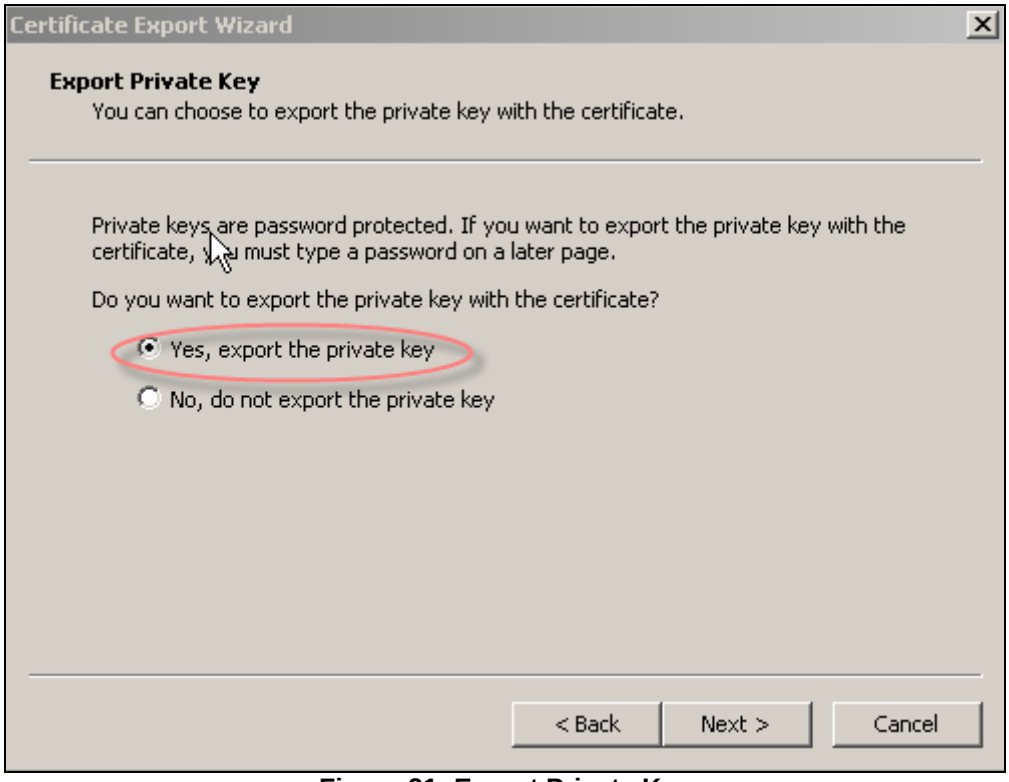


Figure 21: Export Private Key

In the next screen, left click once on the check box next to “Include all certificates in the certification path if possible,” and on the “Next >” button (see Figure 22).

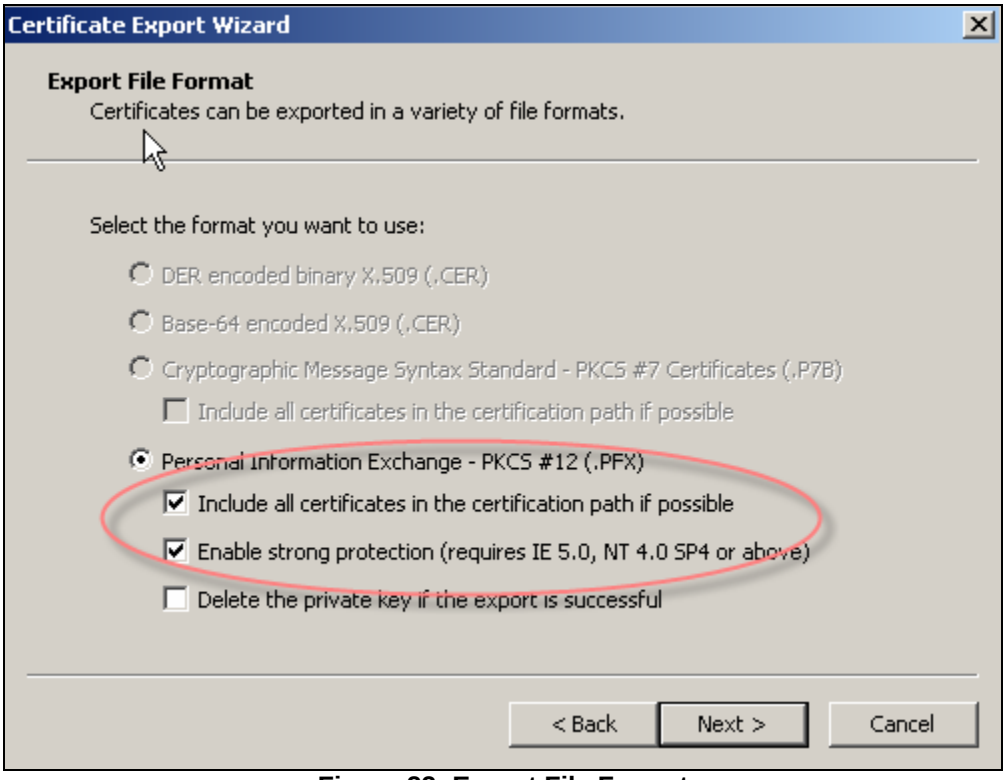


Figure 22: Export File Format

On the next screen, you will be prompted to enter a password for your exported certificate. This is another password that will be associated with the exported file, so it is different from the passwords entered previously.

This password will be required each time you use your exported digital certificate (i.e. digitally signing a payroll (refer to Figure 81), importing into a browser, etc.)

Enter your new password in the text boxes. Do not lose this password or you will not be able to import the certificate back into Internet Explorer or digitally sign a payroll file. Left click on the "Next >" button (see Figure 23).

Figure 23: Password window to protect private key

In the next screen, Internet Explorer prompts for the name and location under which to save the payroll file. Left click on the “Browse...” button (see Figure 24).

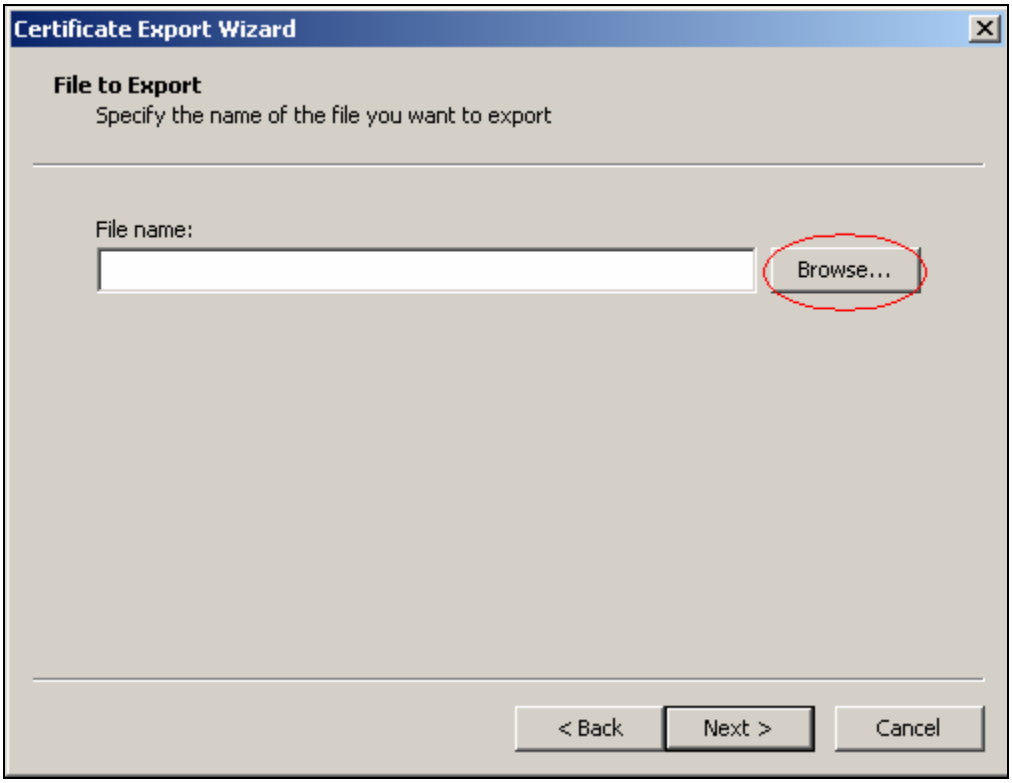


Figure 24: File to export

In the next screen, first left click on the “Desktop” icon on the left. Next, in the text box adjacent to “File name,” enter an easily recognizable name for your digital certificate. A certificate name consisting of the certificate owner’s first name, last name, and the word “Certificate” is usually a good choice (i.e. “John Smith Certificate”).

After entering the certificate name, left click on the “Save” button (see Figure 25). This saved file will be used when you digitally sign payroll documents (refer to Figure 81).

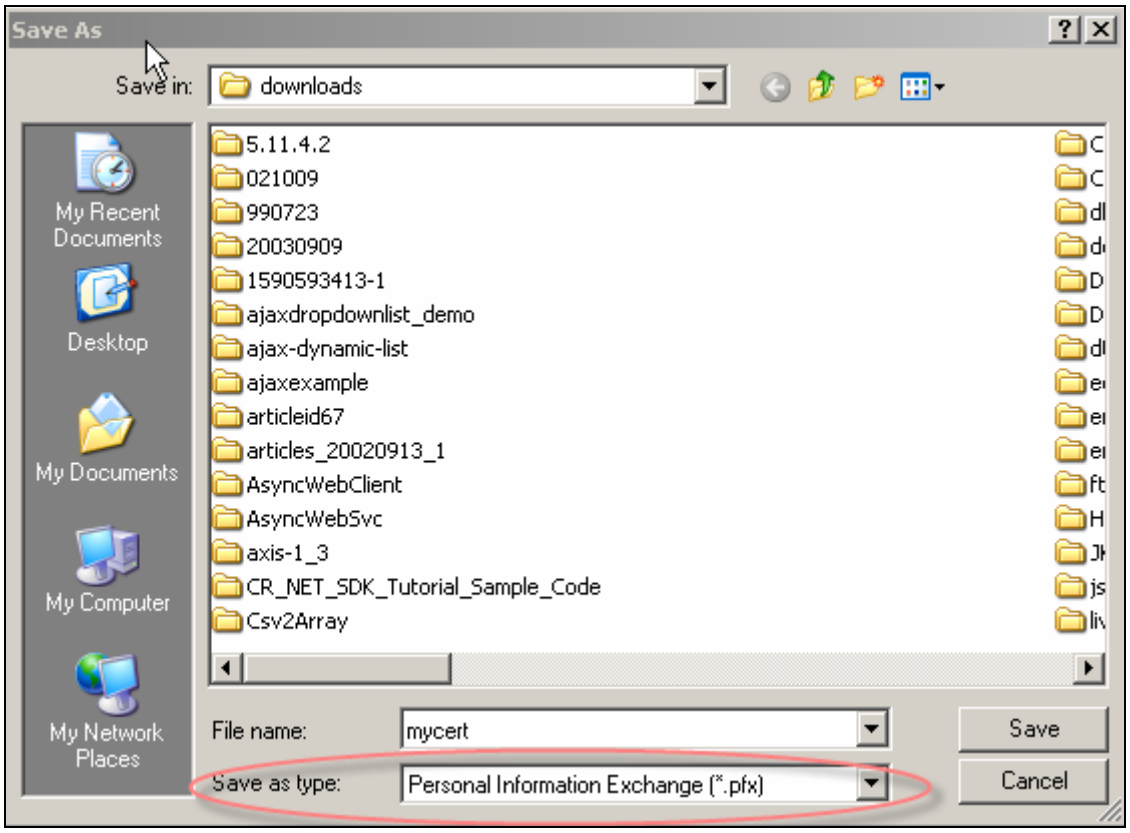


Figure 25: File extension is PFX

The next screen provides the option to review the information that has been entered. Left click on the "Finish" button to proceed (see Figure 26).

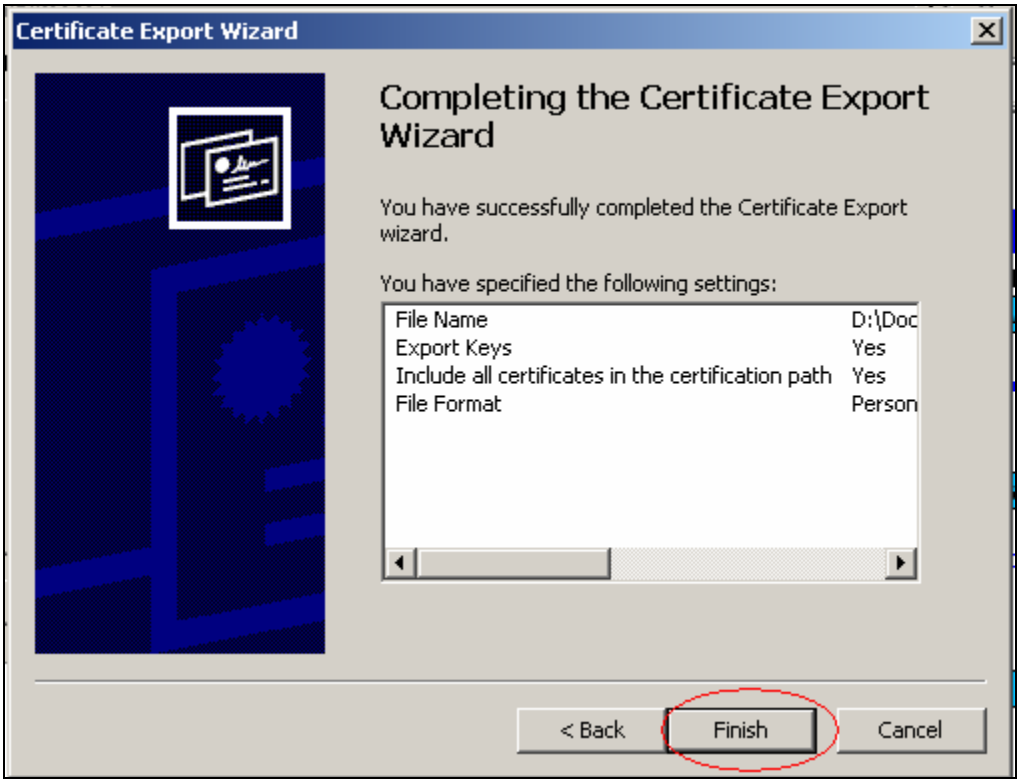


Figure 26: Finish exporting certificate

Internet Explorer now begins the process of making a copy of the digital certificate and placing it on the desktop. Before it can complete this task, however, the password generated when certificate was originally picked up and created must be entered (refer to Figure 11).

In the new window, click the "OK" button (see Figure 27).

Figure 27: Exporting private key

Enter a password in the “CryptoAPI Private Key” textbox. Next, left click the “OK” button (see Figure 28).

Figure 28: Exporting private exchange key

The password will be same password entered when the certificate was downloaded (refer to Figure 11). If the password entered was correct, the following window will be displayed indicating the successful exportation of the certificate (see Figure 29):

Figure 29: Successful certificate export

After pressing the “OK button, the newly exported certificate will appear on the Desktop (see Figure 30).

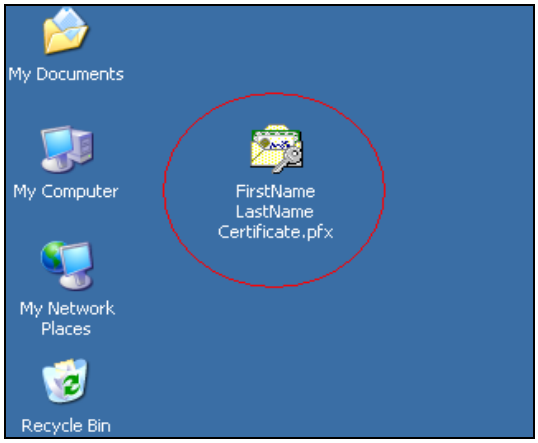


Figure 30: Certificate is exported on the Desktop

You have successfully exported your digital certificate!

2.1.3. Viewing Digital Certificates

To view your digital certificate in Internet Explorer, open your browser and left click on the “Tools” option on top of the Internet Explorer toolbar. From the drop down list, left click on “Internet Options…” (see Figure 31).

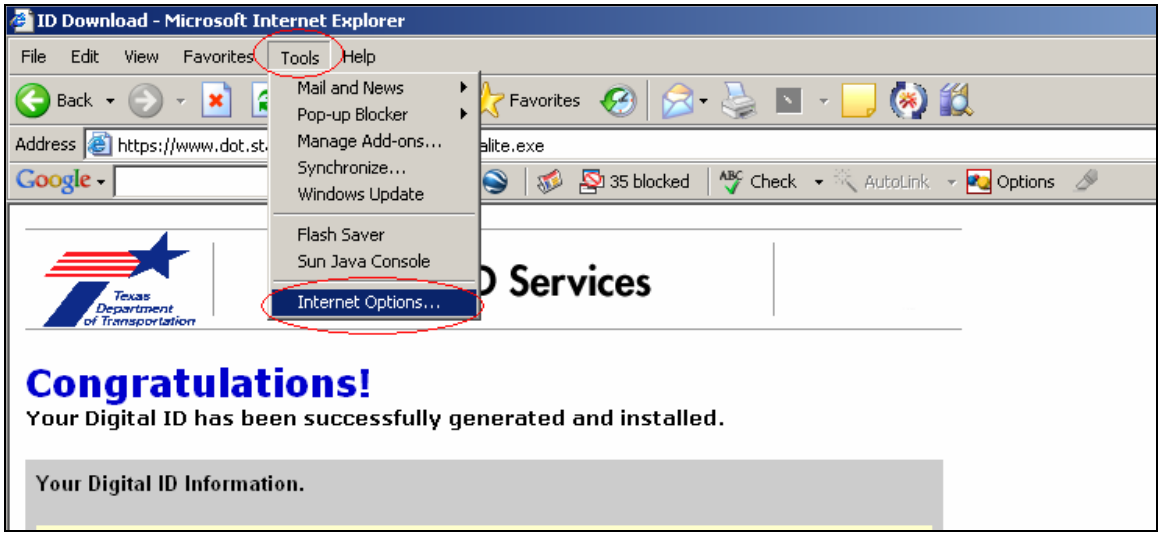


Figure 31: Internet Explorer > Tools > Internet Options

The “Internet Options” window will appear. Next, left click on the “Content” tab and then on the “Certificates...” button (see Figure 32).

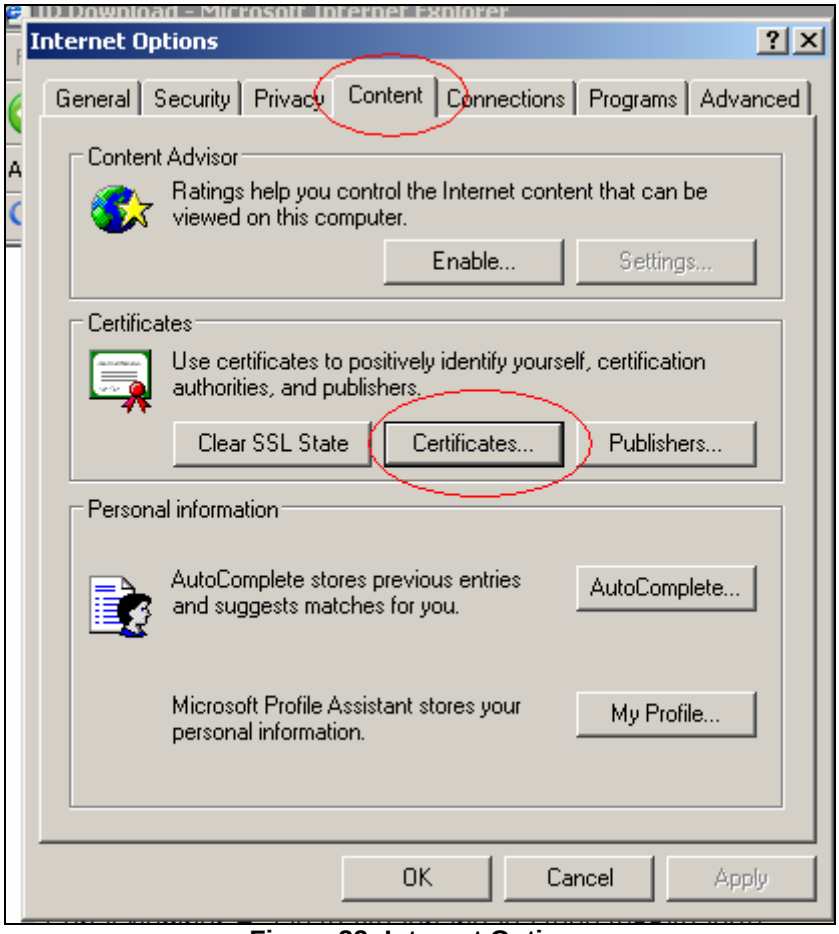


Figure 32: Internet Options

The certificates window will appear and the newly installed digital certificate should be displayed in the window. Double left click on the certificate name under the "Issued To" field (see Figure 33).

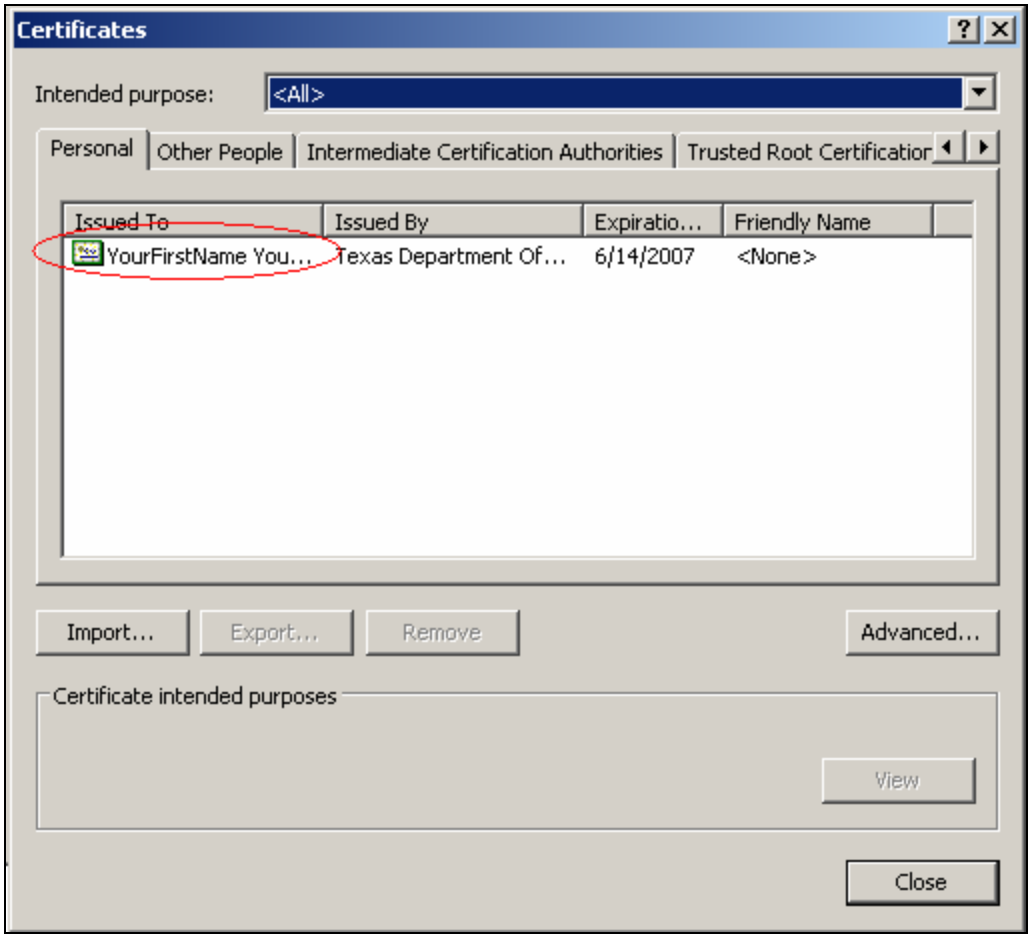


Figure 33: Certificates on the web browser

This opens a window that displays general information about the certificate. The most important sections are the expiration date and the statement that you have a private key (see Figure 34).

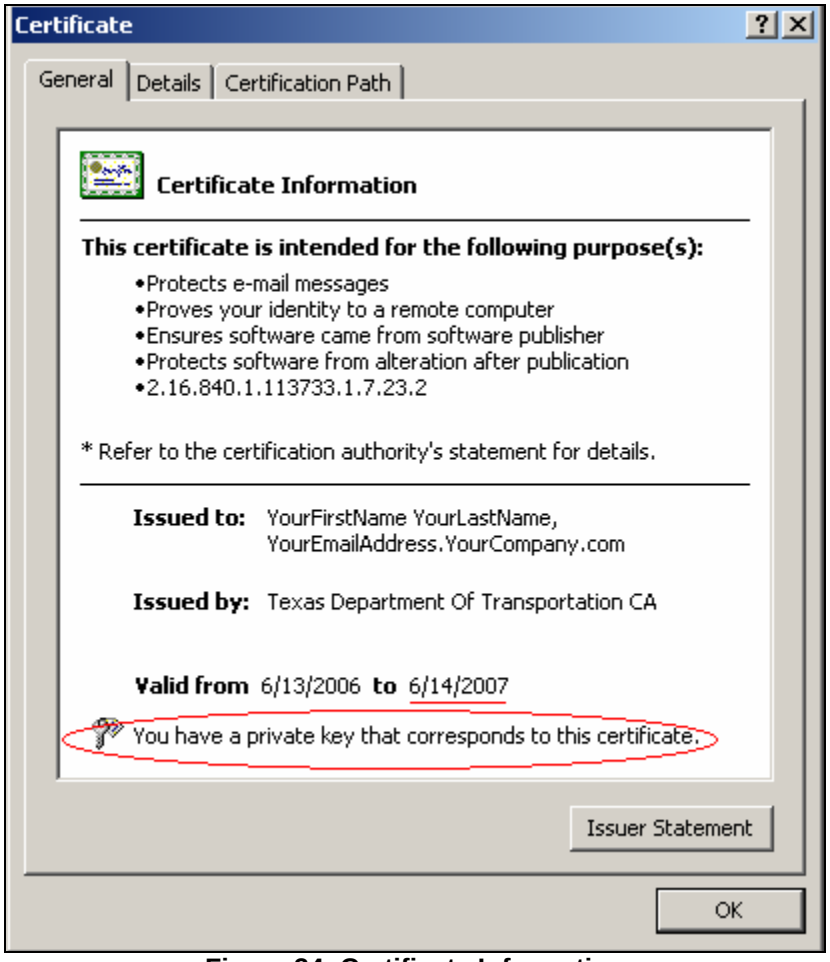


Figure 34: Certificate Information

Once a digital certificate expires, a new certificate must be obtained. Approximately one month prior to certificate expiration, the user will receive e-mails warning of the certificate's impending expiration. To obtain a new digital certificate, complete the Digital Certificate Request (DCR) Form (form number 2196) in accordance with 2.1.1.1. Requesting a Digital Certificate from TxDOT.

Left click the "OK" button to close the window (see Figure 34).

2.1.4. Importing Digital Certificates (Optional)

This section applies only in those instances where a previously exported and saved digital certificate is moved from one location to another (typically this occurs when copying a digital certificate from one computer to another computer). Begin, by locating an exported copy of the digital certificate on the original computer. (Note: If the certificate was exported using the instruction for "Exporting Digital Certificates," 2.1.2. Exporting Digital Certificates of this guide, it will be located on your desktop.) Double left click on the file icon (see Figure 35).

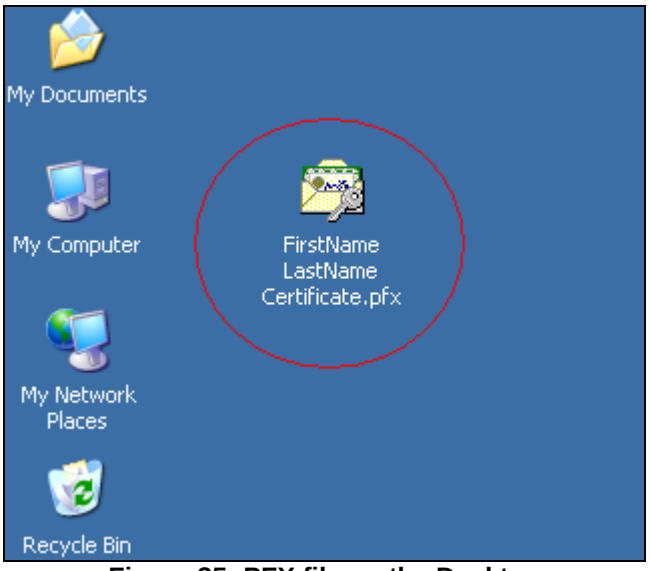


Figure 35: PFX file on the Desktop

Windows will automatically start the “Certificate Import Wizard.” Click “Next >” (see Figure 36).

Figure 36: Welcome the certificate import wizard

In the next window, the location of the file is automatically completed. Left click on the “Next >” button to continue (see Figure 37).

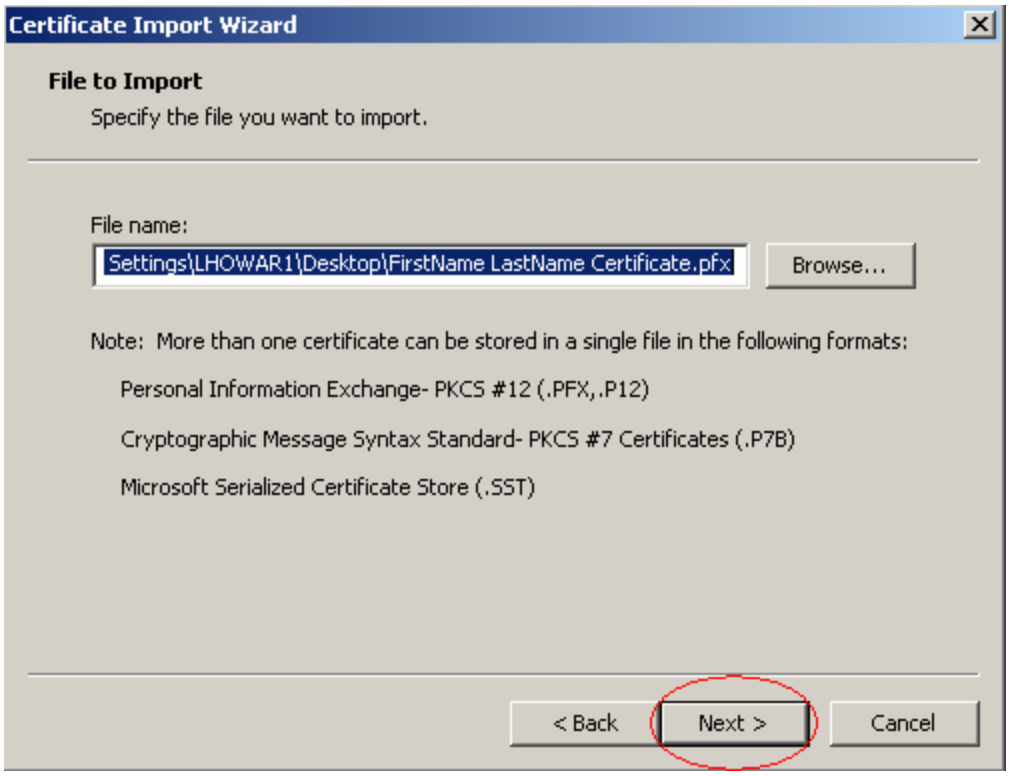


Figure 37: Select the file to import

On the next screen, you are prompted with several options. First, enter the password that was selected when exporting the certificate from Internet Explorer initially into the “Password:” textbox (refer to Figure 23). Next, left click on both check boxes. Finally, left click on the “Next >” button (see Figure 38).

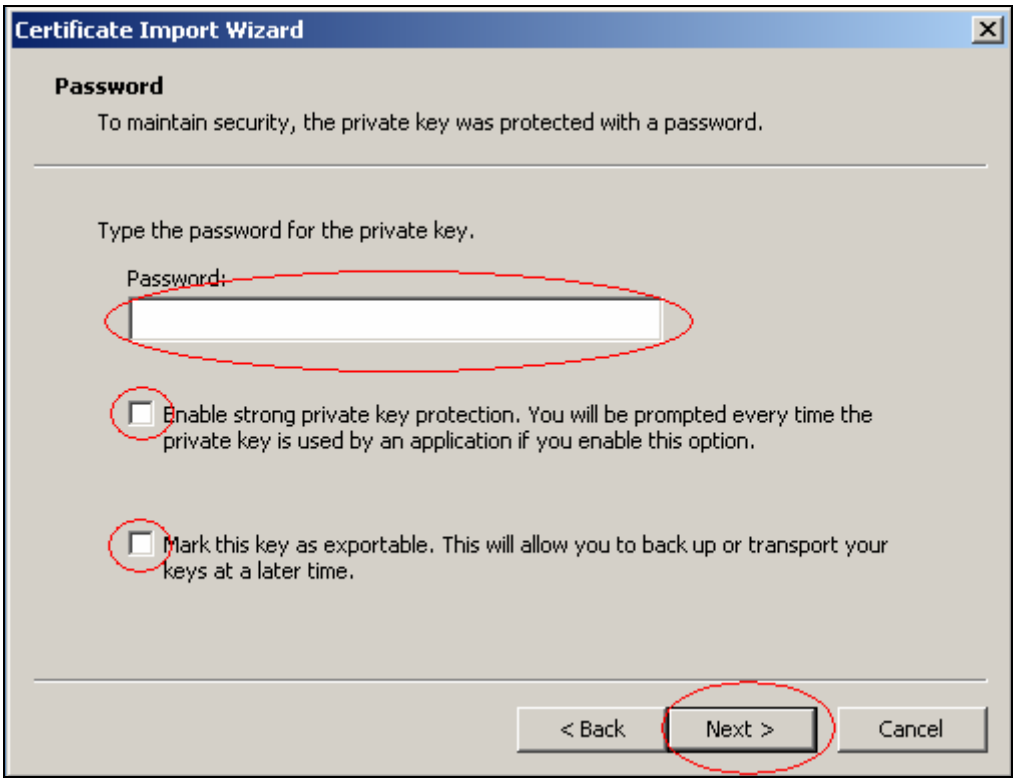


Figure 38: Type the password for the private key

On the next screen, left click the “Next >” button (see Figure 39).

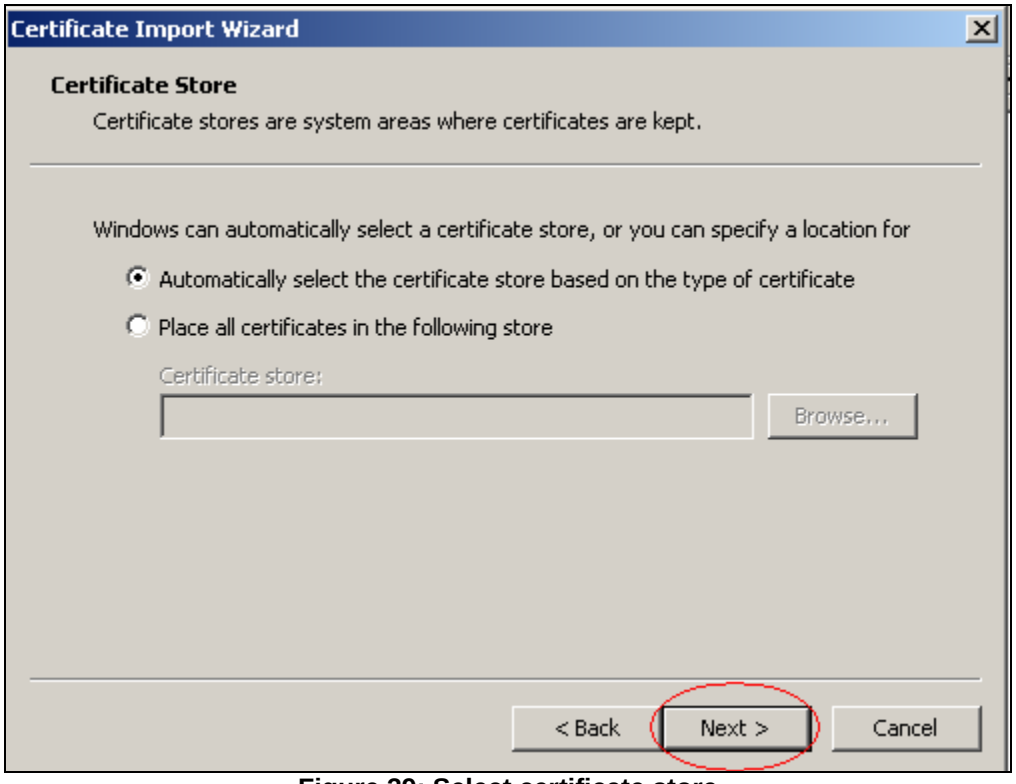


Figure 39: Select certificate store

In the next window, left click on the “Finish” button (see Figure 40).

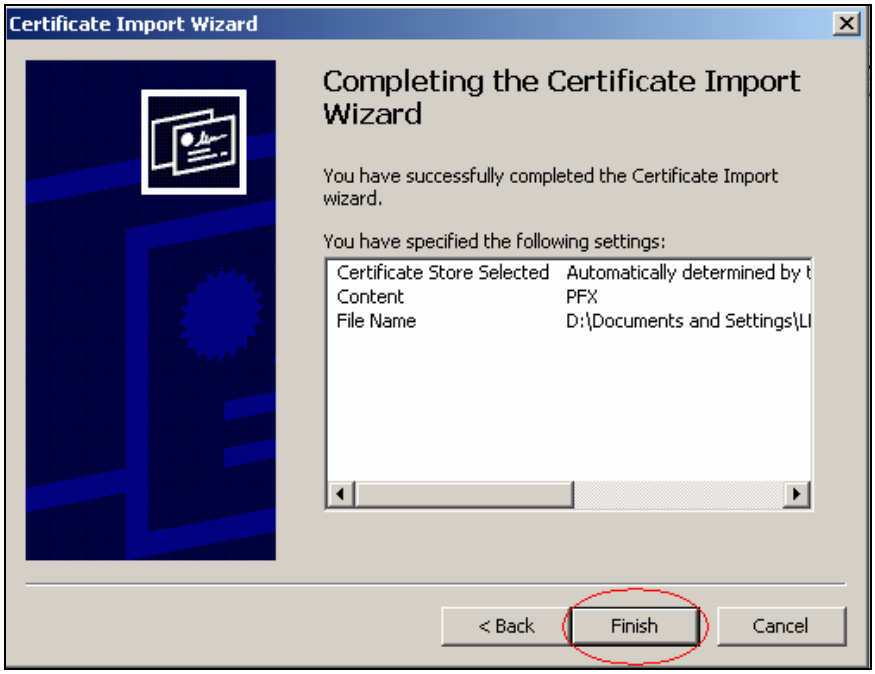


Figure 40: Completing the Certificate Import Wizard

Internet Explorer is in the process of importing a certificate. ***Do not click “OK” – change the security level of the certificate from medium to high***. Left click on the “Set Security Level…” button (see Figure 41).

Figure 41: Set Certificate Security Level

A new window will be presented:

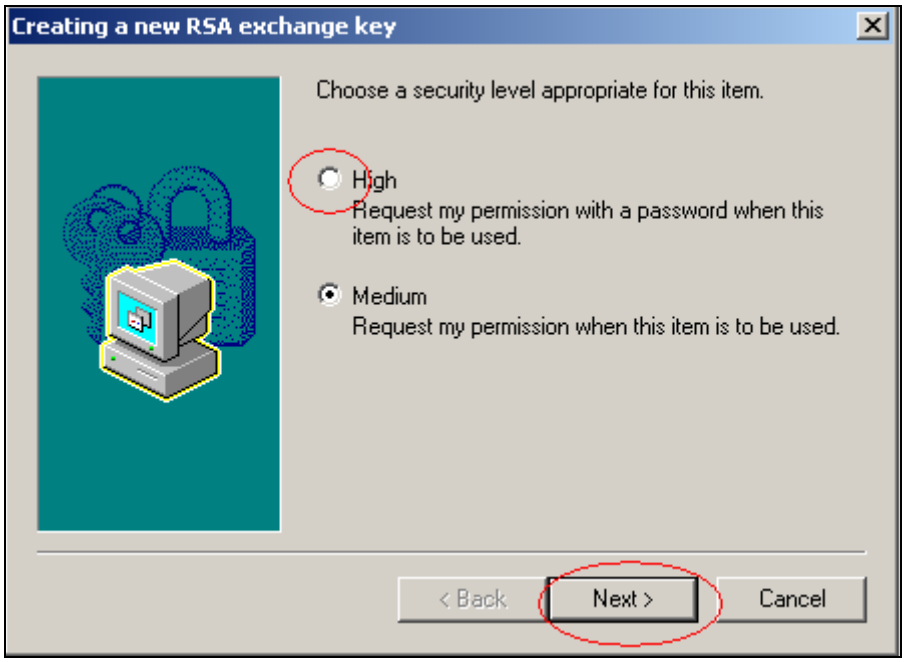


Figure 42: Creating a new RSA exchange key

Click on the radio button next to the word “High” and then click the “Next >” button (see Figure 42).

The next window will prompt you to create a password

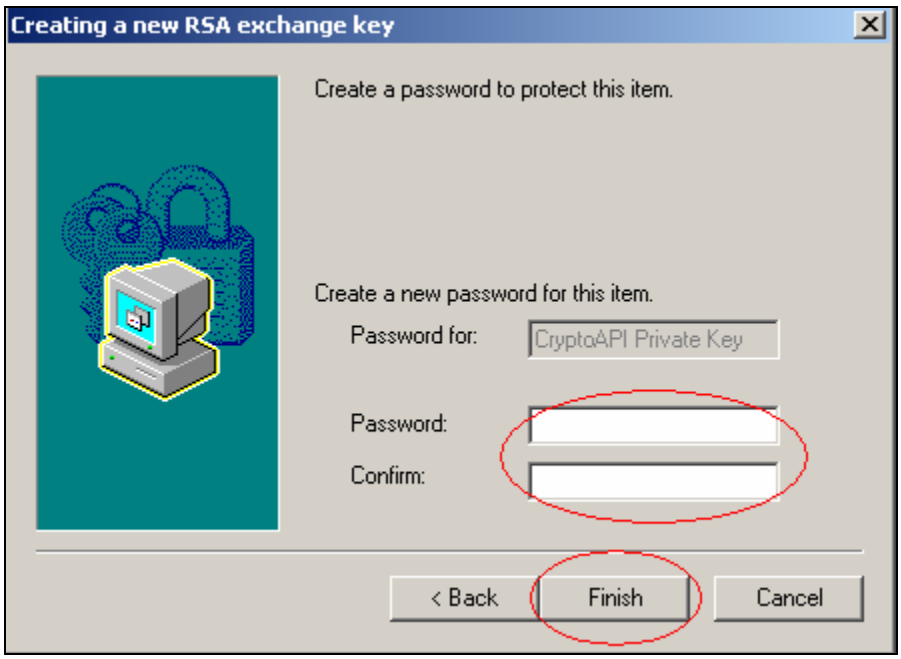


Figure 43: Entering password to protect private key

Enter a password into the “Password:” and “Confirm:” textboxes. ***Do not lose this password or the digital certificate cannot be used to digitally sign documents!*** Next, left click the finish button (see Figure 43).

This returns the user to the original window:

Figure 44: High Certificate Security Level

Please verify that the security level is now set to high. Then click the "OK" button to continue (see Figure 44).

Figure 45: Certificate Imported Successfully

2.1.5. Revoking a Digital Certificate

A digital certificate must be revoked when:

- the person to whom a digital certificate is issued is no longer employed, or is no longer performing duties requiring a digital certificate,
- the security of the digital certificate has been compromised, or
- deemed appropriate by the authorizing company.

Use the Digital Certificate Revocation (DCV) Form (form number 2198) to notify the department that a certificate needs to be revoked. Once revoked, a digital certificate will no longer be accepted by the department's computer systems for signing documents. ***The company's management is responsible for immediately notifying the department when a digital certificate should be revoked. However, the department reserves the right to revoke any digital certificate it issues.***

2.2. Java 2 Runtime Environment (JRE)

In order to use EPRS to sign and submit payroll files to TxDOT, the Java 2 Runtime Environment version 1.4.x (JRE) must be installed on your local computer. JRE may be obtained at http://java.sun.com/j2se/1.4.2/download.html.

Figure 46: Sun Java J2SE download page

Click "Download J2SE JRE**"** in the middle of page**,** and then "Accept License Agreement" (see Figure 46 and Figure 47).

Figure 47: Accept License Agreement

Click “Windows Offline Installation, Multi-language” from the download list (see Figure 48).

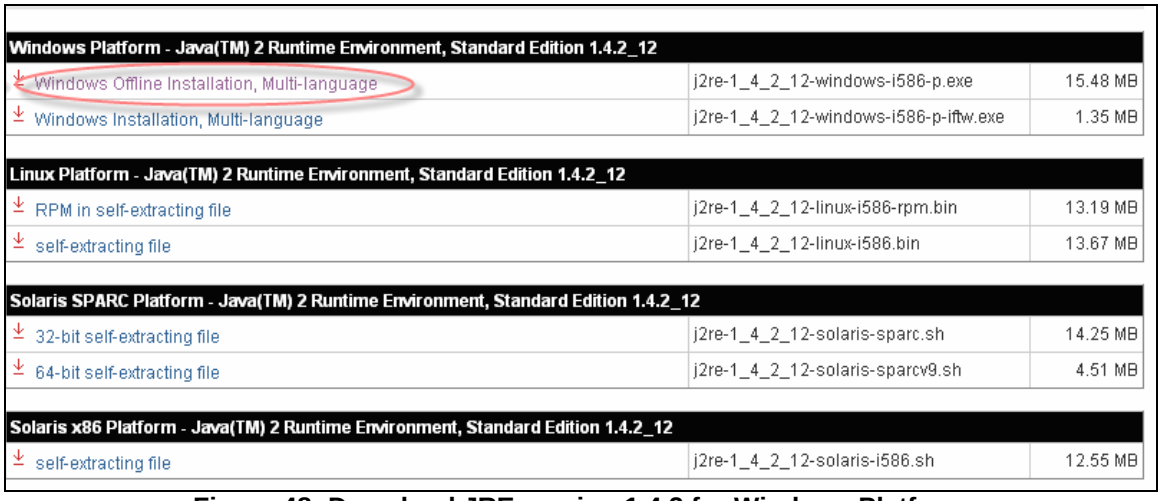


Figure 48: Download JRE version 1.4.2 for Windows Platform

When the popup window asks if you to want to run or save this file, click “Save” to save it to your local hard drive.

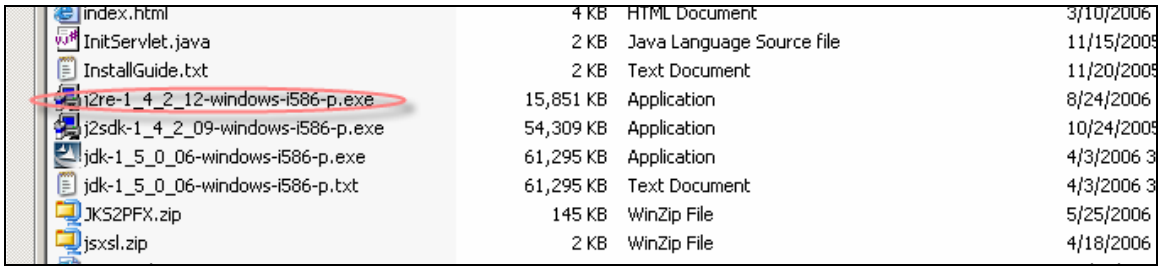


Figure 49: JRE file is saved on the hard drive

Open Explorer, go to the location where you saved j2re-1_4_2_X-windows-i586-p.exe, and then double click this file to run it (see Figure 49).

The installation process is pretty straightforward; simply follow the instruction provided carefully.

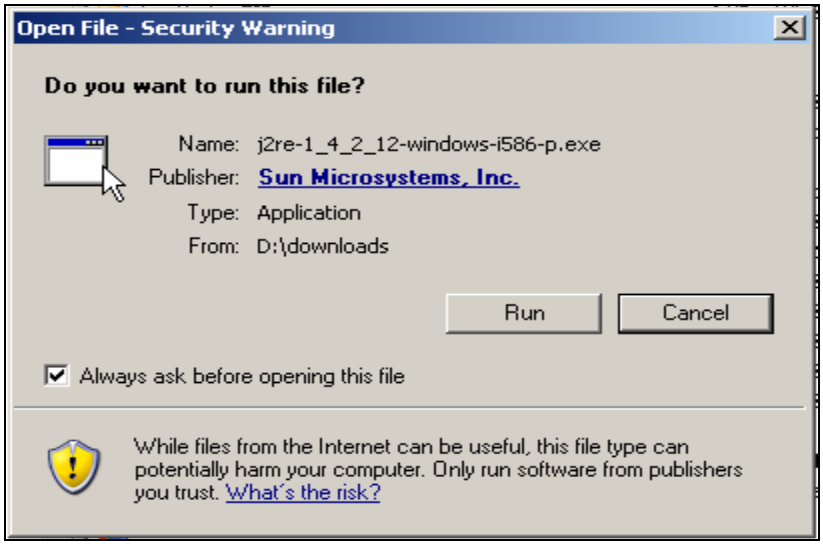


Figure 50: Start to install JRE

In next screen, check "I accept the terms in the license agreement" and click "Next >" (see Figure 51).

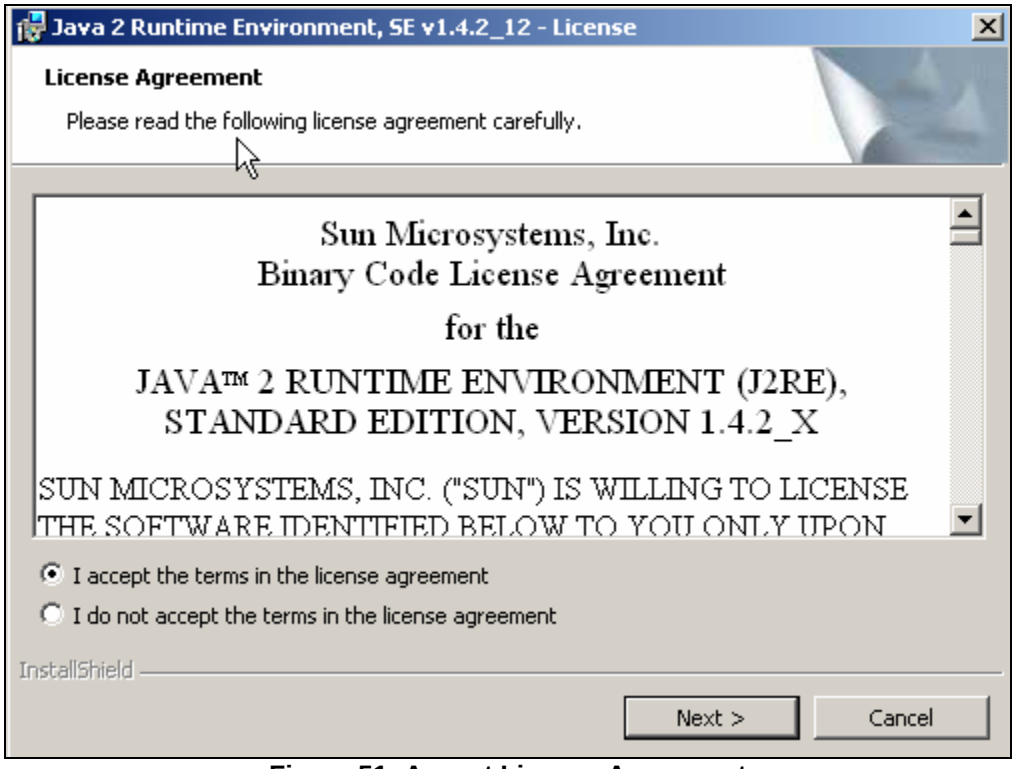


Figure 51: Accept License Agreement

In next screen, select “Typical” setup type, and then click “Next >” (see Figure 52).

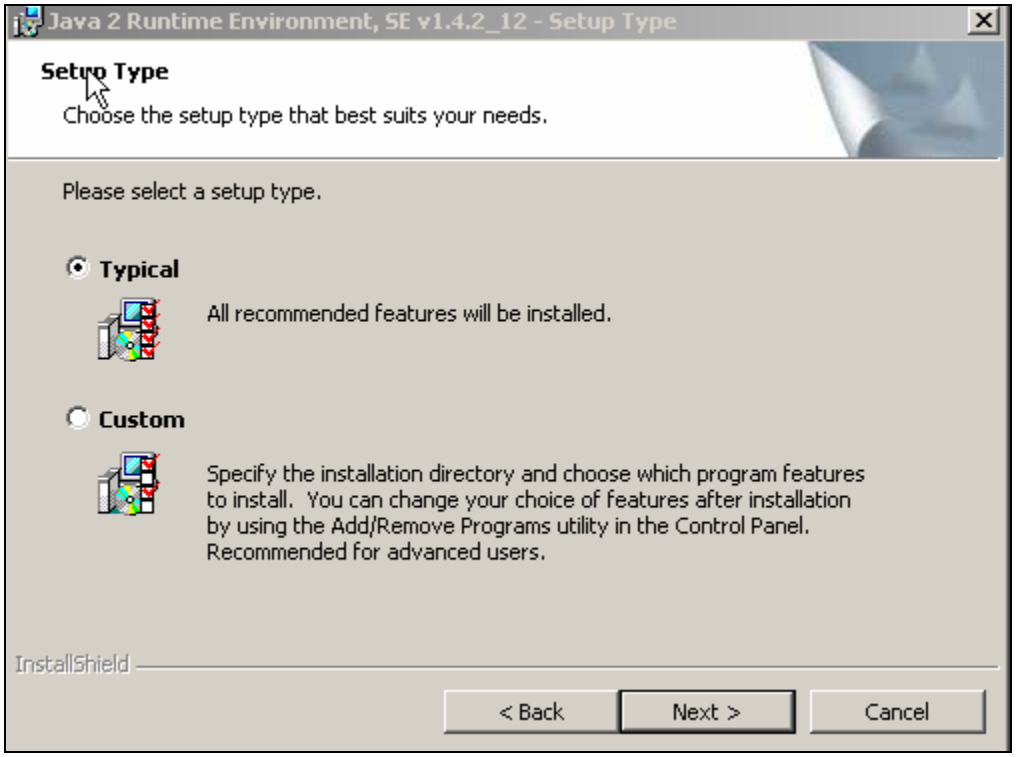


Figure 52: Select Setup Type

The installation process may take several minutes.

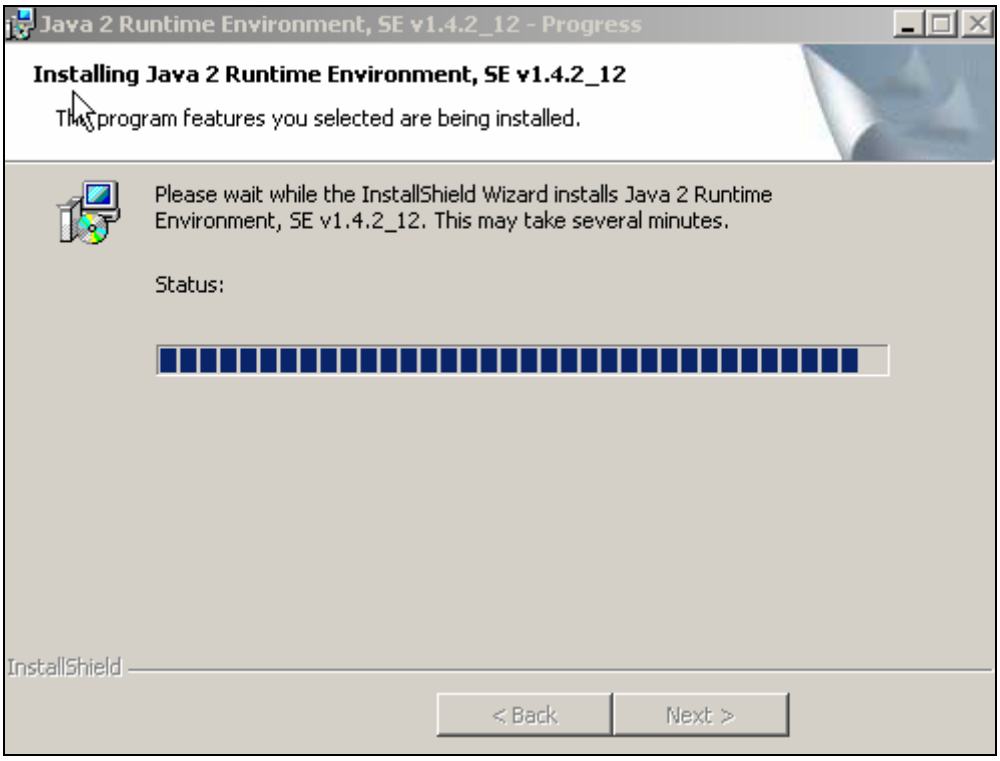


Figure 53: Installation process

When the installation completes, click “Finish” (see Figure 54).

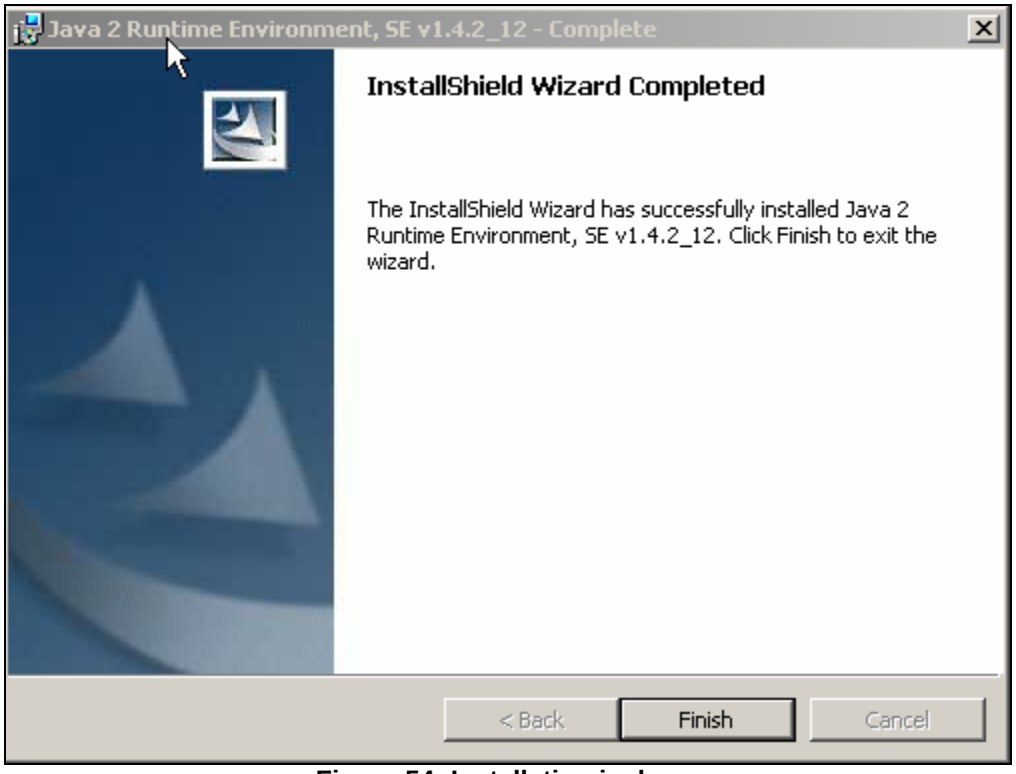


Figure 54: Installation is done.

When the system pops up the computer restart prompt, click “Yes” to restart now (see Figure 55).

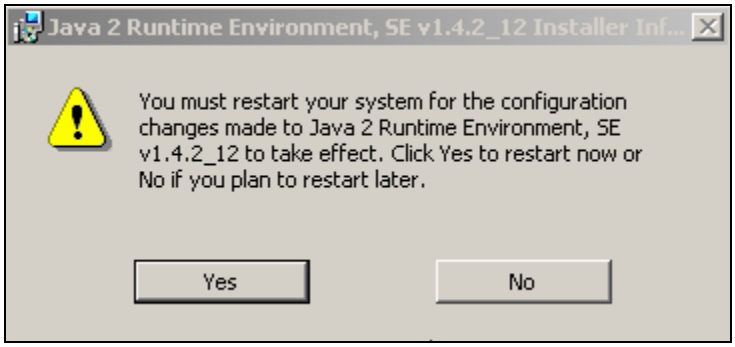


Figure 55: Popup window asking if you want to restart computer

After you restart the computer, you should be able to sign and submit payroll files to TxDOT using JRE.

3. Using the EPRS Web Page

3.1. Home Page

EPRS is available on TxDOT's website at: https://www.dot.state.tx.us/apps/payroll. When accessing this page, the user will be prompted to select the certificate to use in signing the payroll file (see Figure 56). Make sure to choose the correct TxDOT certificate. The web site will not accept an invalid TxDOT certificate, or a digital certificate not issued by TxDOT. If you do not have a digital certificate issued by TxDOT, go to Section 2.1.1. Obtaining a Digital Certificate from TxDOT.

If you are only creating a payroll file and do not intend to sign and submit a payroll file using EPRS, simply click "Cancel" when prompted to select your digital certificate (see Figure 57) and skip to 3.2. Creating a New Payroll Data File.

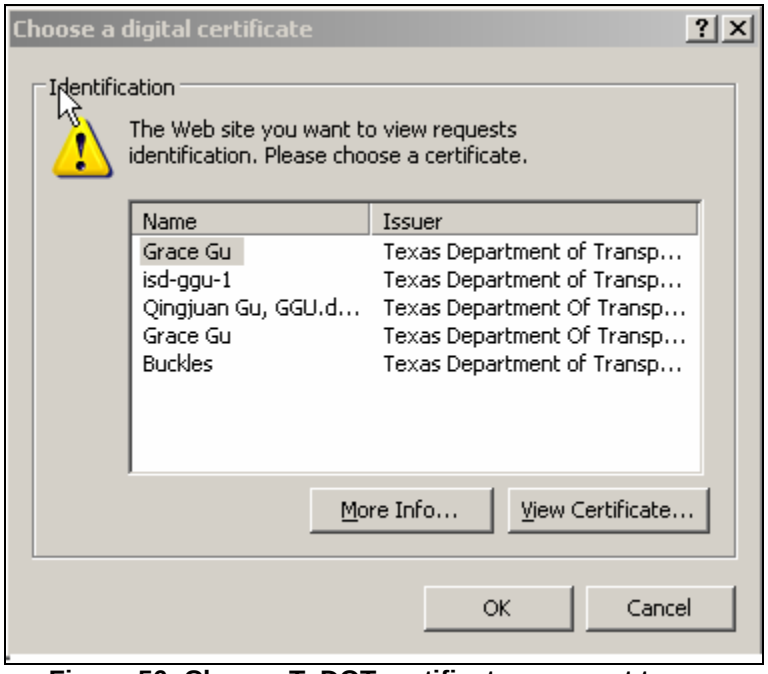


Figure 56: Choose TxDOT certificate you want to use

Enter your password in the "CryptoAPI Private Key**"** field (refer to Figure 11)**.**

Figure 57: Enter private key

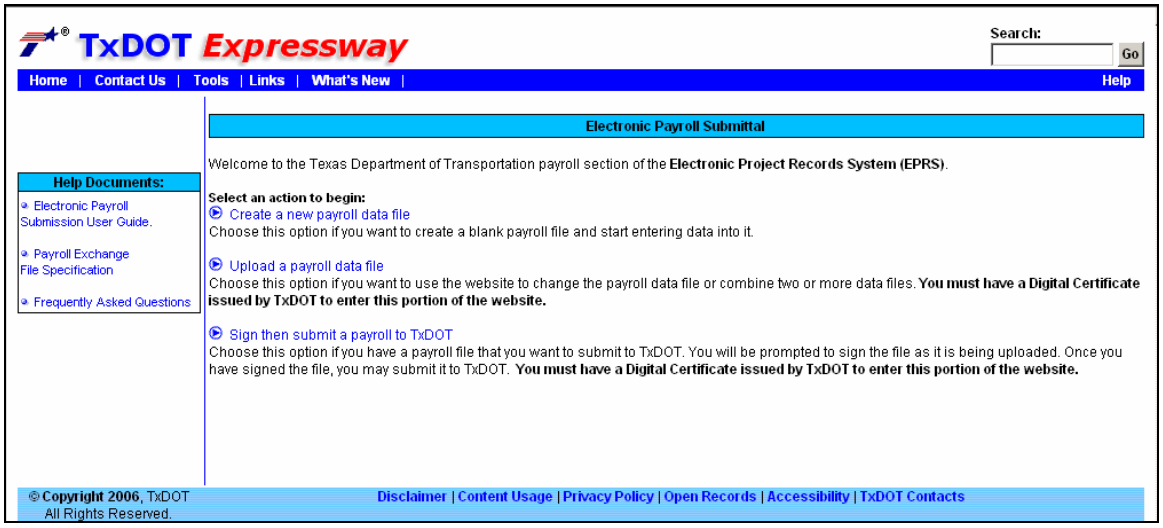


Figure 58: Home Page

A screenshot of the EPRS homepage is listed above (see Figure 58). On the left portion of the webpage is a box labeled "Help Documents," which contains several documents to assist users in navigating through and using EPRS.

From the EPRS homepage, the user has the following options:

- Create a new payroll data file: Use this link to create a new payroll file. After a payroll file is created, the user may save the file, view the file and download the file to their computer.
- Upload a payroll data file: Use this link to open, view, edit and merge payroll files previously created and downloaded from EPRS, or exported as a CSV file from a user's personal payroll software application.
- Sign then submit a payroll to TxDOT: Use this link to digitally sign and submit payroll files to TxDOT.

3.2. Creating a New Payroll Data File

Since this option does not require a digital certificate, there are no restrictions on who may create an EPRS payroll file. Clicking on this link creates a blank payroll file and directs the user to the Edit Page. This is the same Edit Page that users may access from the "File Operations Menu" page (refer to 3.3. File Operations Menu).

The first screen viewed is the main Edit Panel (refer to Figure 59). Use this screen to create a payroll file using EPRS. Enter the CCSJ of the desired project into the "Project CCSJ" field, which will automatically populate the "Project Description" and "Project Address" fields. From the "Contractor Name" dropdown field, select the appropriate contractor for the payroll file. Click the calendar icon to the right side of the "Week Ending Date" field to select the week ending date for the payroll (see Figure 60). To add an employee, click on "Add new employee…" which brings up the Employee Panel (see Figure 61). On this panel, enter all employee related information (i.e. name, address, hours worked, deductions, etc.)

On both the main panel and the employee panel, fields where data entry is required are indicated by a red asterisk (*). If any of these fields are left blank, the user will not be able to submit the file. Please refer to the "Payroll Exchange File Specification" for more information.

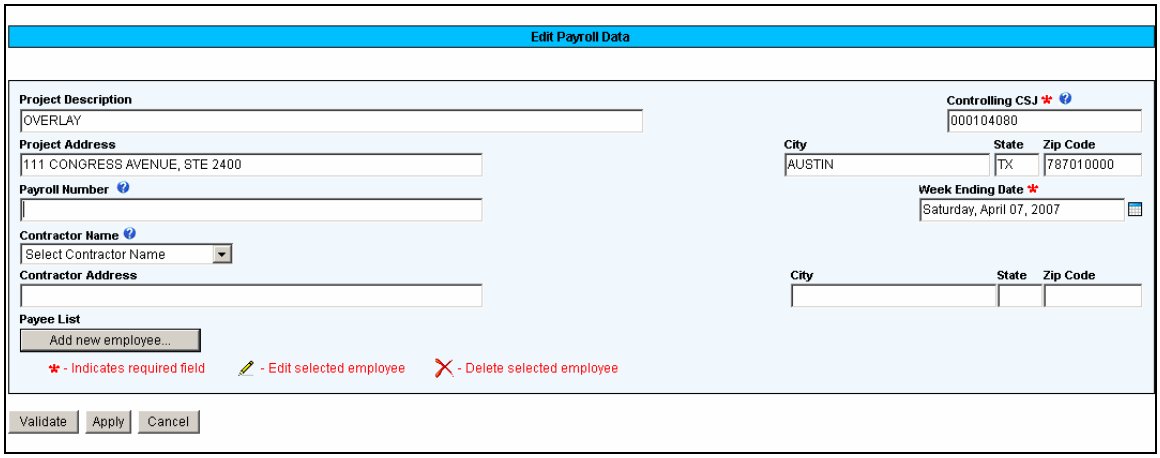


Figure 59: Creating new payroll file

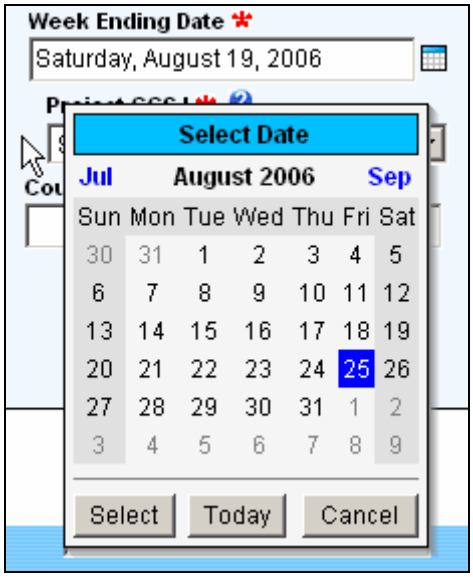


Figure 60: Using calendar to select date

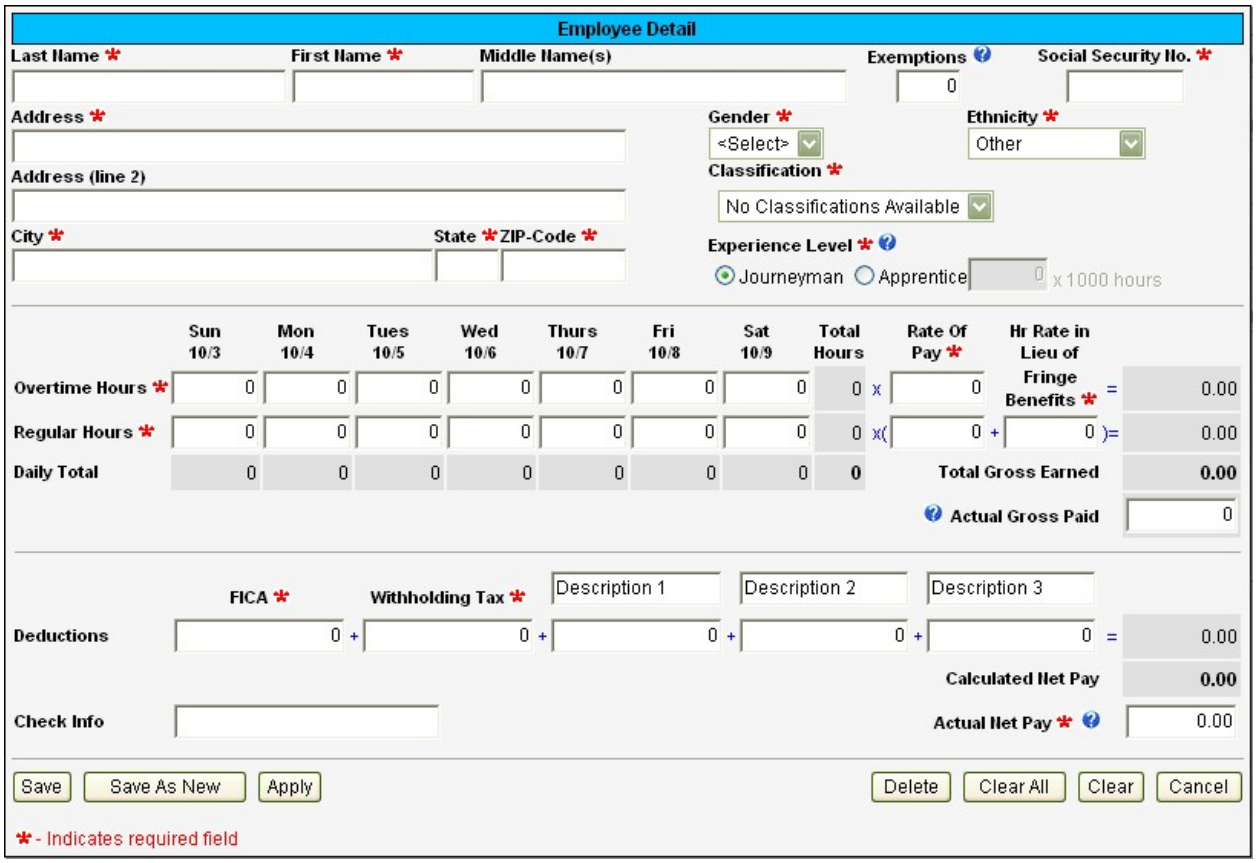


Figure 61: Employee detail information

On the Employee Detail panel, ensure the "Social Security Number" and "State" fields are correctly formatted or a "Warning" message will be generated. The "Social Security Number" field may be in one of two formats: "123-45-6789" or "123456789". The "State" field, as with the "Contractor" and "Project State" fields, must be an accepted postal abbreviation (i.e. "TX" for Texas, "NM" for New Mexico, etc.)

The overtime wage rate is automatically populated as one and one half times the regular hourly rate of pay. The hour number and dollar number fields will each allow numerical entries to two decimal places. The dollar number will be rounded down (i.e. $10.055 will be rounded to $10.05, while $10.056 will be rounded to $10.06). The hour number will be rounded up to the next quarter of the hour (i.e. 3.10 hrs will be rounded up to 3.25 hrs, 3.26 will be rounded up to 3.50, etc.)

Several options appear at the bottom of the "Employee Detail" screen that may be selected to save, delete and create new employees. On the employee panel, located in the top portion of the "Employee Detail" screen, the buttons may be used as follows:

- Save: Saves the current employee and closes this panel, returning the user to the main panel.
- Save As New: Saves the employee as a new employee and returns the user to the main panel.
- Apply: Saves the current employee, but doesn't close the panel.
- Delete: Deletes the current employee from the file and returns the user to the main panel.
- Clear All: Asks the user to confirm the loss of all data and, if the user clicks "OK," clears all the fields in the employee panel.

- Clear: Clears the daily hours, salary information, and deduction information from the current employee. Clicking "Clear" leaves the employee name, address, and other similar fields as they are.
- Cancel: Deletes all changes to the employee since the last Save/Apply and returns the user to the main panel.

The options available at the bottom of the "Edit Payroll Data" screen that may be selected to create and save payroll files are:

- Save: Saves all data in the memory and directs the user to the "File Operations Menu" screen.
- Apply: Saves all data in the memory and stays on the "Edit Payroll Data" screen.
- Cancel: Deletes all changes to the payroll information and directs the user to the "File Operations Menu" screen.

Once you have added an employee, the screen will look similar to

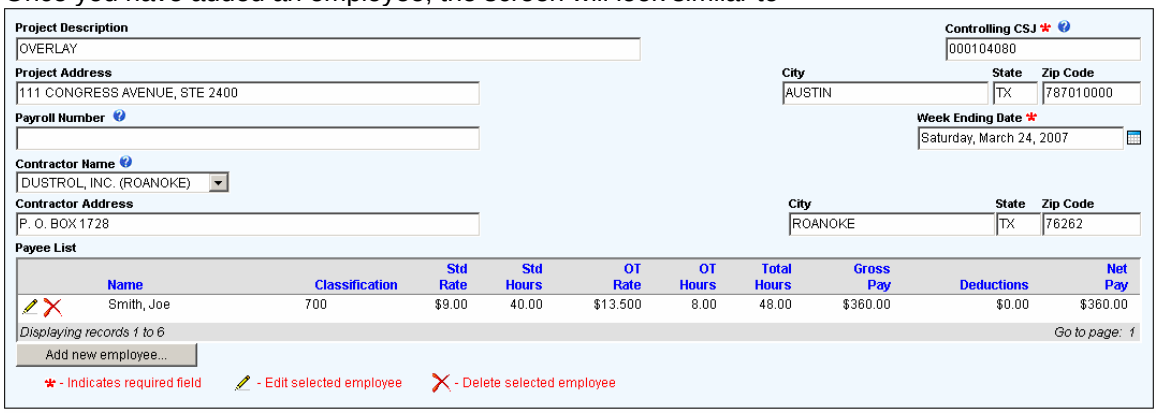


Figure 62:

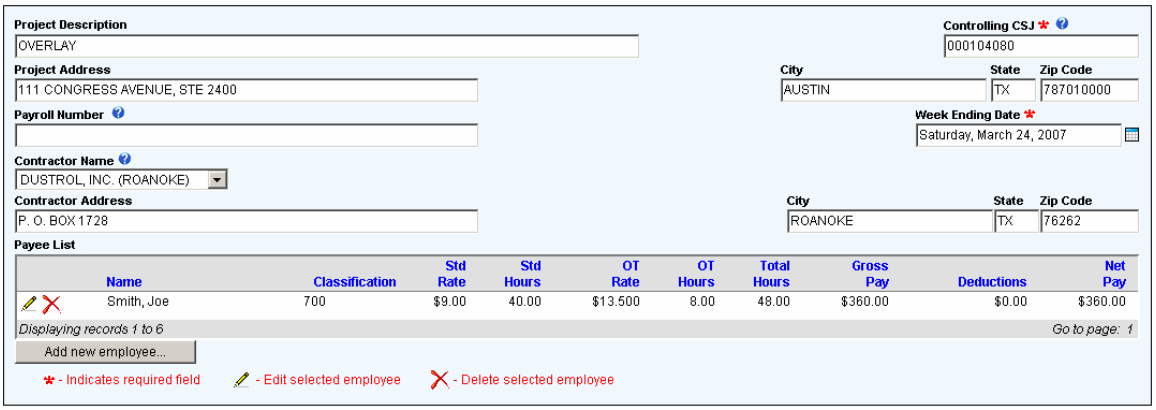


Figure 62: A Sample Project

Once editing of the payroll data is complete, click "Save," which will direct the user to the "File Operations Menu" page where data validation messages will be displayed (refer to refer to 3.3. File Operations Menu). ***Please be aware that clicking any "Save" button will save the data into memory, but will not save the payroll file to the user's computer. If the browser is closed before downloading the payroll file; all data will be lost!!*** Refer to 3.3.3. Downloading Payroll File for information on downloading a payroll file to a user's local hard drive. A downloaded payroll file may be retrieved, or uploaded in EPRS, for editing, signing and submitting (refer to Section 3.4. Uploading Payroll File).

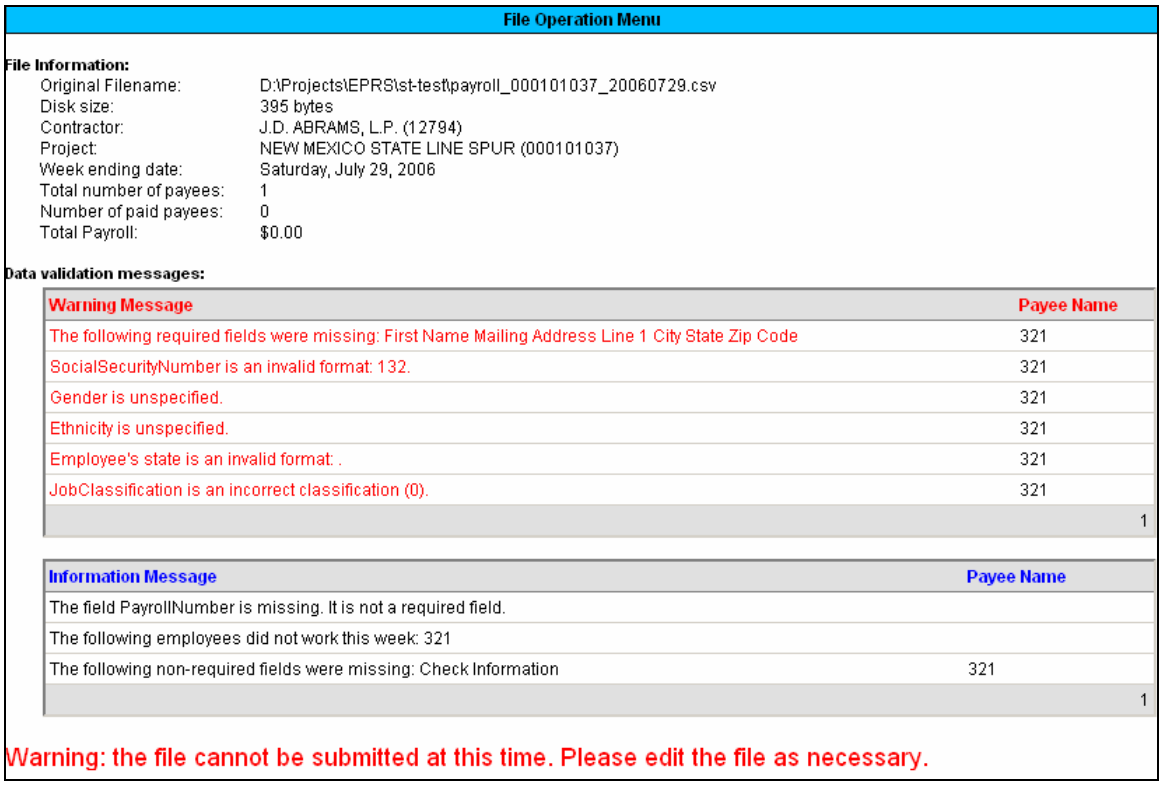
3.3. File Operations Menu

This screen may be reached when uploading a payroll file or creating a new payroll data file, and provides the following information and options

- File Information (see File Summary Figure 63)
- Data Validation Messages (see Figure 63 and Figure 64)
- Edit File option
- View File option
- Merge File option
- Download File option
- Discard File/Return to Main Menu option

The “File Information” portion of the screen contains miscellaneous information regarding the payroll file. The “Original Filename” lists the location and name of the file as contained on the user’s computer, and the file size in bytes. Following is a summary of the project information for the week: The Contractor Name (and ID Number), the Project Description (and ID Number), the day and date of the last day of the payroll week, how many employees are on the payroll, how many employees logged hours for the week, and the total gross salary of all the employees on the payroll.

The “Data validation messages” portion of the screen contains messages that are displayed as either red warning messages or blue informational messages. Warning messages will prevent the user from submitting the payroll file (see Figure 63). Informational messages provide information regarding possible discrepancies, but will not prevent the user from submitting the payroll file (see Figure 64).



File Operation Menu

File Information:

Original Filename:	D:\Projects\EPRS\st-test\payroll_000101037_20060729.csv
Disk size:	395 bytes
Contractor:	J.D. ABRAMS, L.P. (12794)
Project:	NEW MEXICO STATE LINE SPUR (000101037)
Week ending date:	Saturday, July 29, 2006
Total number of payees:	1
Number of paid payees:	0
Total Payroll:	$0.00

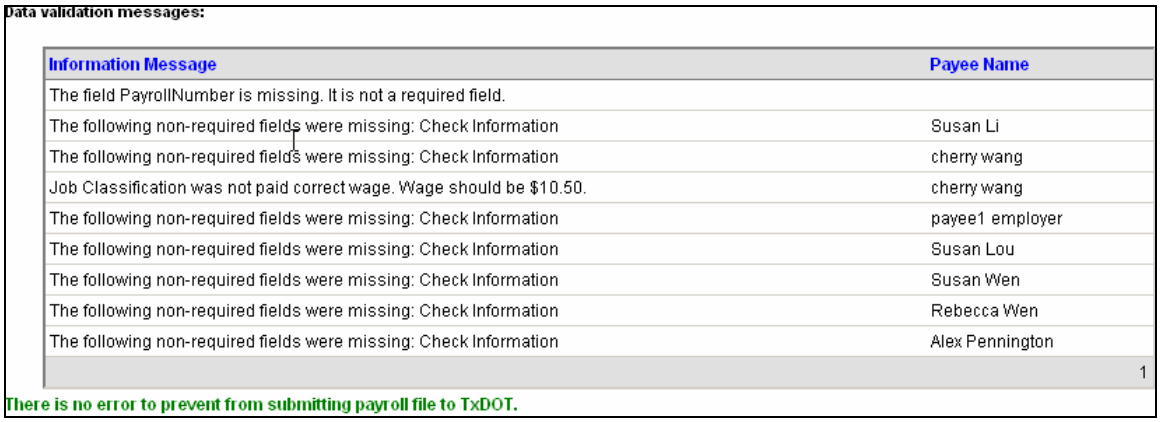
Data validation messages:

Warning Message	Payee Name
The following required fields were missing: First Name Mailing Address Line 1 City State Zip Code	321
SocialSecurityNumber is an invalid format: 132.	321
Gender is unspecified.	321
Ethnicity is unspecified.	321
Employee's state is an invalid format: .	321
JobClassification is an incorrect classification (0).	321
	1

Information Message	Payee Name
The field PayrollNumber is missing. It is not a required field.	
The following employees did not work this week: 321	
The following non-required fields were missing: Check Information	321
	1

Warning: the file cannot be submitted at this time. Please edit the file as necessary.

Figure 63: Data validation message with warning information



Data validation messages:

Information Message	Payee Name
The field PayrollNumber is missing. It is not a required field.	
The following non-required fields were missing: Check Information	Susan Li
The following non-required fields were missing: Check Information	cherry wang
Job Classification was not paid correct wage. Wage should be $10.50.	cherry wang
The following non-required fields were missing: Check Information	payee1 employer
The following non-required fields were missing: Check Information	Susan Lou
The following non-required fields were missing: Check Information	Susan Wen
The following non-required fields were missing: Check Information	Rebecca Wen
The following non-required fields were missing: Check Information	Alex Pennington
	1

There is no error to prevent from submitting payroll file to TxDOT.

Figure 64: Data validation message without warning information

Information messages are generated for four reasons:

- Non-required fields are blank.
- Employees listed were not paid.
- When the regular hourly wage rate is less than the prevailing minimum wage rate applicable to the contract.
- When the overtime hourly wage rate is less than 1.5 times the minimum prevailing wage rate applicable to the contract.

Information messages will not prevent payroll submission using EPRS.

Warning messages are generated for several reasons, such as:

- Required fields are blank.
- Invalid payroll week ending date.
- The Gender or Ethnicity fields are unspecified.
- Fields are incorrectly formatted.
- Invalid contractor (i.e. contractor/subcontractor is not approved to work on the project).
- Duplicate employee entries with the same social security numbers and job classification codes.
- Job Classification code does not match any approved codes for the project.
- An employee record contains amount(s) for Other Deductions, but no descriptions are entered (amounts for any Other Deductions must be accompanied by a description).
- The total for FICA, Withholding, and Other Deductions does not equal the Total Deductions field.
- Other unknown exception error occurs (if this message is generated, the user should proof the data).

For unknown exception errors where the data has been corrected or otherwise verified as correct, contact TxDOT for further instruction (refer to Section 4. System Support and Help). Payroll files with warning messages cannot be submitted using EPRS.

Following the file information and data validation sections of the screen, the following options are available (see Figure 65):

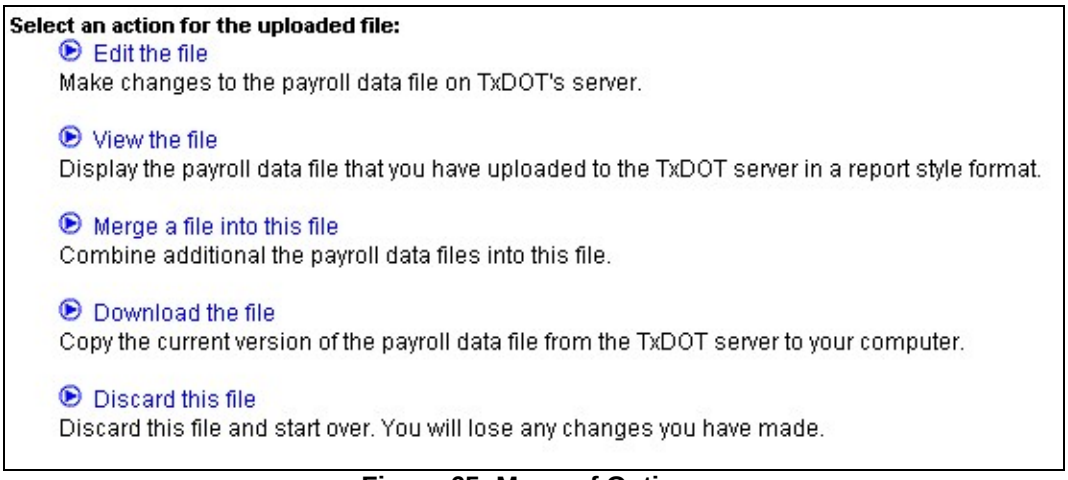


Figure 65: Menu of Options

- Edit the file: This link takes the user to the edit page (Section 3.2. Creating a New Payroll Data File).
- View the file: This page provides a view of the data uploaded in a format similar to the paper payroll contractors currently use (3.3.1. Viewing Data).
- Merge a file into this one: If the user wishes to merge two files into one, click on this link (3.3.2. Merging Files).
- Download the file: If the user wishes to save a copy of this file to their computer, click on this link (3.3.3. Downloading Payroll File).
- Discard this file: Clicking on this link deletes any changes made to the file and returns the user to the Home page, where the user can start over or choose another option.

3.3.1. Viewing Data

Wage Summary Information

Enterprise Construction
ID: 1701

Week Ending: 9/18/2004
Payroll Number: NCC1701

Project Name: Boldly go where no one has gone before
Project CCSJ: 622170130

Second Star to the Right
Austin, TX 78701

Project Address: Straight on till Morning
Austin, TX 78701

Back Download Print

Employee: Name / Address / Social Security Number / Gender, Ethnicity	# Exempt / Work Class / Experience Level		----Hours---- Su 12	Mo 13	Tu 14	We 15	Th 16	Fr 17	Sa 18	Total Hours	Hourly Rate	Cash in Lieu of Benefits	Gross Amounts Earned / Total	Deduction Description	Deduction Amount / Total	Check Number / Net Chk
Kirk , James Tiberius Captain's Quarters, Enterprise A Deck 6 Austin , TX 78701 321-54-6987 M , White	0 139 - Electrician Journeyman	O S	0.0 8.0	0.0 8.0	0.0 8.0	2.0 8.0	2.0 8.0	0.0 8.0	0.0 0.0	4.0 48.0	$84.00 $56.00	$10.00	$336.00 $3,168.00 $3,504.00	FICA Fed W/H 401(k) Hooter's Scholarship	$256.00 $128.00 $64.00 $32.00 $0.00 $480.00	001 $3,024.00
McCoy , Leonard Bones Bridge Officer's Quarters Medical Bay Austin , TX 78701 321-54-6923 M , White	1 522 - Sign Installer (PGM) Journeyman	O S	0.0 8.0	0.0 8.0	0.0 8.0	0.0 8.0	0.0 8.0	5.0 8.0	0.0 0.0	5.0 48.0	$78.00 $52.00	$7.00	$390.00 $2,832.00 $3,222.00	FICA Fed W/H 401(k)	$200.00 $100.00 $50.00 $0.00 $0.00 $350.00	003 $2,872.00
Spock , Mister First Officer's Quarters Vulcan Austin , TX 78701 321-54-6978 M , Native American	1 148 - Fireman Journeyman	O S	2.0 8.0	2.0 8.0	0.0 8.0	0.0 8.0	0.0 8.0	0.0 8.0	0.0 0.0	4.0 48.0	$78.00 $52.00	$8.00	$312.00 $2,880.00 $3,192.00	FICA Fed W/H 401(k) Vulcan School of Science	$200.00 $100.00 $50.00 $25.00 $0.00 $375.00	002 $2,817.00

Back Download Top Print

Figure 66: Viewing an Exchange File

From this screen the user can view the data in the file, download the file, or print the screen. Download works the same on this page as it does on the "File Operations Menu" screen (3.3. File Operations Menu). Any warnings will be highlighted in red.

In order to print this screen, the layout must first be changed to "Landscape." To do this, click on File → Page Setup. In the section Orientation, select "Landscape" and click "OK." Then click on the Print Icon  on the web browser. The page will then print to the designated printer.

3.3.2. Merging Files

Selecting the "Merge a file into this file" option will direct the user to the "Merge Operations Menu" (see Figure 67). The merge options screen contains a file information section (similar to the "File Operations Menu" screen) and contains the following three options:

- Continue with Merge
- Upload
- Discard

The upload file option allows the uploading of a file by the user to merge with the active file. Selecting this link will direct the user to an upload screen similar to the initial upload screen (refer to Figure 71). If the second file uploads correctly, the program will check to ensure files are compatible (i.e. the following fields must be identical: Contractor ID, Submit Year, Submit Month, Submit Day, and Project ID). If the two files are not compatible, an error message will be displayed (see Figure 68). In the example provided, two of the required fields contained in the payrolls are different (Submit Month and Submit Day), which prevented merging the two payroll files. In this instance, the only options the user has available are the upload and discard options.

Selecting the "Discard" option will take the user back to the "File Operations Menu" screen (refer to 3.3. File Operations Menu). If a second payroll was previously uploaded, the file will be discarded.

Selecting the "Continue with Merge" option will only be allowed if the second file was uploaded correctly. If compatible, the files will be merged. If the merge was successful, the user will be returned to the "Merge Operations Menu" screen, where another file may be merged with the current payroll file.

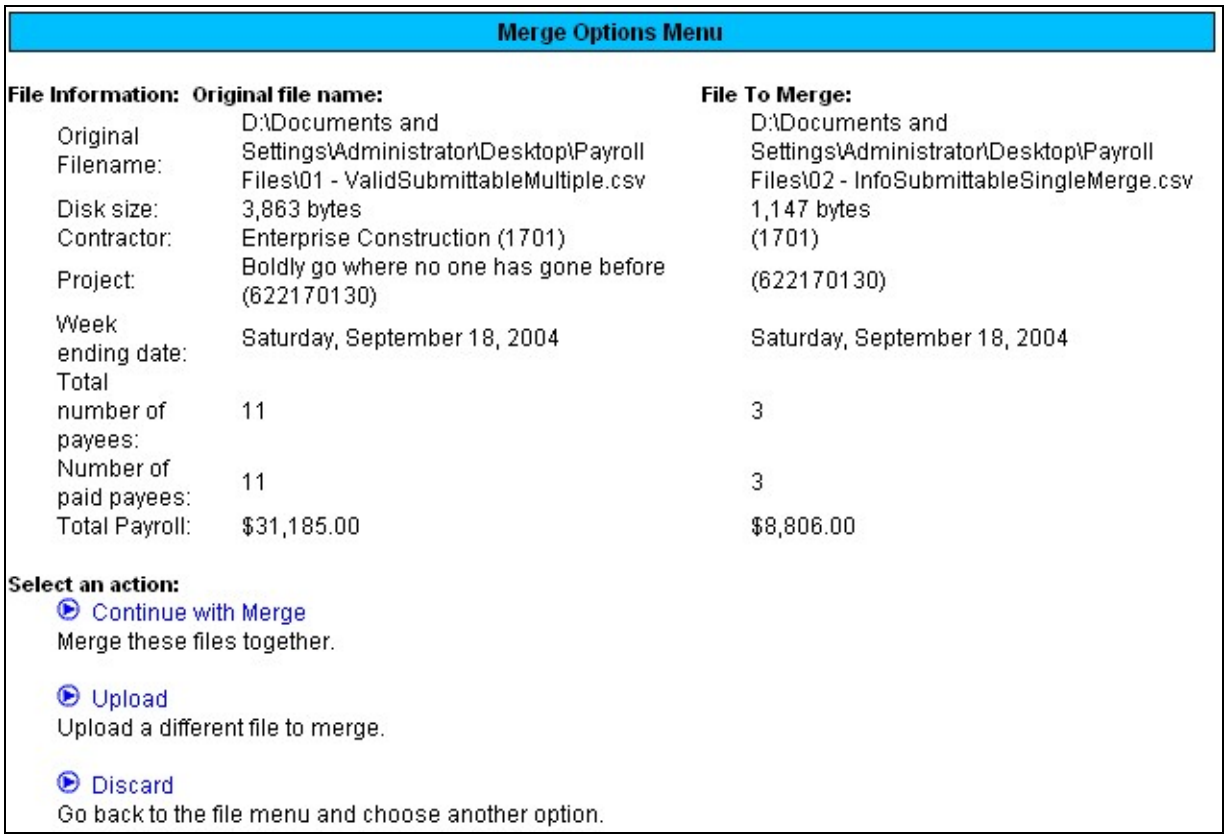


Figure 67: Merging Two Files

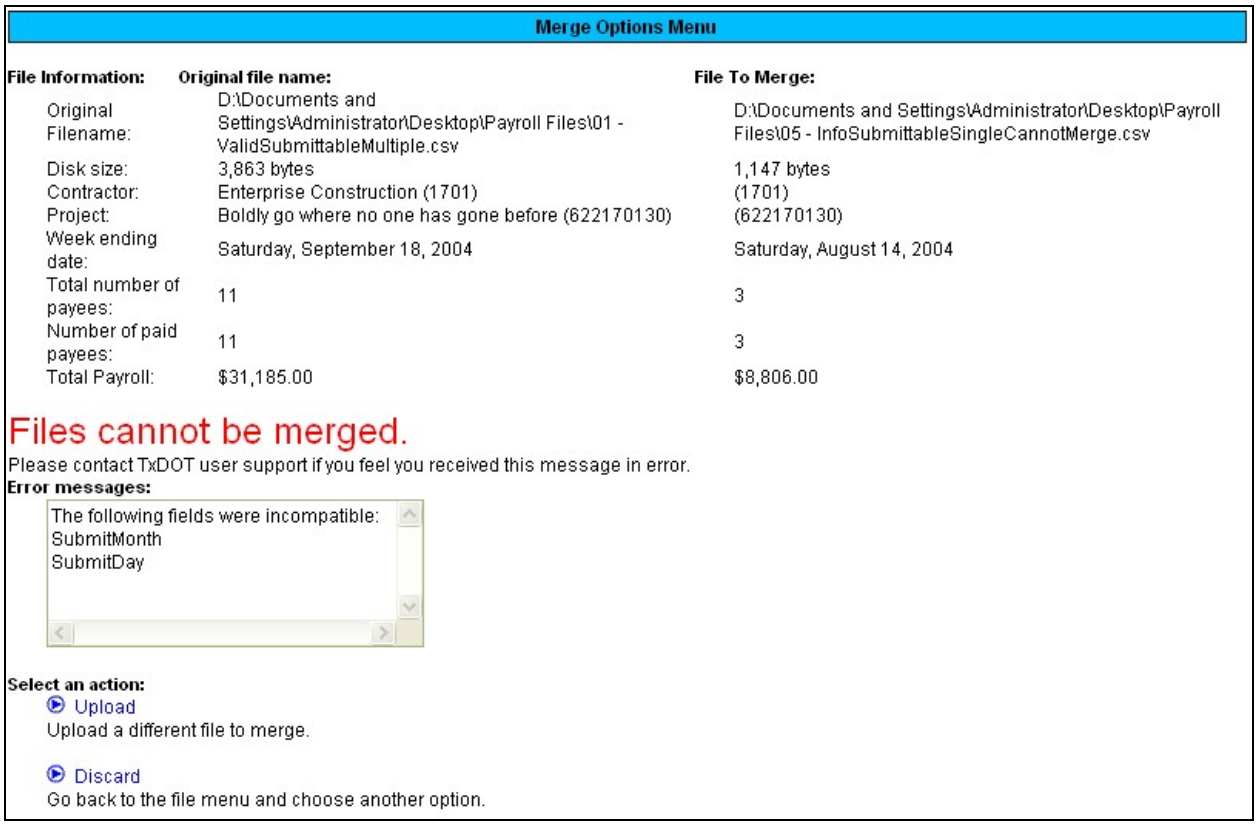


Figure 68: Errors, Cannot Merge

3.3.3. Downloading Payroll File

This link does not take the user to another screen, but brings up a dialog box instead (see Figure 69).

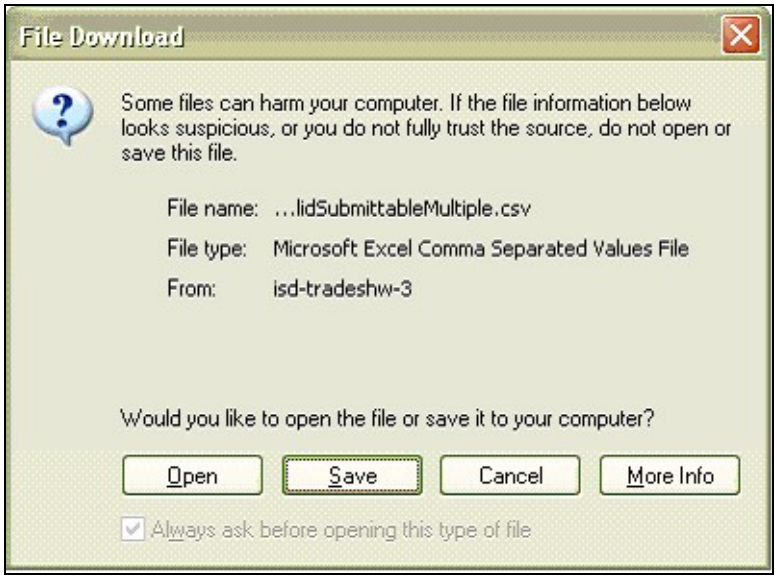


Figure 69: Download a File

Clicking on "Save" will bring up a browse box that allows the user to enter a file name and navigate to the location where they wish to save the file on their computer. Clicking "Save" (see

Figure 70) will then save the file to the user's computer under the name and in the location specified. Users may download a payroll file from either the "File Operations Menu" screen or the "View the File" option selected from the "File Operations Menu" screen.

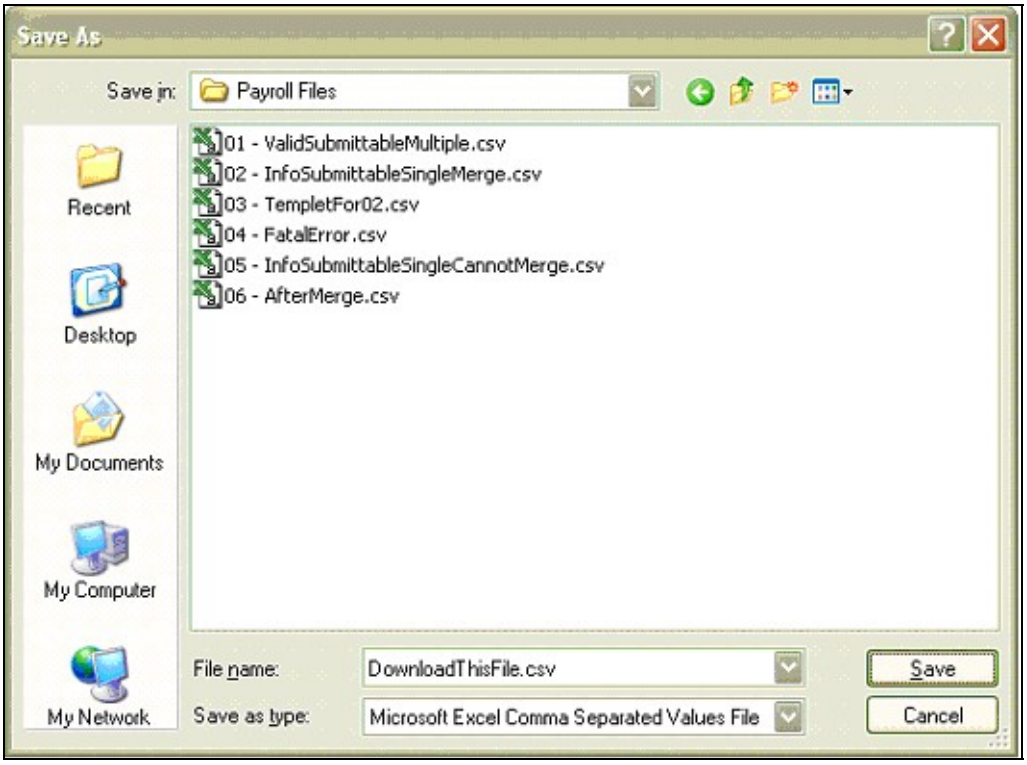


Figure 70: Click Save to Download the File

3.3.4. Discard this file

Selection of this link discards any changes the user may have made to the file and returns the user to the EPRS home page (Section 3.1. Home Page). ***Failure to download a payroll file prior to clicking on this link will result in the loss of all data. The user is not prompted for confirmation of this discard.***

3.3.5. Application Error Page

In those instances where a catastrophic error occurs, the system will display an error screen and direct the user back to the EPRS home page. Refer to Section 4. System Support and Help if unexplainable errors occur.

3.4. Uploading Payroll File

Use of this option will require a TxDOT issued digital certificate. Clicking on this link will allow a user to upload a file downloaded from the EPRS website, or saved as a CSV file, on the user's local computer. To upload a file, click on "Browse," which brings up a dialog box (see Figure 71 and Figure 72). Navigate to the desired file and click "Open." To continue to the next page, simply click "Upload Payroll File" (clicking this box is not possible without a TxDOT issued digital certificate) (see Figure 73). Clicking on "Cancel uploading a file" will cancel any action taken and return the user to the EPRS home page.

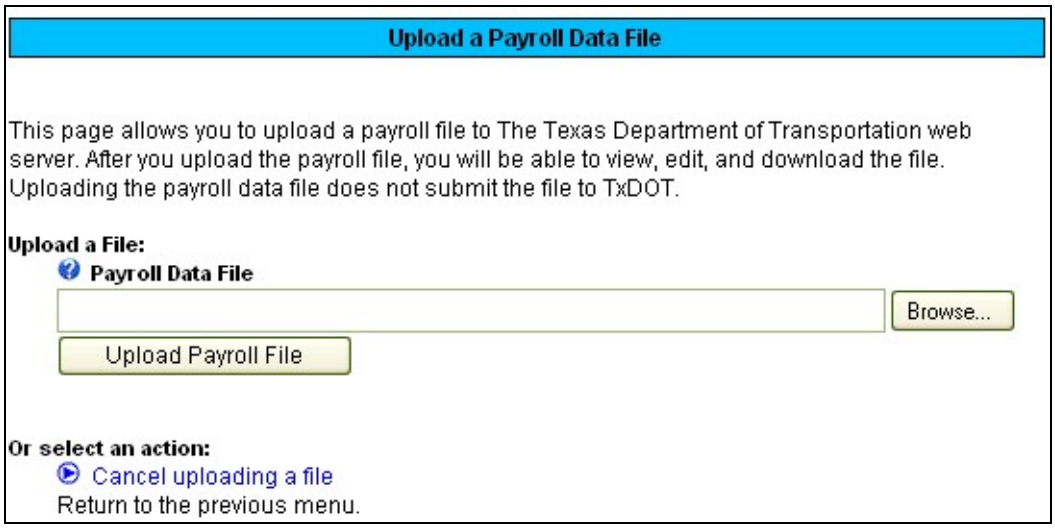


Figure 71: Upload a File

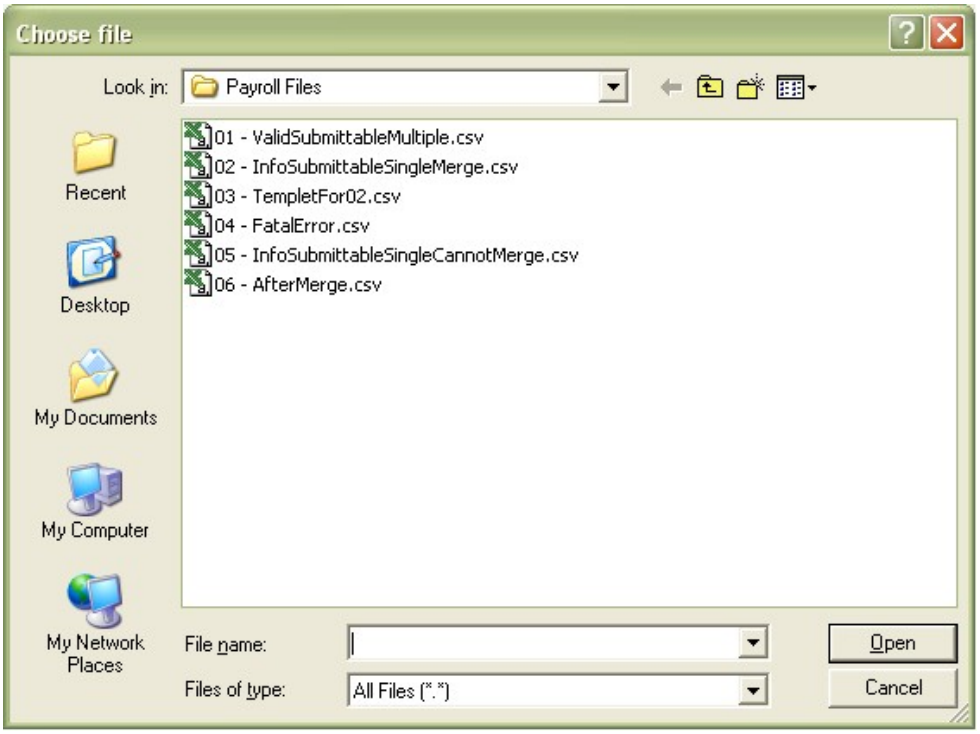


Figure 72: Open a File

Figure 73: Ready to Continue

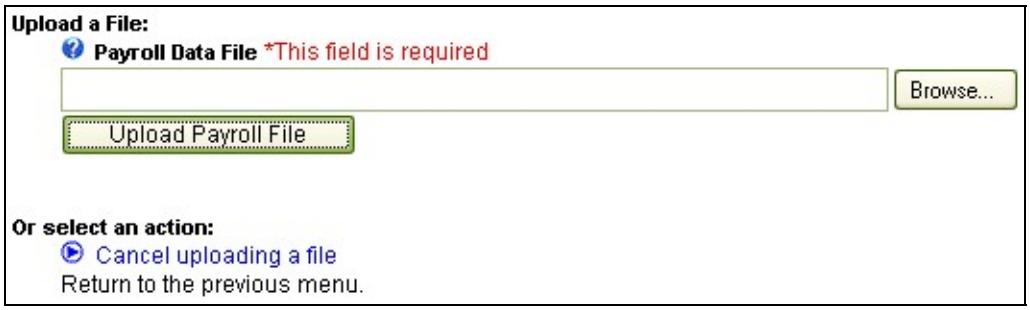


Figure 74: A Path and Filename is Required

If errors occur in attempting to upload a payroll file, the user will be directed to the "Exchange File Parsing Errors" screen (see Figure 75). If no errors are encountered, the user will be directed to "File Operations Menu" screen described in 3.3. File Operations Menu.

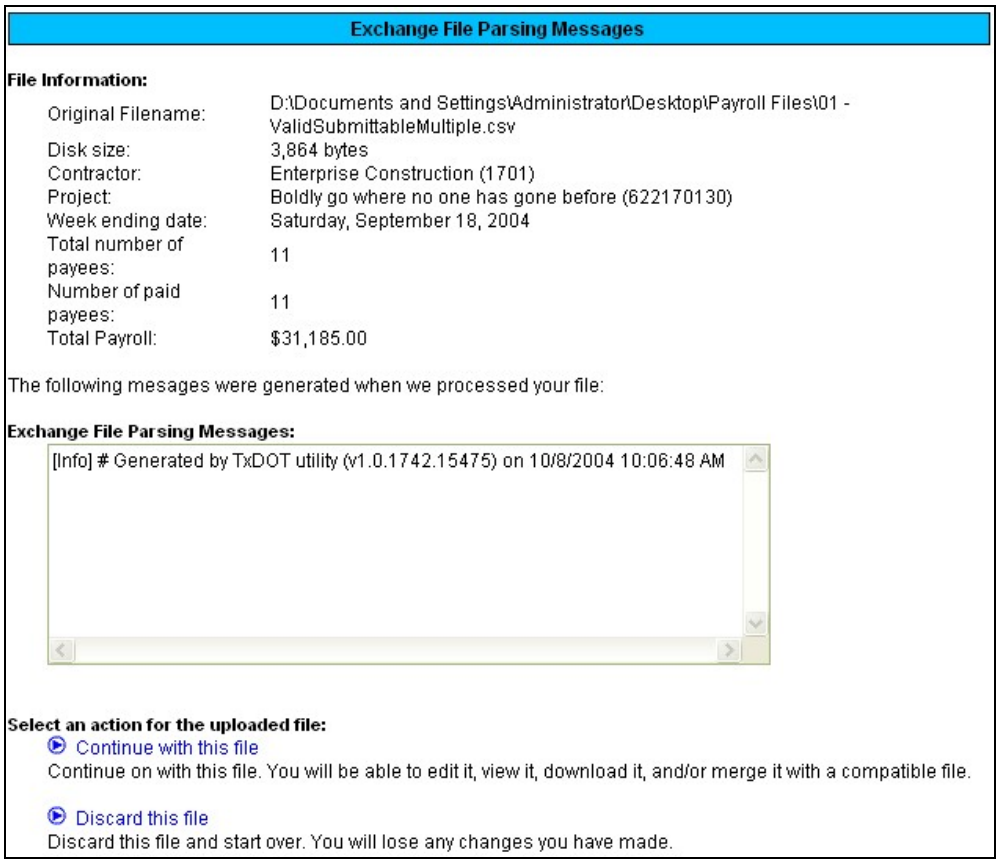


Figure 75: Information about Parsing

When uploading a payroll file, the following error messages may be displayed on the "Exchange File Parsing Messages" screen (see Figure 75 and Figure 76). Messages will display a level and brief description of the actual issue. Three message levels exist as described below:

- "Fatal" (highest): A file cannot be edited or submitted. This type of message only appears when processing the file, and cannot be created while editing the file through the website.
- "Warning" (medium): A file can be edited, but cannot be submitted.
- "Info" (lowest): A file can be both edited and submitted. These messages are informational only and intended to provide notes of interest, such as blank non-required fields; employees listed with no hours worked; when the file was generated, and by whom; etc.

While all three message levels may be seen on this screen, the presence of any "Fatal" messages will prevent the user from continuing; the user's only option is to discard the file and start over (see Figure 76). The user may continue with the payroll file upload only if the messages are "Info" or "Warning" and the file was correctly processed.

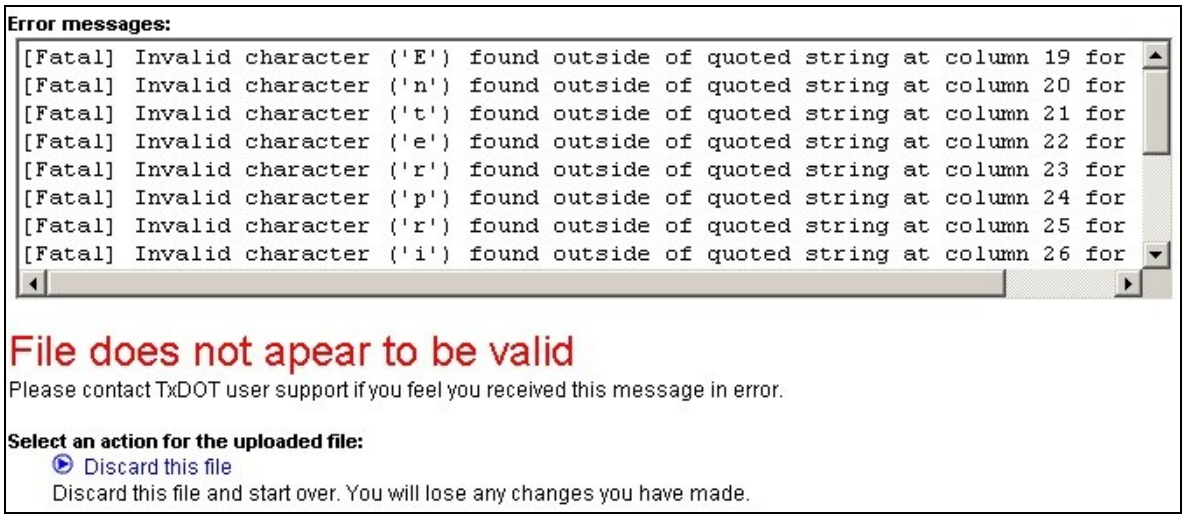


Figure 76: Fatal Errors during Parsing

3.4.1. Submitting Payroll Corrections

Corrected payrolls must be submitted when payroll errors or discrepancies are discovered. In order to submit a corrected payroll file, you will need to upload the originally submitted payroll in accordance with Section 3.4. Uploading Payroll File. If the originally submitted payroll file was created using EPRS, you will need to upload the original payroll file that was downloaded under Section 3.3.3. Downloading Payroll File. If the originally submitted payroll file was exported from the user's personal software program, you will need to upload the original exported CSV file.

Once the originally submitted payroll file is uploaded into EPRS, make the appropriate corrections to the payroll file by clicking on "Edit the file" from the "File Operations Menu" (refer to Figure 65). Once all corrections have been made to the payroll file, save and download the file in accordance with Section 3.3.3. Downloading Payroll File. At this point, the corrected file may then be signed and resubmitted to TxDOT in accordance with Section 3.5. Signing and Submitting a Payroll File to TxDOT.

If a personal payroll software program is used and supplemental wages are paid in a current payroll period to correct incorrect wages paid during a previous payroll period, the payroll file for the current payroll period will also require editing. Correct the original payroll file as indicated above and remove any payroll entries for supplemental wages paid in the current payroll using the "Edit the file" link from the "File Operations Menu." The following is provided as an example of this process:

> *During a district review of electronic payrolls submitted for XYZ Contractor, it is discovered that "Joe Smith" was paid for 40 hours work at an hourly wage rate of $6.50 per hour; however, the prevailing minimum hourly wage rate for Joe's job classification is $6.75 per hour. XYZ Contractor institutes a supplemental paycheck for Joe during the current payroll period for 40 hours work at $0.25 per hour using his personal payroll software program. XYZ Contractor uploads the originally submitted CSV file, edits the original payroll to reflect the corrected hourly wage rate of $6.75 for Joe, and resubmits to TxDOT using EPRS. After uploading the CSV file for the current payroll period, and prior to signing and submitting to TxDOT, the contractor will edit the current payroll file using the EPRS edit function from the "File Operations Menu" to remove the payroll entry for Joe at the $0.25 hourly wage rate.*

3.5. Signing and Submitting a Payroll File to TxDOT

Selection of this option will direct the user to the "Create Certification Statement" screen (see Figure 77). This screen contains the required certification statement associated with payroll submittal. The user has the choice to check or uncheck certain options, and add a list of exceptions to the statements provided.

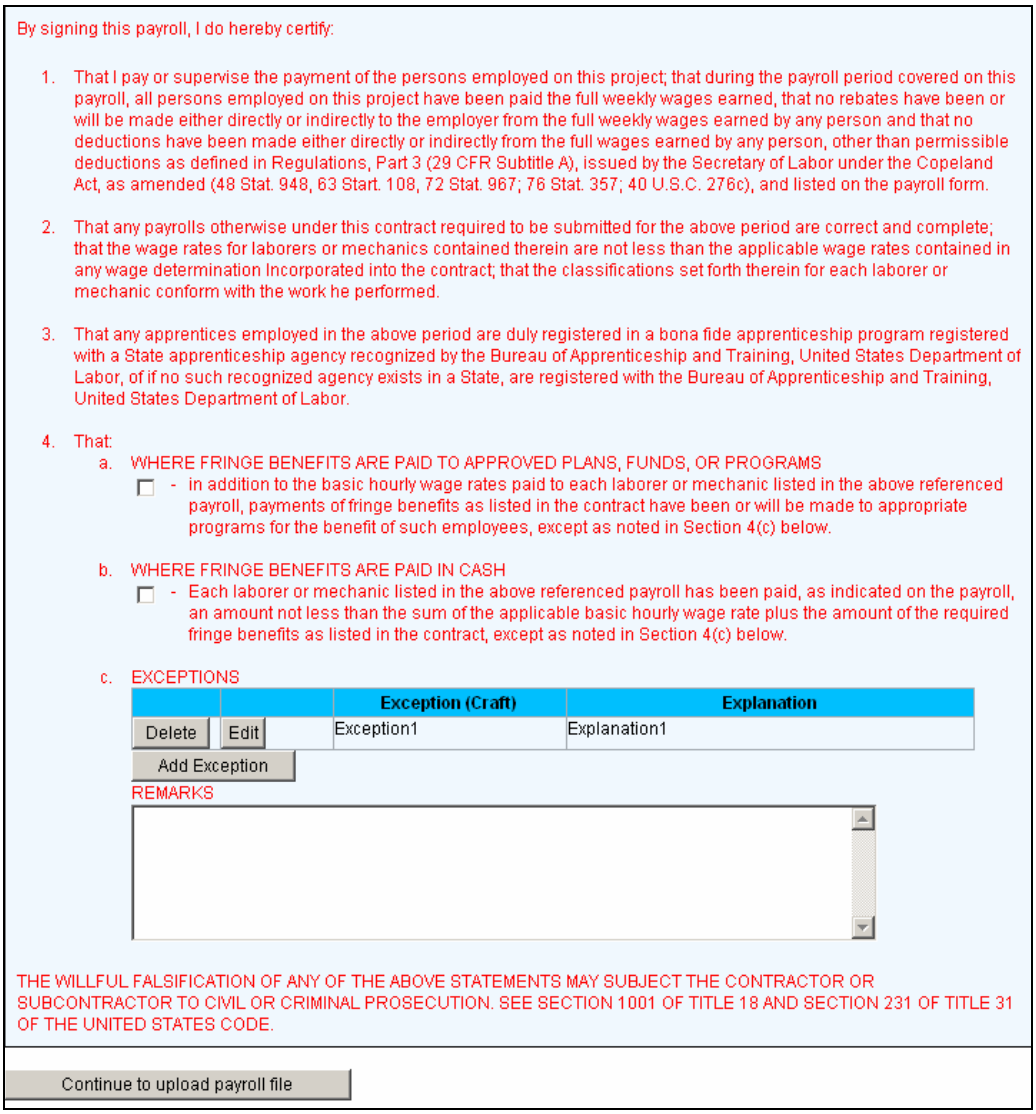


Figure 77: Creating Certification Statement

Click “Add Exception” to add exceptions to the statements provided. Users may also make corrections for errors, if necessary, or delete exceptions that have been added.

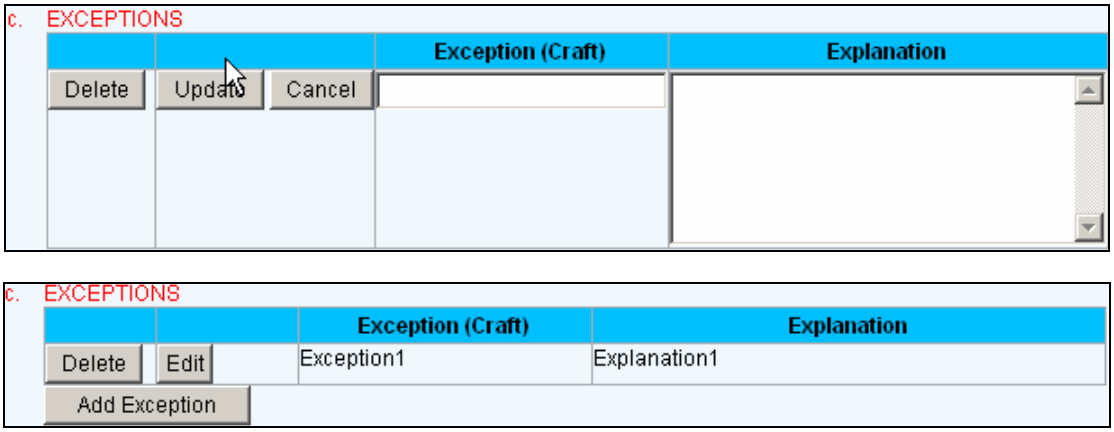


Figure 78: Add Exceptions

After entering the relevant data, click “Continue to upload payroll file.” If a pop-up box appears, asking for the user to confirm acceptance of a Java Applet, click “Yes” in order to proceed. If the pop-up box does not appear, or if the user is prompted to install the Java Runtime Environment (JRE), exit the application and install JRE (refer to Section 2.2. Java 2 Runtime Environment (JRE).

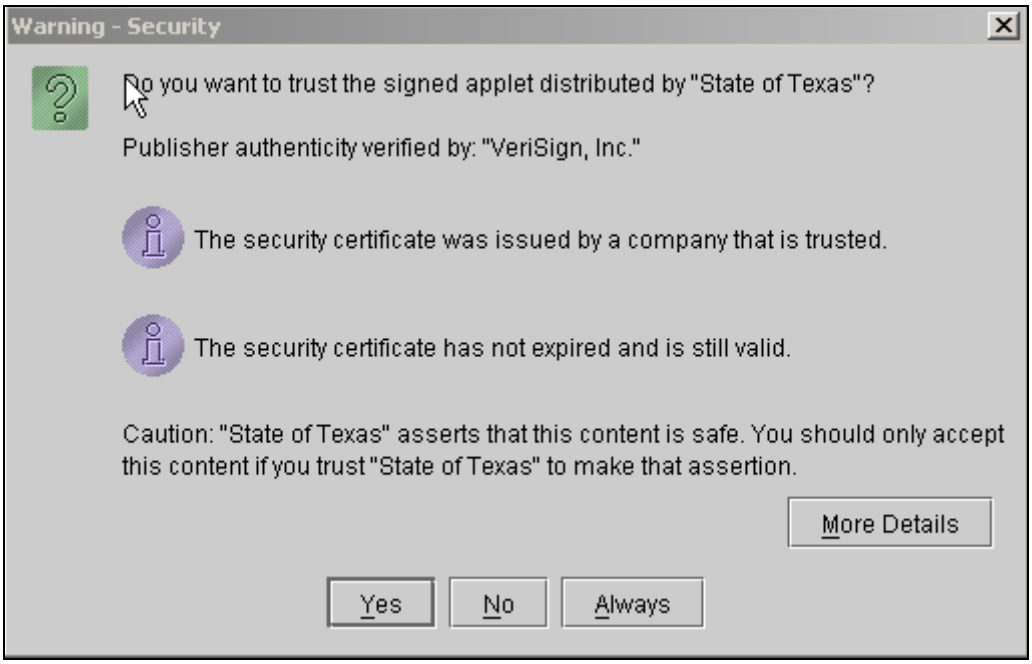


Figure 79: Popup window for the Java Applet

The user may then navigate to the file that is to be signed and submitted (see Figure 80), and click “Sign and Upload Data,” or click on “Return to main menu” to start over.

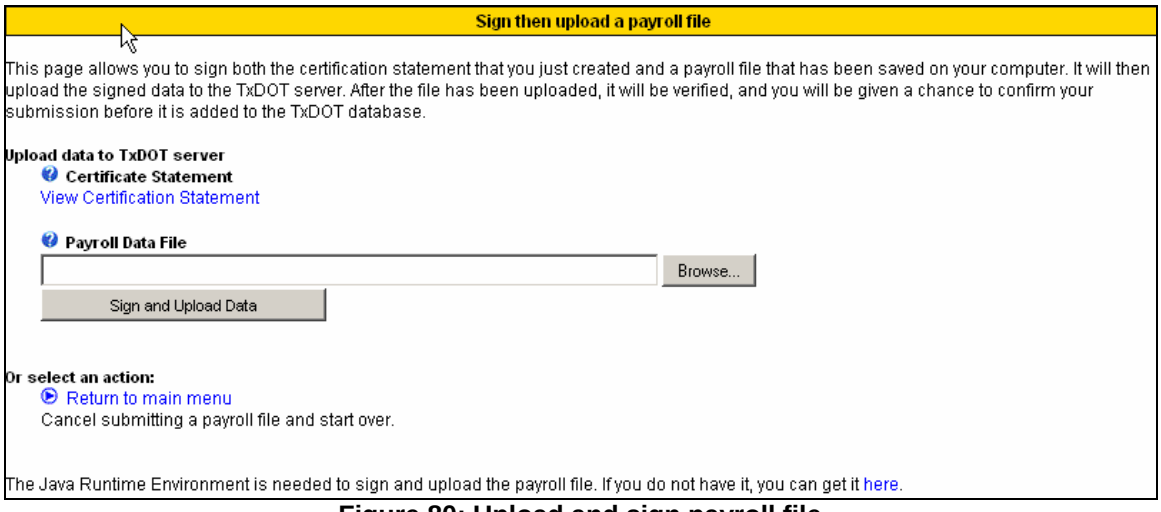


Figure 80: Upload and sign payroll file

If the user chooses to "Sign and Upload Data," a dialog box pops up asking the user to enter a certificate and password (see Figure 81). The certificate will be the .pfx file that you exported under Section 2.1.2. Exporting Digital Certificates, (refer to Figure 19), while the password is the same password saved when exporting the certificate (refer Figure 23). After entering the requested information and clicking "Upload," the user is directed to the "Submit Payroll File" screen where they are asked to confirm the submission of the payroll file (see Figure 82). If the user chooses "Submit Payroll to TxDOT," the file is checked for correctness and, if possible, submitted to the TxDOT database (see Figure 83).

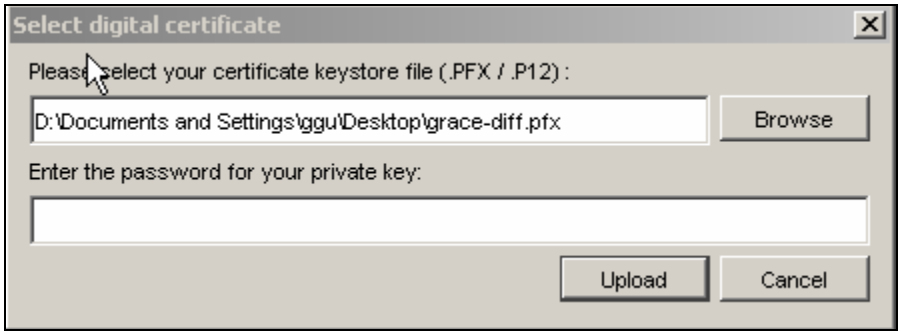


Figure 81: Choose the Certificate and Enter the Password

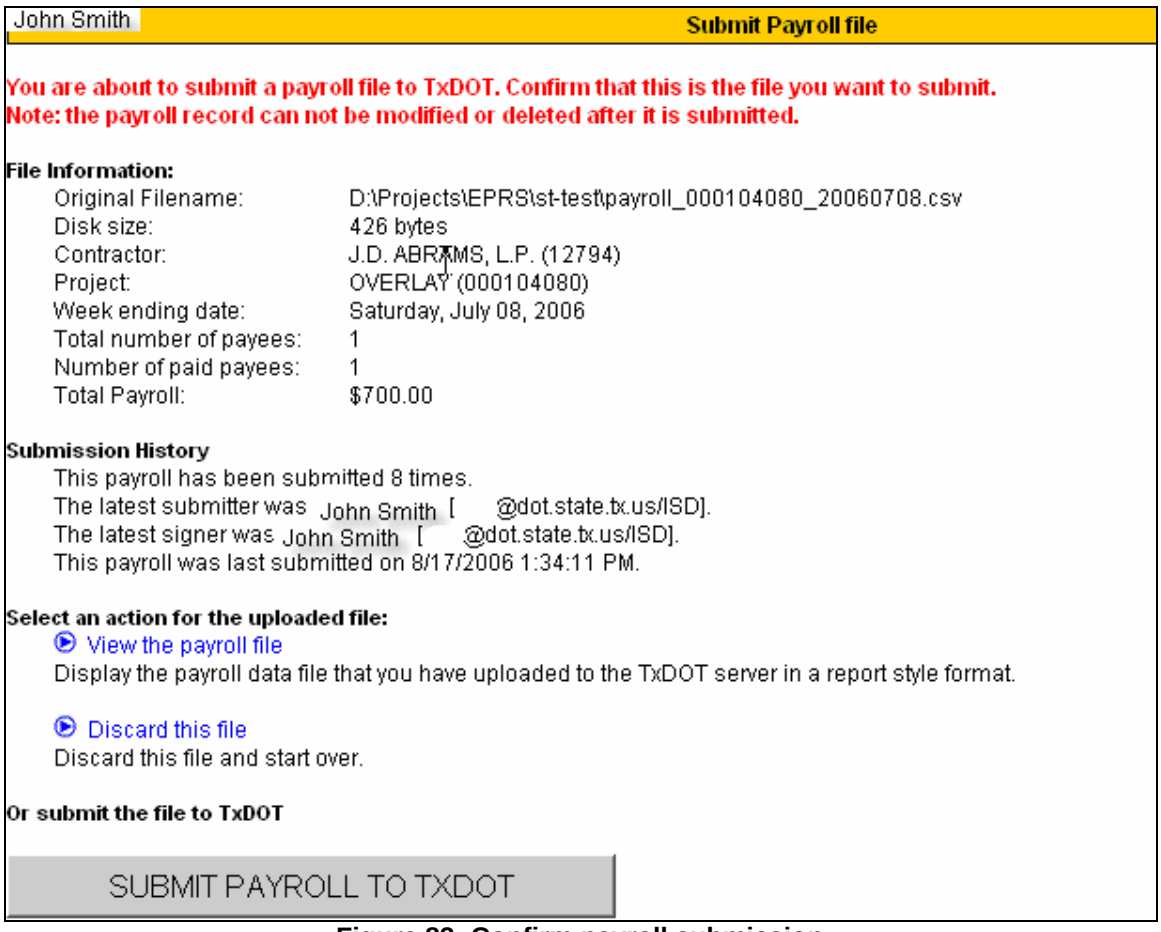


Figure 82: Confirm payroll submission

Figure 83: Payroll submission summary

4. System Support and Help

If problems or errors occur, refer to this user guide and the Frequently Asked Questions (FAQ) located on the EPRS website. If further assistance is need, contact the appropriate TxDOT District Wage Coordinator, or the CST EPRS Help Desk at (512) 416-2435 or (512) 416-2520.

U.S. Department of Labor

Employment Standards Administration
Wage and Hour Division
Washington, D.C. 20210

NOV 12 2004

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Re: Electronic Signatures and the Copeland Act

Dear Sirs:

I am writing in response to your inquiry concerning the use of electronic signatures on documents submitted to satisfy the requirements of the Copeland Act and its regulations, at 29 CFR 3.3 and Part 5. Current law establishes that the proper use of electronic signatures on certified payrolls and related compliance statements satisfies the requirements of the Copeland Act and its implementing regulations. Those signatures carry the same legal effect as handwritten signatures. The discussion below outlines the statutory and regulatory requirements in question, including record retention, and the use of electronic signatures to satisfy those requirements. Additionally, the addresses of several of the Office of Management and Budget's websites are provided to assist in ensuring the highest possible level of accuracy, efficiency and security when compliance documents are submitted and received electronically.

Copeland Act

The Copeland Act prohibits inducing

> by force, intimidation, threat of procuring dismissal from employment, or otherwise, any person employed in the construction or repair of public buildings or public works, financed in whole or in part by the United States, to give up any part of the compensation to which that person is entitled under a contract of employment.

18 U.S.C. 874. Section 2 of the Copeland Act further requires "each contractor and subcontractor to furnish a weekly statement with respect to the wages paid each employee during the preceding week." 40 U.S.C. 3145(a)(formerly 40 USC 276(c)).

The statute's implementing regulations provide, in relevant part, that each covered contractor or subcontractor

> shall furnish each week a statement with respect to the wages paid each of its employees engaged on [covered] work . . . during the preceding weekly payroll period. This statement shall be executed by the contractor or subcontractor or by an authorized officer or employee of the contractor or subcontractor who supervises the payment of wages, and shall be on form WH 348, "Statement of Compliance", or on an identical form on the back of WH 347, "Payroll (For Contractors Optional Use)" or on any form with identical wording.

29 CFR 3.3(b). See also 29 CFR 5.5(a)(3)(ii)(A) (requiring regular submission of payroll copies to the appropriate federal agency). The regulations further specify as follows:

> Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract.[1]

---

[1] The signed compliance statement must provide the following certifications:

29 CFR 5.5(a)(3)(ii)(B) (emphasis added).

While the Copeland Act does not require that the "weekly statement" be signed, the implementing regulations do require a signed "statement of compliance." However, the regulations do not specify that the signature should be "handwritten." In addition, Wage and Hour's Form WH-347 also does not contain any language prohibiting electronic signing. See 29 CFR 5.5(a)(3)(ii)(C) (authorizing the use of Form WH-347 to satisfy the "statement of compliance" requirement). Furthermore, the Department is aware of no decision by the Administrative Review Board or any federal court addressing the issue of whether the Copeland Act requires a handwritten signature on the contractor's compliance statement. Thus, there is nothing in the Copeland Act, its implementing regulations, or the caselaw expressly prohibiting the use of electronic signatures as a valid means of compliance with the Copeland Act's reporting requirements.

> (1) That the payroll for the payroll period contains the information required . . . and that such information is correct and complete;
>
> (2) That each laborer or mechanic . . . employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR Part 3;
>
> (3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

29 CFR 5.5(a)(3)(ii)(B)(1)-(3).

Supporting Legislation

Recent legislation authorizes and directs federal agencies to accept the use of electronic signatures. Government regulatory and enforcement activities, such as those under the Davis-Bacon and Related Acts, are generally subject to the Government Paperwork Elimination Act (GPEA), Pub. L. 105-277, 112 Stat. 2681 (1998) (codified at 44 U.S.C. 3504, note), which requires, when practicable, that Federal agencies use electronic forms, electronic filing, and electronic signatures to conduct official business with the public. In section 1707, the GPEA states, in relevant part, that

> [e]lectronic records submitted or maintained in accordance with procedures developed under this title . . . or electronic signatures or other forms of electronic authorization used in accordance with such procedures, shall not be denied legal effect, validity, or enforceability because such records are in electronic form.

44 U.S.C. 3504, note.

Additionally, the Electronic Signatures in Global and National Commerce Act (E-Sign Act), Pub. L. No. 106-229, 114 Stat. 464 (2000) (codified at 15 U.S.C. 7001, et seq.), which applies to commercial transactions between the Government and private entities, similarly provides that

> a signature, contract or other record . . . may not be denied legal effect, validity, or enforceability solely because it is in electronic form; and . . . a contract . . . may not be denied legal effect, validity, or enforceability solely because an electronic signature or electronic record was used in its formation.

15 U.S.C. 7001(a)(1) and (2).

In support of these laws, the Office of Management and Budget (OMB) offers extensive guidance to assist federal agencies in the use of electronic forms, filing, and signatures with which to conduct official business. See e.g., http://www.whitehouse.gov/omb/fedreg/gpea2.html (OMB guidance to agencies on implementing GPEA); www.whitehouse.gov/omb/memoranda/m00-10.html (same); www.whitehouse.gov/

omb/memoranda/esign-guidance.pdf (OMB guidance on E-Sign Act); www.whitehouse.gov/omb/memoranda/m00-15.html (same).

Record Retention

While the implementation of systems with which to accept electronic records has been largely left to the discretion of the federal agency, for purposes of the Copeland Act and the Davis-Bacon and Related Acts, agencies should be reminded that, in accordance with the Reorganization Plan No. 14 of 1950, reprinted in 5 USC Appendix, and in 64 Stat. 1267, they continue to act as the first level of enforcing authority for ensuring that appropriate records are maintained by the contractor and the employees are compensated in accordance with the Davis-Bacon Act. See 29 CFR 5.6. Moreover, because the use of such records may be required for litigation purposes, a reliable means of retrieving compliance documents collected and stored electronically should be included in any such methodology or arrangement.

In addition to filing requirements, contractors continue to have an obligation to retain records. The regulations state that: "Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work . . . ." 29 CFR 5.5(a)(3)(i). Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof . . .), daily and weekly number of hours worked, deductions made and actual wages paid. Id. The use of electronic signatures in no way negates the record keeping requirements and responsibilities outlined above.

Conclusion

Pursuant to the pertinent provisions of the Copeland Act and the GPEA, described above, accurate electronic signatures are sufficient for compliance purposes under the Copeland Act. However, all parties are reminded of the responsibility to ensure the accuracy of the electronic signature process, and the proper retention and accessibility of the resulting electronically transmitted

documents. For any further questions or concerns on this subject, please contact Timothy Helm, Team Leader, Office of Enforcement Policy, Government Contracts Team. He can be reached on 202-693-0574.

Sincerely,

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Acting Administrator

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