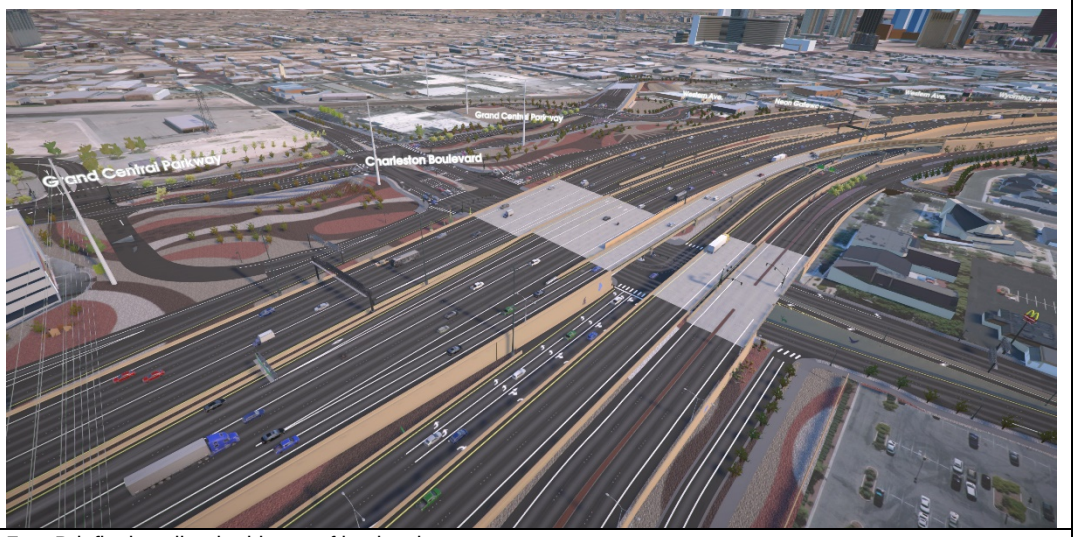
AASHTO Innovation Initiative

Nomination of Technology Ready for Implementation

<table>
<tr><td>Sponsor</td><td>Nominations must be submitted by an AASHTO member DOT willing to help promote the technology</td><td colspan="3">1. Sponsoring DOT (State): Nevada</td></tr>
<tr><td></td><td></td><td colspan="3">2. Name and Title: Amir Soltani, Chief of Project Management; Nick Johnson, Senior Project Manager; and Dale Keller, Senior Project Manager</td></tr>
<tr><td></td><td></td><td colspan="3">Organization: Project Management</td></tr>
<tr><td></td><td></td><td colspan="3">Street Address: 1263 Stewart St.</td></tr>
<tr><td></td><td></td><td>City: Carson City</td><td>State: NV</td><td>Zipcode: 89712</td></tr>
<tr><td></td><td></td><td>E-mail: asoltani@dot.state.nv.us; njohnson@dot.state.nv.us; Dkeller@dot.state.nv.us</td><td>Phone: (775)-888-7321 (Amir); 775-430-0995 (Nick); (702) 667-4533 (Dale)</td><td>Fax: (775)-888-7322</td></tr>
<tr><td></td><td></td><td colspan="3">3. Is the sponsoring State DOT willing to promote this technology to other states by participating on a Lead States Team supported by the AASHTO Innovation Initiative? Yes or No: Yes</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">4. Name of Technology:

Virtually Immersive Visualization</td></tr>
<tr><td></td><td></td><td colspan="3">5. Please describe the technology.

Traditional visualization focuses on creating projects for specific camera angles and then rendering image and video files. Virtually Immersive Visualization (VIV) focuses on modeling the project in 3D as accurately as possible along with the existing and contextual elements (near buildings, billboards, signs…) and optimizing this realistic 3D representation of the project and adjacent infrastructure for real-time performance. This optimized virtual world can then be used to render videos and images as other visualization but also adds the ability to offer immersive visualization including an interactive version of the project accessible via touch screen kiosk and with virtual reality including virtual helicopter tours over the proposed project. Actual existing and proposed data is utilized to build the realistic model and a game engine is utilized for real-time presentation.</td></tr>
</table>

		6. 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 list your attachments here. A demonstration of the interactive version of this technology utilized for Project Neon in Las Vegas can be seen at this link: https://www.youtube.com/watch?v=MM4HBSqDH9A The virtual helicopter tour can be seen here: https://www.youtube.com/watch?v=Bm3eyEQaml0 Final rendered video can be seen here: https://www.youtube.com/watch?v=tORVfHU4kLM (in 4k resolution) More information about Project Neon can be found at www.ndotprojectneon.com 
State of Development (30 points)	Technologies must be successfully deployed in at least one State DOT. The AII selection process will favor technologies that have advanced beyond the research stage, at least to the pilot deployment stage, and preferably into routine use.	7. Briefly describe the history of its development. Project NEON is the state of Nevada's largest and most expensive public works project ever. The project is located in the heart of Las Vegas with a total cost estimate of approximately $900 million dollars. The 3.7-mile stretch of I-15 between Sahara Avenue and the Spaghetti Bowl is the busiest stretch of roadway in Nevada. It sees 300,000 vehicles per day and 25,000 lane changes per hour, resulting in 3 crashes per day. Traffic in the project area is expected to double by 2035. An element of the project outreach program includes 3D visualization to allow traveling public, homeowners, businesses, local and regulatory agencies to see impact of the project to their businesses, properties and environment. Sam Lytle, PE worked for NDOT from 2009 to 2013 where he started to develop visualization techniques for NDOT projects. He left NDOT and started Civil FX, a consulting firm focused on visualization of large infrastructure projects. In 2015, Civil FX was part of the winning team pursuing Project Neon as the visualization lead. As the Civil FX team had extensive experience in both civil engineering data and video game engine technology, they delivered the project's visualization requirements by developing the Virtually Immersive process. The rendered visualization has been used extensively for public outreach by news organizations while the immersive elements of the virtual model (interactive kiosk and virtual reality) are used daily in the public information office which has two touch screen kiosks, two virtual reality headsets and a large 4k television.

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

The Project Neon visualization started in November of 2015 and was delivered in May of 2016. Since then, NDOT has utilized Virtually Immersive Visualization via Civil FX on another project, SR-28 Shared Use Path at Lake Tahoe, NV which is currently under construction. A rendering of this project can be seen here: https://www.youtube.com/watch?v=ZIBpUagrc2g and the virtual helicopter tour here: https://www.youtube.com/watch?v=XcZPKuxhQ4A

Nevada State Route 28 south of Lakeshore Drive, in Incline Village on Lake Tahoe's east shore, parallels 11 miles of undeveloped shoreline, the lake's longest stretch. The two-lane, mountainside road is also the only access route for over one million recreationists and 2.6 million-plus vehicles per year. Use along the corridor continues to grow, with shoulder-parking projected to double in the next 20 years. The conditions are challenging for motorists and the nearly 2,000 pedestrians and bicyclists using travel lanes during peak times.

In response to increasing demand and to address and mitigate safety and environmental concerns, NDOT partnered with 13 federal, state, and local agencies to work collaboratively to identify solutions and develop the recommendations included within the SR 28 National Scenic Byway Corridor Management Plan. As part of this effort, 3D visualization has been used to address public and regulatory concerns. This approach vastly enhanced interagency coordination, regulatory review and approval.

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

There are two elements that would make routine deployment of VIV technology possible. The first is a fully developed interface in the Unity 3D game engine that could be easily used by non-experts. The second is a training curriculum that would educate a team on how to use existing and proposed data to create a realistic and optimized 3D model of any project.

10. Have other organizations used this technology? Yes or No: No If so, please list organization names and contacts.

Organization	Name	Phone	E-mail

Potential Payoff (30 points)

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

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

This technology was developed to meet public outreach requirements of high resolution and realistic rendered images and videos while offering the immersive benefits. Because this process utilizes actual design files (i.e., a Microstation roadway surface) thus saving the time and cost of remodeling this data and the benefits of rapid rendering made possible by an optimized model in a real-time game engine, the overall cost of Virtually Immersive is not significantly more than traditional 3D visualization.

The immersive elements of VIV can be utilized at public events, stakeholder meetings and at project offices as has been the case on Project Neon.

		12. 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. In addition to the communication benefits associated with visualization, VIV offers additional benefits as described previous as well as technical clarity visuals, eminent domain legal case visuals, landscaping details and more. The reason this is possible is the freedom of camera movement available inside the realistic and fully modeled virtual model. For example, many business owners have come to the Project Neon office looking for how the project impacts their business and are immediately able to see before and after views of the project from the business parking lot by moving the camera to that location almost instantly.
		13. 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? Virtually Immersive Visualization can be effectively used for infrastructure projects of any size but it is especially valuable for public agencies (State DOTs, cities, counties…) with projects of significant public interest. This could be projects throughout the United States and elsewhere.
Market Readiness (30 points)	The AII selection process will favor technologies that can be adopted with a reasonable amount of effort and cost, commensurate with the payoff potential.	14. What actions would another organization need to take to adopt this technology? Most agencies already utilize visualization for project communication, often through 3rd party consultants. To adopt VIV, organizations could either use a consultant trained on VIV or work to develop staff in-house with the same capabilities.
		15. What is the estimated cost, effort, and length of time required to deploy the technology in another organization? The first task would be to make the interface and process user friendly for non-experts and the second would be to develop the training curriculum. The estimated cost for this would be $100,000 to $200,000 over the course of 3 to 6 months. The cost of effort involved with taking this software, process and curriculum to and other organization would require several weeks of training along with follow up on regular intervals which would be another $20,000 to $50,000 per organization.
		16. What resources—such as technical specifications, training materials, and user guides—are already available to assist deployment? The Civil FX team utilized experts in Unity 3D, Microstation, 3ds Max and AutoCAD Civil 3D, so training guides on these specific software packages could prove beneficial. The number of software programs required for developing VIV could be reduced by research and development.
		17. What organizations currently supply and provide technical support for the technology? Civil FX is the only firm NDOT is aware of that develops visualization in the virtually immersive method with NDOT design data but there may be other firms that have developed similar processes or utilize similar technology.

		18. Please describe any legal, environmental, social, intellectual property, or other barriers that might affect ease of implementation. No barriers that we are aware of.
Submit Completed form to		***http://web.transportation.org/tig_solicitation/Submit.aspx***

AASHTO Technology Implementation Group

Nomination of Technology Ready for Implementation

2016 NOMINATIONS DUE BY MONDAY, OCTOBER 3, 2016

Sponsor	*Nominations must be submitted by an AASHTO member DOT willing to help promote the technology.*	1. Sponsoring State DOT: California		
		2. Name: Duper Tong		
		Title: Chief, Office of Traffic Engineering		
		Mailing Address: P.O. Box 942874, MS-36		
		City: Sacramento	State: CA	Zip Code: 94274-0001
		E-mail: duper.tong@dot.ca.gov	Phone: (916) 654-5176	Fax: (916) 653-3055
		3. Date Submitted: 10/03/2016		
		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: Update of Overhead and Roadside Signs With High-Performance Sign Sheeting		
		6. Please describe the technology: The California Department of Transportation (Caltrans) is replacing its lighted green-background highway signs with retroreflective signs that, in most applications, require no electricity because they are fully illuminated solely by vehicle headlights. The new signs require no catwalks to replace burned-out bulbs, because light fixtures are being removed. This saves money, reduces risks to workers, and decreases opportunities for graffiti and copper-wire theft. The new signs use high-performance retroreflective sheeting for both the background and the text. Retroreflective materials bounce light from vehicle headlights back to drivers' eyes, making the signs appear brighter and easier to read. Caltrans is also replacing many roadside signs that do not depend upon electricity to illuminate them. Overall, the quality of signs is improved with this sign replacement and upgrade effort, and reduces Caltrans' carbon footprint.		
		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 or Development (30	*Technologies must be successfully deployed in at least one State DOT. The TIG selection process will favor*	8. Please describe the history of the technology's development. Replacement began in 1999 of many of the original overhead freeway signs that were constructed of green, opaque background guide signs with white, reflective buttons riveted to the face of aluminum signs with green, baked-on powder-coat finish with signs constructed with white on green retroreflective sheeting. During the past 15 years, the predominant sheeting types used have been retroreflective materials with glass beads or prisms that are classified by ASTM, as Type III, or Type IV. However, with development of retroreflective sheeting Type XI (eleven), the use of this product dramatically improved the look and performance of overhead signs.		

	technologies that have advanced beyond the research stage, at least to the pilot deployment stage, and preferably into routine use.	9. For how long and in approximately how many applications has your State DOT used this technology? In August of 2014, Caltrans adopted a policy to upgrade road signs on the State Highway System to Type Xi retroreflective sheeting for colored backgrounds. In the 2014-15 State Highway Operation and Protection Program (SHOPP), Caltrans funded $89 million for 15 projects that will replace about 1,800 old signs with new high-performance upgrades. In the 2016-17 SHOPP funding cycle, $28 million will replace obsolete signs in two additional projects in the San Diego region, currently in design. Sign replacement of this order of magnitude is unprecedented, in California.
		10. What additional development is necessary to enable routine deployment of the technology? Caltrans management has made this replacement and upgrade effort a priority, and there are three additional Caltrans districts (1, 8 and 9) that will also be developing sign replacement projects in the future.
		11. Have other organizations used this technology? Please check one: ☒ Yes ☐ No If so, please list organizations and contacts. (states listed use Type XI sign sheeting for both back-ground and legend, per 2014 Caltrans DRISI Preliminary Investigation, published online at: http://www.dot.ca.gov/newtech/researchreports/preliminary_investigations/docs/type_xi_sign_sheeting_preliminary_investigation.pdf)

Organization	*Name*	*Phone*	*E-mail*
Delaware DOT	Weiser, Adam		adam.wesier@state.de.us
Florida DOT	El-Urfali, Alan		Alan.El-Urfali@dot.state.fl.us
Hawaii DOT	Chen, Long		dotpao@hawaii.gov
Illinois DOT	Armstrong, Kyle		kyle.armstrong@illinois.gov
Minnesota DOT	Hietpas, Jay Jerard		Jay.Hietpas@state.mn.us
Nebraska DOT	Waddle, Daniel J.		Dan.Waddle@nebraska.gov
New Mexico DOT	Jian, Afshin		afshin.jian@state.nm.us
South Dakota DOT	Bennett, Christina		Christina.Bennett@state.sd.us
Texas DOT	Chacon, Michael		michael.chacon@txdot.gov
Wisconsin DOT	McNary, William R		william.mcnary@dot.wi.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? Type XI retroreflective sheeting is a high-performance sign sheeting technology that promotes higher visibility, extended service life to provide minimum levels of retroreflectivity, and helps all drivers (especially older drivers) to view signs during nighttime, and to appear the same color day or night, without additional illumination beyond vehicle headlights. It also reduces costs for electricity that can be turned off; and, will mitigate graffiti and wire theft vandalism maintenance costs for overhead signs.
		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. Once all the state's highway signs are replaced with high-performance retroreflective signs, each year the department will save $600,000 in maintenance costs; save $1.6 million for 16,000 megawatt-hours of energy, enough energy for about 1,400 homes for a year, and reduce its greenhouse gas footprint by 5,800 tons of carbon dioxide.

		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? As signs are replaced in-kind during the current round of SHOPP funding, and in future as capital rehabilitation projects are performed, eventually, all Caltrans overhead freeway and expressway signs will be brought up to this standard. With the exception of county expressways in Santa Clara County, these overhead signs are limited to State of California highway system. In a few locations in large cities where traffic volumes on local streets require overhead signs, this technology could be utilized in limited locations.
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? Caltrans is not imposing these requirements on local agencies, as it could be seen as an unfunded mandate. However, Caltrans will encourage local agencies to also utilize high performance Type XI retroreflective sheeting, as there are benefits, as outlined in Item #13, above.
		16. What is the estimated cost, effort, and length of time required to deploy the technology in another organization? This is not mandated to follow by California's local agencies, per FHWA guidance for a public agency to assess and/or manage the minimum level of retroreflectivity on traffic signs. However, this is a choice that Caltrans has opted to follow to uniformly implement usage of Type XI sign sheeting on the State Highway System. It would depend upon a local agencies established priorities in applying its chosen method(s) of assessing and manage maintenance of minimum levels of retroreflectivity on the signs that it deploys.
		17. What resources—such as technical specifications, training materials, and user guides—are already available to assist deployment? Caltrans has developed specifications, bid item listings, and special provision contract standard documents that local agencies may utilize to segregate Type XI retroreflective sheeting from the overall cost to replace signs. Traffic Operations Policy Directive #14-02 Revision 1 on-line, with guidance on how to follow is on-line at: http://www.dot.ca.gov/trafficops/policy/14-02_rev1.pdf
		18. What organizations currently supply and provide technical support for the technology? The Federal Highway Administration (FHWA) publishes on-line content on maintained minimum levels of retroreflectivity of signs at: http://safety.fhwa.dot.gov/roadway_dept/night_visib/policy_guide/sign_15mins/ , http://safety.fhwa.dot.gov/roadway_dept/night_visib/sign_retro_4page.pdf , and frequently-asked questions, at: http://safety.fhwa.dot.gov/roadway_dept/night_visib/signfaq.cfm
		19. Please describe any legal, environmental, social, intellectual property, or other barriers that might affect ease of implementation. Currently, there are two manufacturers of Type XI retroreflective sheeting (3M and Avery-Dennison). Without a third manufacturer, FHWA requires that this sheeting must be fully-funded by State contracting funds, as they have not allowed a Public Interest Finding (PIF) be filed as a blanket for all sign replacement projects. Type XI retroreflective sheeting, used on each project must be segregated out from the customary cost of sign manufacturing and installation, to determine the State's full-funding requirement for the sign sheeting, only. The majority cost of the sign (substrate, sign supports, installation and traffic control) are funded at the usual federal percentage).

AASHTO Technology Implementation Group

Nomination of Technology Ready for Implementation

<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</td></tr>
<tr><td colspan="3">2. Name: Robbin Cabelus</td></tr>
<tr><td colspan="3">Title: Transportation Planning Director</td></tr>
<tr><td colspan="3">Mailing Address: 2800 Berlin Turnpike</td></tr>
<tr><td>City: Newington</td><td>State: CT</td><td>Zip Code: 06111</td></tr>
<tr><td>E-mail: robbin.cabelus@ct.gov</td><td>Phone: (860)594-2051</td><td>Fax: (860) 594-2056</td></tr>
<tr><td colspan="4">3. Date Submitted: 10/03/2016</td></tr>
<tr><td colspan="4">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>Technology Description (10 points)</td><td>The term “technology” may include processes, products, techniques, procedures, and practices.</td><td colspan="3">5. Name the technology: MMUCC Compliant Electronic Crash Reporting and Analysis System</td></tr>
</table>

6. Please Describe the Technology:

The Connecticut Department of Transportation (CTDOT) and UConn collaborated to develop the new MMUCC (Model Minimum Uniform Crash Criteria) Version 4 crash data collection system that was implemented in Connecticut on January 1, 2015.

MMUCC Compliant Fillable PDF With Electronic Features:

A universal, low-cost, electronic, field based, MMUCC data collection tool was needed to develop a "safety net" for departments without participating vendors or whose vendors were not ready. This "smart" form included the following features: 1) Auto population and page generation capabilities 2) Ability to import crash diagrams 3) Added pages and appendices for more complex crashes 4) Electronic file transmission to the CTDOT FTP site and ability to backfill local RMS systems via XML files and 5) Incorporated all of CTDOT edit rules and warnings; includes validation button to take users to exact fields that need correction.

The following is a link to the fillable PDF:

http://ctsrc.uconn.edu/wp-content/uploads/sites/1630/2016/07/Blank-Fillable_PR1_Rev_Sept_15_2015.pdf

MMUCC Compliant IT Management Package :

In order to facilitate upgrading of Record Management System (RMS) vendor software, the fillable PDF, uploading of crash data to the FTP site, management of data at the FTP site, and back end processing; the CTDOT had to develop a full suite of IT management tools from scratch. These included: 1) A MMUCC xml schema (10,000 lines of code) which set the formatting requirements for data transmission; all vendors/fillable PDF user had to submit crash data the same way, 2) Development of MMUCC validation and edit rules. These were incorporated into the fillable PDF, vendor software, applied at the FTP site, and used to QC data, 3) A CTDOT Specifications Guide to define data element/attributes and their values as well as edit and validation rules, 4) A Testing and Certification Guide with crash scenarios (from CTDOT's data base) to test RMS vendor software, 5) A Crash Report Reader tool to apply validations and edits at the FTP site and to test vendor software, and 6) A Crash Uploader Tool to ease transmission of the fillable PDF and purchase of software licenses for crash diagrams.

The following is a link to the DOT Specifications document:

http://www.ct.gov/dot/cwp/view.asp?a=2094&q=533114

MMUCC Compliant UConn Crash Data Repository:

As a result of the Crash Data Improvement Program (CDIP) project, the UConn Crash Data Repository (CDR) serves as the primary source of MMUCC crash data in CT; it is web based and accessible to any public user, offering timely, accurate, and complete crash data. Users may view summaries, run and save queries, view data from individual reports and diagrams, map crashes, generate summary tables, and download raw crash data for further analysis.

Key features of the CDR are as follows: 1) Basic and advance query tools for individual departments containing 20 years' worth of pre MMUCC data (1995 to 2014), 2) Basic report tools that can create summary fatality, injury, and property damage only (PDO) tables for key crash types for individual departments, counties, Metropolitan Planning Organizations, Councils of Governments, and DOT districts including State rankings, 3) An advanced query tool that provides options to select date ranges, locations, contributing factors by specific routes and for specific communities, 4) Prepopulated crash data templates that have been established to assist law enforcement agencies with highway safety grant applications, 5) 2015 to current MMUCC crash data-summary tables of individual crash reports which can query and add tables for any data field and attribute in the crash providing direct access to Easy Street Draw diagrams for every crash, and 6) Mapping capability: heat and pin maps, Google map street view.

The following is a link to UConn's Crash Data Repository and training videos:

Link: http://www.ctcrash.uconn.edu/ www.Youtube.com/ctsrc www.vimeo.com/ctsrc

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.

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.

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

Based on a CDIP Assessment in May, 2012 the CTDOT Crash Data and Analysis and Highway Safety Offices approached UConn to partner on a new initiative to overhaul their crash data collection system. The result was a collaborative effort to improve the quality and accessibility of the State's crash data. Knowing that the existing paper based crash reporting system was no longer sustainable, the CDIP focused on building crash data collection and management tools. The CDIP resulted in a Statewide MMUCC based fully electronic reporting system that now provides real time, accurate and complete crash data to all highway safety users. In addition, the CTDOT decided to adopt the latest version of MMUCC, which on its own can be an intimidating process for even the most progressive States. While most of these efforts are typically funded independently and developed incrementally, Connecticut took a different approach.

The CDIP plan process identified the following problems: 1) A paper crash report (PR-1) with overlays that had not been changed since 1994, limiting the State's ability to analyze new behavioral and engineering trends on State and local roadways, 2) Paper based submission of 70 percent of the state's approximately 100,000 annual crash reports, 3) A business process that captured only one third of crash data and discarded the rest, 4) A data entry paper backlog of 16 months and growing, 5) A law enforcement culture of "just filling out reports for insurance companies", 6) The absence of CTDOT authorized xml schema and edit rules to facilitate expanded electronic reporting, 7) The absence of a default electronic crash reporting tool to assist low technology agencies, and 8) The need for timely and complete crash data to support the Highway Safety Plan, Strategic Highway Safety Plan, and Highway Safety Improvement Plan (HSIP) program which was currently not being met.

The Connecticut CDIP experience produced a "toolbox" which serves as a roadmap for other states to follow. The CDIP "toolbox" includes all of the following tools which are easily transferable to other States: 1) *electronic MMUCC compliant fillable PDF, 2) creation of MMUCC validation and edit rules, 3) MMUCC xml schema, 4) Records Management System (RMS) vendor certification protocol, 5) comprehensive six hour accredited MMUCC training curriculum for law enforcement and DOT staff, and 6) expanded Crash Data Repository (CDR) capable of mapping, visualizing and analyzing MMUCC data.*

The new MMUCC crash reporting system went fully operational on January 1, 2015.

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

This is the statewide crash data collection and analysis system for Connecticut. As of September 29, 2016 there have been 181,439 crashes reported using this system, involving 342,374 vehicles and 433,803 people. The CT State police and over 90 local police departments use this system to submit data to the CTDOT. There are over 900 registered users that use this system for crash data summaries and analysis.

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

Routine deployment would be difficult since each state collects different data on their crash report form. Our system has an XML schema and follows the MMUCC guideline on what should be collected at the scene of the crash. Therefore, if a state is MMUCC compliant then it should be minimal effort to implement the tools necessary for a state to duplicate what has been done in Connecticut.

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

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

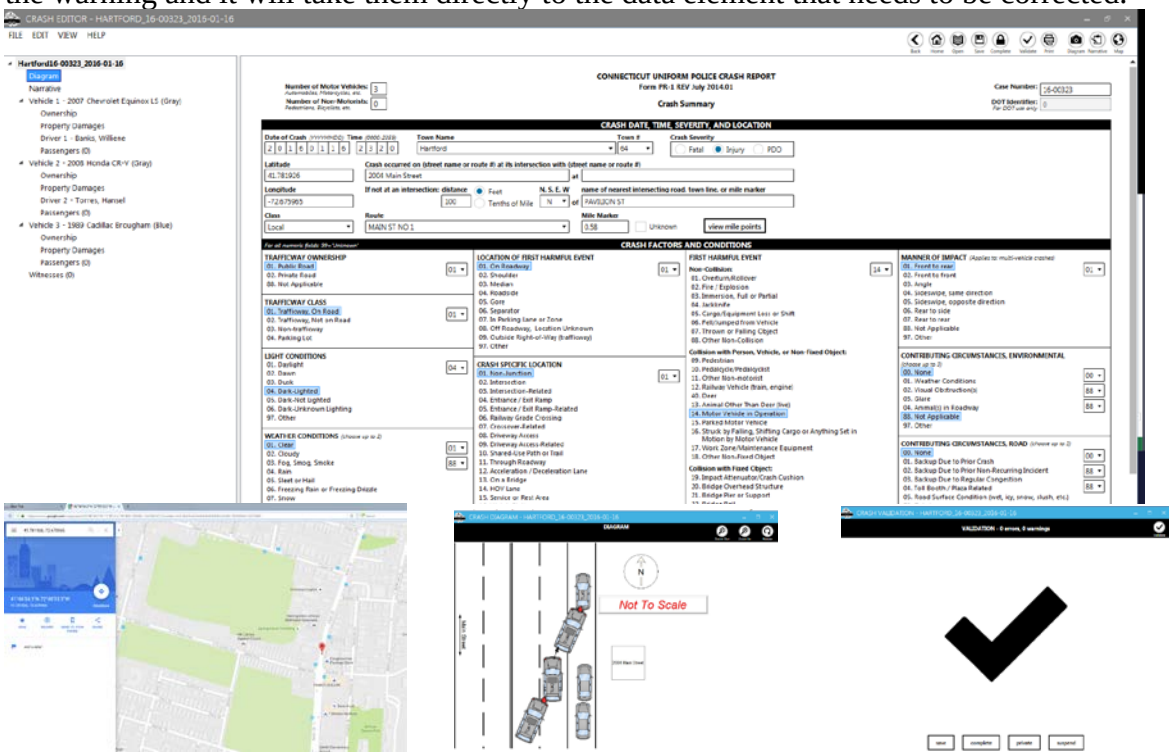
Payoff Potential (30 points)	*Payoff is defined as the combination of broad applicability and significant benefit or advantage over other currently available technologies.*	12. How does the technology meet customer or stakeholder needs in your State DOT or other organizations that have used it? The E-crash and CTCrash systems work in tandem and are the official crash data collection system and crash data repository for the state of Connecticut. There are over 900 registered users that run over 100 queries each day and perform over 50 data downloads a week. Connecticut Safety professionals are very happy with the system developed and use the system on a daily basis.			
		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. **Timeliness:** Crash report processing times have been reduced from 16 months to two weeks (Prior to CDIP implementation, crash data to support the Highway Safety Plan, the Strategic Highway Safety Plan, and the Highway Safety Improvement Plan was at least two years old) **Accessibility:** Availability of MMUCC data at the UConn CDR is virtually in "real time" (within one day of final crash processing at the CTDOT) **Completeness and Uniformity:** Achieved 99.3 percent overall MMUCC compliance for elements collected at the crash scene resulting in an increase in crash report fields in the CTDOT data base by almost three fold **Accuracy:** As a result of the application of new validation and edit rules, errors which had to be manually corrected on virtually every pre MMUCC report have dropped to just 1 per cent of all MMUCC reports received **Integration:** Within the Crash Data Repository, pre MMUCC crash data already has been linked to selected attributes in the State's roadway inventory file; capacity has been created to link to CTDOT's new GIS based LRS system when completed; fatal and surviving driver impairment data now being collected for future linkage **Accessibility:** Web based access to all MMUCC crash data collected including ability to run advanced queries, map crashes on road segments, intersections, and by community, view crash diagrams, and through Google maps to view crash locations **Long Term Impacts:** Changed the crash reporting dynamic between CTDOT and the law enforcement community forever. Developed state of the art MMUCC training materials. Developed cutting edge IT tools to facilitate electronic crash reporting including a fillable PDF. Established sustainable relationships with the RMS vendor community in collaborating on data quality. **Proof of the benefit of University Based Research and Technical Support:** The Connecticut MMUCC PR-1 project through a Memorandum of Understanding (MOU) with UConn was able to establish a Transportation Safety Research Center (TSRC) to provide a range of crash management and technical support services to expedite the conversion to MMUCC and full electronic reporting. More importantly, the MOU expanded the capacity of the existing CDR to adopt, query, display, and analyze MMUCC crash data. The TSRC now seeks to become a center of excellence with the integration of crash, roadway, and other safety files and expanded analytical tools and staff. The ability to identify and address the State's highway safety problems both from a behavioral and engineering perspective has been greatly enhanced.			
		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? This technology would be of interest to every state DOT for the collection and analysis of crash data. Streamlining, standardizing, and removing the duplication effort required to process paper crash reports is a substantial savings to state DOTs. The collection of accurate field validated data is also a substantial savings of effort to correct reports as well as a tool to greatly increase data quality. Lastly using a web-based approach to data analysis and distribution encourages safety research and analysis with little effort on formatting and data collection. Every state could implement this type of system. Connecticut has developed the toolkit to do so with this 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? Each state would need to evaluate their current system and then follow the steps and procedures outlined in the Connecticut toolbox to deploy this system. We would recommend they appoint or hire a full time data champion to serve as the project manager and implement the system as described.
		16. What is the estimated cost, effort, and length of time required to deploy the technology in another organization? For Connecticut this was a 3 year project. Other states would need to invest a similar timeframe to train and educate the entire state on the new system. The cost for Connecticut was roughly $6 million dollars. Other states can take the software, toolbox, and materials developed and implement a similar system for much less. The total cost would depend on the size of the state, the number of officers that need to be trained, software vendors in the state and the extent to which they deviate from the Connecticut model. A full implementation in the $3 million range would not be unreasonable for a medium size state.
		17. What resources—such as technical specifications, training materials, and user guides—are already available to assist deployment? We have established a web site with a Tool Kit for other states to follow. The links are below. http://www.ct.gov/dot/cwp/view.asp?a=2094&q=533114 http://ctsrc.uconn.edu/
		18. What organizations currently supply and provide technical support for the technology? The Connecticut Transportation Safety Research Center (CTSRC) developed the crash data repository system known as "CTCrash," which was launched in June of 2011. The CTSRC was also a major partner in the implementation of the Connecticut Crash Data Improvement Program (CDIP) and the E-crash software. The Connecticut Department of Transportation (CTDOT) maintains the new MMUCC (Model Minimum Uniform Crash Criteria) Version 4 crash data collection system that was implemented in Connecticut on January 1, 2015.
		19. Please describe any legal, environmental, social, intellectual property, or other barriers that might affect ease of implementation. Funding for the majority of the software development effort was derived from Section 154 transfer funds under SAFETEA-LU and MAP-21. Those funds are typically split in the CTDOT between the Highway Safety Office and the Office of Engineering. Therefore, the software was developed with federal funds and the software is public property. States are welcome to the software but will need assistance implementing the system.

Software Images and Descriptions attached.

Crash Editor

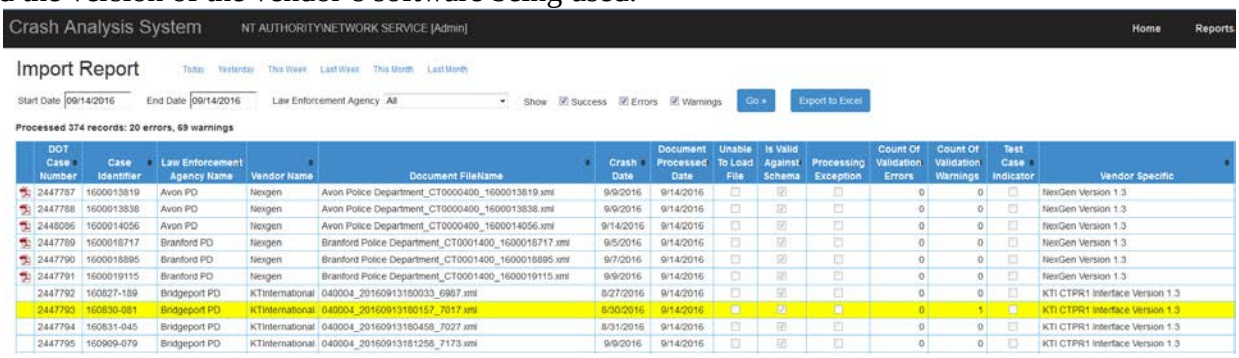
The crash editor allows the CTDOT and UConn staff to open each crash individually and then validate the report against the CTDOT edit rules. Furthermore the coder reviewing the crash will add the route and milepost information while also updating the Latitude and Longitude of the crash. Geolocation to the state's Linear Referencing System is the primary objective of this process. However coders also investigate warnings and modify the case if deemed necessary. This process should take less than 5 minutes per crash. CTDOT coders are expected to process at least 10 crashes an hour. All crashes that are reviewed have passed the CTDOT edits and validations and therefore should already be of a high quality. If the submitted crash does not pass the edit check in the automated import process it is rejected and automatically sent back to the police department to fix and resubmit. These rejections and submissions are tracked using the Crash system described below. The screen shots below detail what the CTDOT coders see when they edit crashes. The software was designed to look exactly like the crash report for ease of data entry and validation. If a warning is noted in the report the coders can click on the warning and it will take them directly to the data element that needs to be corrected.



Crash Import Report

The following report displays information about the crash reports imported for a queried period of time by particular law enforcement agency(s). The color of the cells indicates if the report was accepted (no fill), has warnings (yellow fill), or was rejected (red fill). This allows the DOT to quickly review agencies or time periods where for example a vendor makes an upgrade to a client's system. Details are retained concerning timeliness (crash date vs. upload date), RMS vendor, law enforcement agency,

and the version of the vendor's software being used.



DOT Case Number	Case Identifier	Law Enforcement Agency Name	Vendor Name	Document FileName	Crash Date	Document Processed Date	Unable To Load File	Is Valid Against Schema	Processing Exception	Count Of Validation Errors	Count Of Validation Warnings	Test Case Indicator	Vendor Specific
2447787	1600013819	Avon PD	Nexgen	Avon Police Department_CT0000400_1600013819.xml	9/9/2016	9/14/2016				0	0		NexGen Version 1.3
2447788	1600013838	Avon PD	Nexgen	Avon Police Department_CT0000400_1600013838.xml	9/9/2016	9/14/2016				0	0		NexGen Version 1.3
2448096	1600014056	Avon PD	Nexgen	Avon Police Department_CT0000400_1600014056.xml	9/14/2016	9/14/2016				0	0		NexGen Version 1.3
2447789	1600018717	Branford PD	Nexgen	Branford Police Department_CT0001400_1600018717.xml	9/5/2016	9/14/2016				0	0		NexGen Version 1.3
2447790	1600018895	Branford PD	Nexgen	Branford Police Department_CT0001400_1600018895.xml	9/7/2016	9/14/2016				0	0		NexGen Version 1.3
2447791	1600019115	Branford PD	Nexgen	Branford Police Department_CT0001400_1600019115.xml	9/9/2016	9/14/2016				0	0		NexGen Version 1.3
2447792	160827-189	Bridgeport PD	KTInternational	040004_20160913180033_6987.xml	8/27/2016	9/14/2016				0	0		KTI CTPR1 Interface Version 1.3
2447793	160830-081	Bridgeport PD	KTInternational	040004_20160913180157_7017.xml	8/30/2016	9/14/2016				0	1		KTI CTPR1 Interface Version 1.3
2447794	160831-045	Bridgeport PD	KTInternational	040004_20160913180458_7027.xml	8/31/2016	9/14/2016				0	0		KTI CTPR1 Interface Version 1.3
2447795	160909-079	Bridgeport PD	KTInternational	040004_20160913181258_7173.xml	9/9/2016	9/14/2016				0	0		KTI CTPR1 Interface Version 1.3

Daily Summary Report

CTDOT also tracks how each agency is performing. The report below shows the number of cases submitted to the DOT for a given date range, number of cases rejected, and number of cases that were rejected and never resubmitted. Our crash data liaisons use this report to make calls to police departments that are not submitting, have a large number of rejected reports or do not resubmit crashes that were rejected. This tool allows our team to target training or outreach to police departments that need extra help in getting crash reports into the CTDOT.

Agency ID	Agency Name	Vendor Name	Cases Submitted	Cases Rejected	Outstanding Errors
T745	Amtrak PD	Fillable PDF	0	0	0
CT0000200	Ansonia PD	Nexgen	0	0	19
CT0000400	Avon PD	Nexgen	3	0	3
CT0000700	Berlin PD	New World	0	0	1
CT0000901	Bethel PD	Fillable PDF	0	0	36
CT0001100	Bloomfield PD	Nexgen	0	0	37
CT0001400	Branford PD	Nexgen	3	0	19
CT0001509	Bridgeport PD	KTInternational	31	0	17
CT0001700	Bristol PD	Nexgen	9	0	37
CT0001800	Brookfield PD	IMC	0	0	2
CT0002300	Canton PD	Nexgen	0	0	13
CT0020000	Capitol PD	Nexgen	0	0	0
CT0019000	CCSU PD	Nexgen	0	0	3
CT0002500	Cheshire PD	New World	4	0	0
CT0002700	Clinton PD	IMC	0	0	0
CT0003200	Coventry PD	Hunt	0	0	7
CT0003300	Cromwell PD	Nexgen	1	0	9
CT0003400	Danbury PD	Nexgen	5	0	46
CT0003500	Darien PD	Tritech Inform	2	0	3
CT0018300	DEEP PD	Nexgen	0	0	11
CT0003700	Derby PD	Hunt	0	0	11

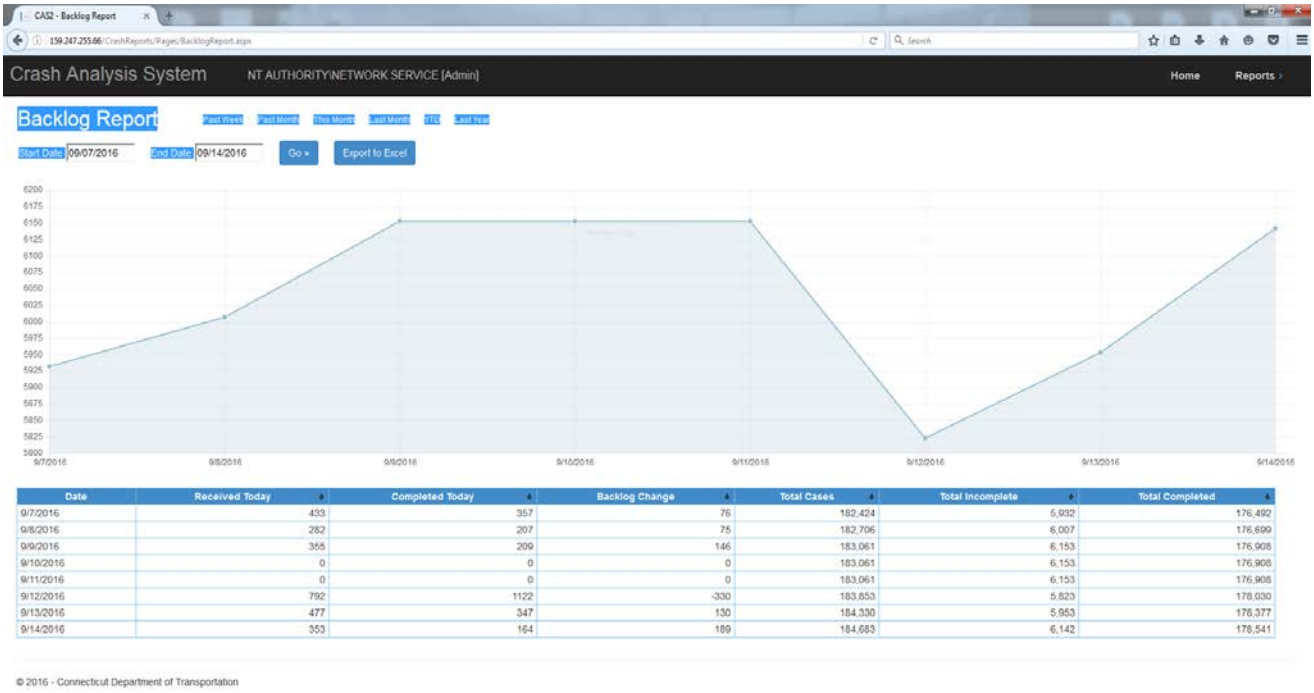
Agency Status report

The purpose of this report is to track historical reporting rates with current reporting rates. By selecting a month and a year the system will report on the number received in the current year and then compare that number to the previous year. If there are a dramatic number of fewer reports the team may reach out to the department to see if they have issues or a backlog of data. This report also shows the last date a case was received from an agency and the software version that was used to submit that report.

Agency Name	Vendor Name	Total Cases Submitted September 2016	September 2013 Total	September 2013 Percent	Total Cases With Errors	Total Cases With Warnings	Last Document Processed Date	Last Vendor Specific
Amtrak PD	Fillable PDF	0			0	0	6/28/2016	UConn Form PR-1 REV September 14, 2015
Ansonia PD	Nexgen	4	35	11%	1	1	9/12/2016	CT DOT CrashEditor v1.8.9.0
Avon PD	Nexgen	12	32	38%	1	0	9/14/2016	NexGen Version 1.3
Berlin PD	New World	9	46	20%	0	0	9/13/2016	New World Systems
Bethel PD	Fillable PDF	18	27	67%	4	5	9/13/2016	UConn Form PR-1 REV September 14, 2015
Bloomfield PD	Nexgen	18	39	46%	0	1	9/13/2016	NexGen Version 1.3
Branford PD	Nexgen	15	39	38%	0	5	9/14/2016	NexGen Version 1.3
Bridgeport PD	KTInternational	39	382	10%	0	10	9/14/2016	KTI CTPR1 Interface Version 1.3
Bristol PD	Nexgen	56	113	50%	0	6	9/14/2016	NexGen Version 1.3
Brookfield PD	IMC	0	32	0%	0	0	8/22/2016	CT DOT CrashEditor v1.8.9.0
Canton PD	Nexgen	1	6	17%	0	0	9/13/2016	NexGen Version 1.3
Capitol PD	Nexgen	0			0	0	9/24/2015	
CCSU PD	Nexgen	0			0	0	8/30/2016	NexGen Version 1.3
Cheshire PD	New World	16	35	46%	0	1	9/14/2016	New World Systems v.2
Clinton PD	IMC	1	12	8%	0	0	9/9/2016	TriTech Perform 6.5.8
Coventry PD	Hunt	6	19	32%	0	1	9/12/2016	CT DOT CrashEditor v1.8.9.0
Cromwell PD	Nexgen	6	39	15%	0	1	9/14/2016	NexGen Version 1.3
Danbury PD	Nexgen	72	206	35%	0	10	9/14/2016	NexGen Version 1.3
Darien PD	Tritech Inform	7	19	37%	0	2	9/14/2016	Tritech Inform RMS 4.10
DEEP PD	Nexgen	0			0	0	9/5/2016	NexGen Version 1.3
Derby PD	Hunt	0	54	0%	0	0	9/12/2016	CT DOT CrashEditor v1.8.9.0
DMHAS PD	Nexgen	0			0	0		
DMV PD	Nexgen	0			0	0	7/6/2016	NexGen Version 1.3
East Hampton PD	Fillable PDF	3	9	33%	2	1	9/12/2016	UConn Form PR-1 REV September 14, 2015
East Hartford PD	KTInternational	26	89	29%	0	5	9/14/2016	KTI CTPR1 Interface Version 1.3

Backlog Report

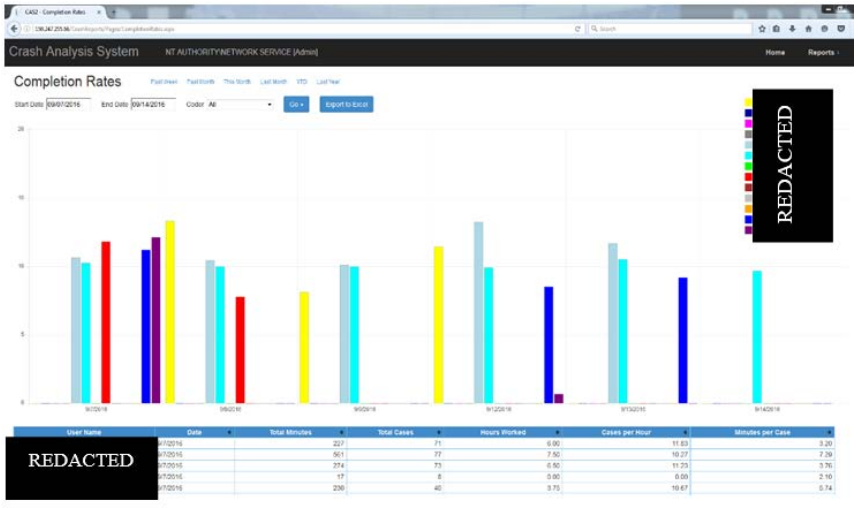
The CTDOT uses the backlog report to monitor the current number of crashes in the queue to be processed. This report displays the queue in a graph. The table below the graph contains the number of crashes processed by their coding staff on a daily basis, the number of reports submitted to the CTDOT, the change in the backlog, and the total number of reports received since the start of the MMUCC switchover. This report is critical to timeliness. If the backlog begins to grow the CTDOT can evaluate the need for more coders, overtime, or assistance from UConn in processing crash reports. It will also let the CTDOT determine if their day-to-day operations are sufficient to eliminate or prevent a backlog of crashes.



Date	Received Today	Completed Today	Backlog Change	Total Cases	Total Incomplete	Total Completed
9/7/2016	433	357	76	182,424	5,932	176,492
9/8/2016	282	207	75	182,706	6,007	176,699
9/9/2016	355	209	146	183,061	6,153	176,908
9/10/2016	0	0	0	183,061	6,153	176,908
9/11/2016	0	0	0	183,061	6,153	176,908
9/12/2016	792	1122	-330	183,853	5,823	178,030
9/13/2016	477	347	130	184,330	5,953	178,377
9/14/2016	353	164	189	184,683	6,142	178,541

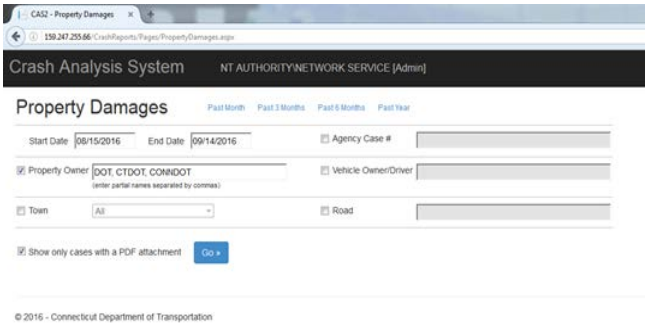
Coder Performance

The completion rates report provides a more detailed look at how each coder is performing and the average number of crashes they are coding per hour (graph) and per day (table). This report is used to monitor how efficient each coder is and if there are issues that need to be resolved. Coding is not the only assignment for many of the CTDOT coders so a low production day is not an indication of poor performance but can be used to help manage workload with the goal of timely and accurate crash data.



CTDOT Property Damage Report

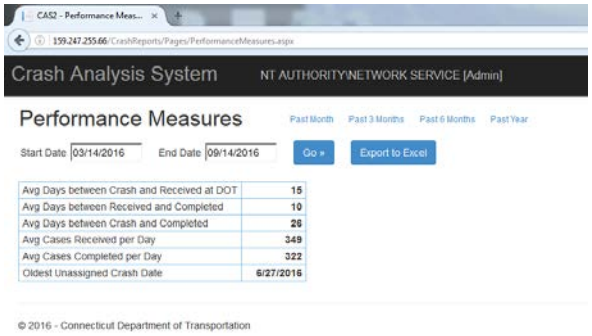
This report was generated to allow the CTDOT to quickly identify crashes where CTDOT property was damaged, and then display those reports. The CTDOT uses this application to track down



responsible drivers and an associated insurance company when they are looking to charge parties for damage to state infrastructure.

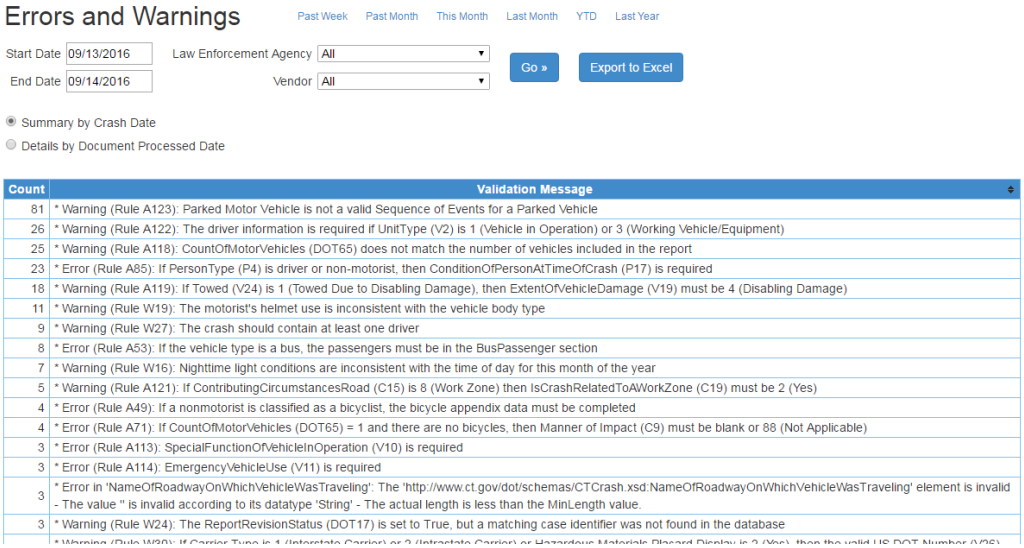
Performance Measures

The performance measures report is used to track how the overall system is performing with respect to timeliness.



Errors and Warnings

The errors and warnings report displays how frequently a warning or error is being triggered upon import of crash reports. This information can then be used to tailor newsletter articles or custom trainings to police departments. Furthermore, this report can be used to establish or strengthen edit and validation rules provided to software vendors.



Count	Validation Message
81	* Warning (Rule A123): Parked Motor Vehicle is not a valid Sequence of Events for a Parked Vehicle
26	* Warning (Rule A122): The driver information is required if UnitType (V2) is 1 (Vehicle in Operation) or 3 (Working Vehicle/Equipment)
25	* Warning (Rule A118): CountOfMotorVehicles (DOT65) does not match the number of vehicles included in the report
23	* Error (Rule A85): If PersonType (P4) is driver or non-motorist, then ConditionOfPersonAtTimeOfCrash (P17) is required
18	* Warning (Rule A119): If Towed (V24) is 1 (Towed Due to Disabling Damage), then ExtentOfVehicleDamage (V19) must be 4 (Disabling Damage)
11	* Warning (Rule W19): The motorist's helmet use is inconsistent with the vehicle body type
9	* Warning (Rule W27): The crash should contain at least one driver
8	* Error (Rule A53): If the vehicle type is a bus, the passengers must be in the BusPassenger section
7	* Warning (Rule W16): Nighttime light conditions are inconsistent with the time of day for this month of the year
5	* Warning (Rule A121): If ContributingCircumstancesRoad (C15) is 8 (Work Zone) then IsCrashRelatedToAWorkZone (C19) must be 2 (Yes)
4	* Error (Rule A49): If a nonmotorist is classified as a bicyclist, the bicycle appendix data must be completed
4	* Error (Rule A71): If CountOfMotorVehicles (DOT65) = 1 and there are no bicycles, then Manner of Impact (C9) must be blank or 88 (Not Applicable)
3	* Error (Rule A113): SpecialFunctionOfVehicleInOperation (V10) is required
3	* Error (Rule A114): EmergencyVehicleUse (V11) is required
3	* Error in 'NameOfRoadwayOnWhichVehicleWasTraveling': The 'http://www.ct.gov/dot/schemas/CTCrash.xsd:NameOfRoadwayOnWhichVehicleWasTraveling' element is invalid - The value '' is invalid according to its datatype 'String' - The actual length is less than the MinLength value.
3	* Warning (Rule W24): The ReportRevisionStatus (DOT17) is set to True, but a matching case identifier was not found in the database

MMUCC Compliant Crash Data Repository

As a result of the CDIP project, the UConn Crash Data Repository (CDR) serves as the primary source of MMUCC crash data in CT. The CDR is web based and accessible to any public user, offering timely, accurate, and complete crash data. Users may view summaries, run and save queries, view data from individual reports and diagrams, map crashes, generate summary tables, and download raw crash data for further analysis.

Key features of the CDR are as follows:

- Current Features:
  - Basic and advanced query tools containing 20 years' worth of pre MMUCC data (1995 to 2014)
  - Basic report tool can create summary fatality, injury, and PDO tables for key crash types for individual departments, counties, Transportation Planning regions, and DOT districts including State rankings
  - Advanced query tool provides options to select date ranges, locations, contributing factors by specific routes and for specific communities
  - Prepopulated crash data templates have been established to assist law enforcement agencies with grant applications

- 2015- current MMUCC crash data-summary tables of individual crash reports; can query and add tables for any data field and attribute in the crash; direct access to EasyStreetDraw™ diagrams for every crash
- Mapping capability: heat and pin maps, Google Street View™
- Data dashboard capabilities

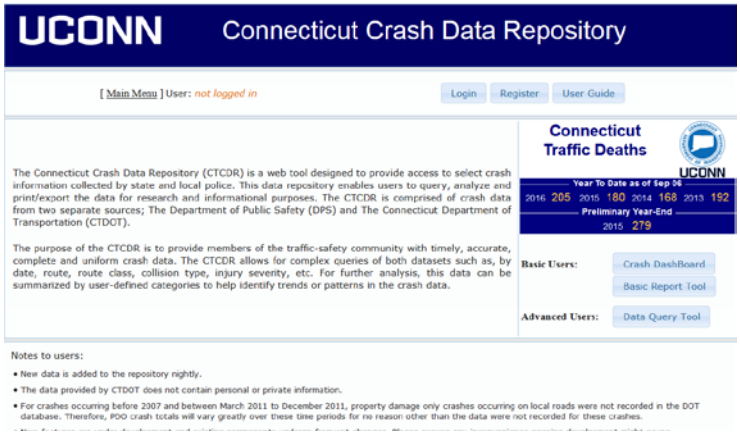
- New Features in Planning Stage:
  - Merging of common fields for old PR-1 and MMUCC data for trend analysis
  - Integration of infraction and citation data
  - Integration of toxicology databases containing alcohol and drug impairment information for DUI stops and all crashes
  - Integration of census and demographic information
  - Integration of EMS and Trauma registry information

Below are some screen shots and more detailed information about the Connecticut Crash Data Repository.

Data Analysis Tools: CTCrash.uconn.edu

This section will describe some of the data analysis tools that are part of the Connecticut crash data repository. The opening screen of CTCrash.uconn.edu allows the user to quickly identify the number of fatal crashes that have occurred year to date. The "Connecticut Traffic Deaths" box displays the previous 4 years of fatalities, year to date with a preliminary year end fatality number for the previous year. This allows fatal crash numbers to be quickly and easily tracked and compared from year-to-year.

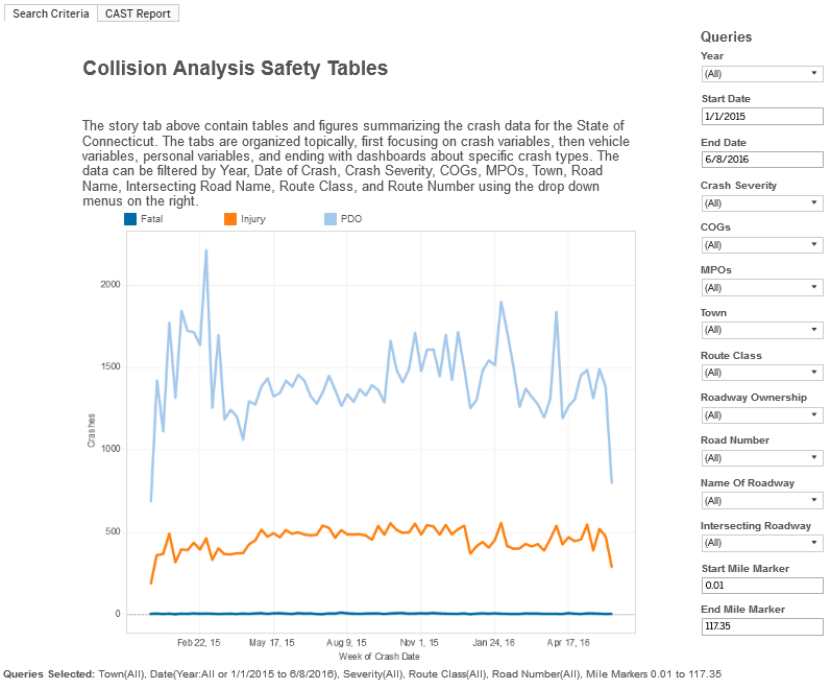
Users can register for the system instantly and then have access to all the tools provided.



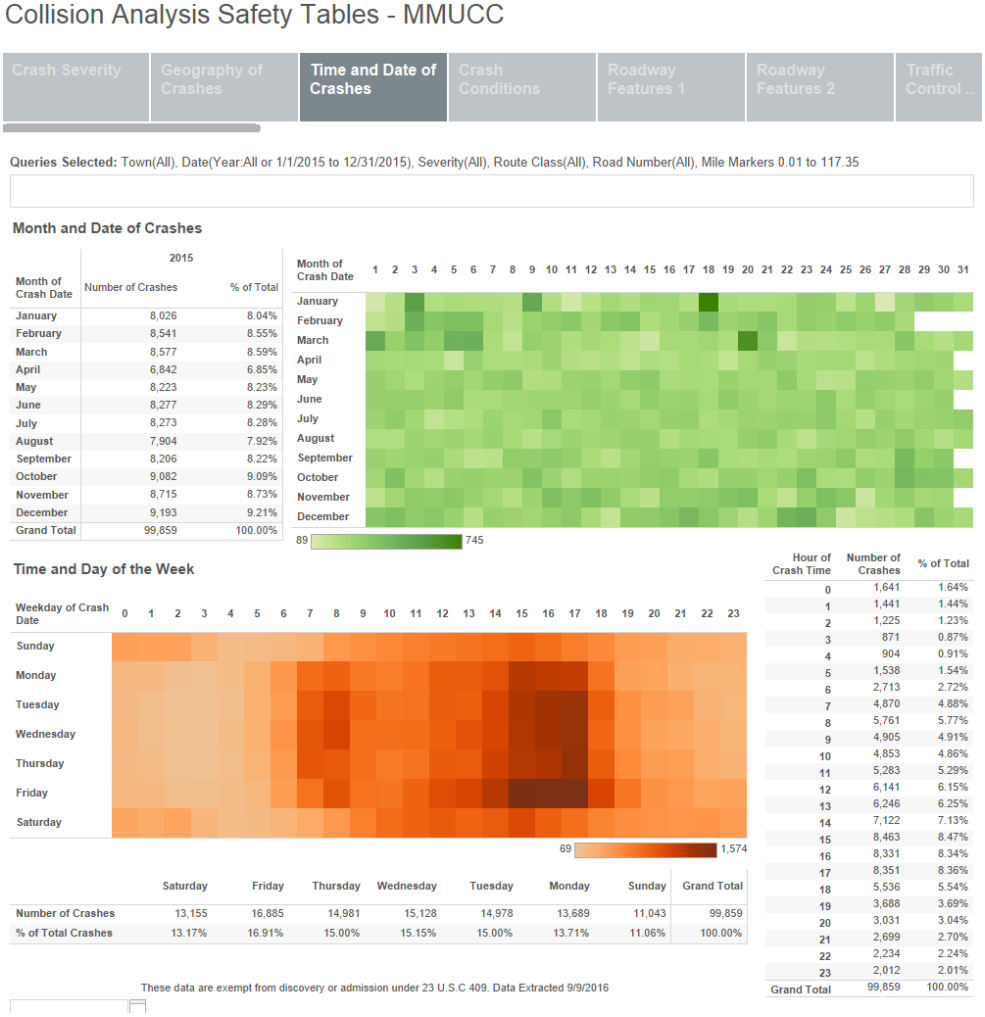
Crash Dashboards

The crash dashboards provide a fast way to perform a query on the crash data and return a large number of statistics, facts and figures for analysis of crash trends in the state. Users make their selections using the drop downs on the left, and the graphic in the middle of the screen adjusts the numbers accordingly.

Once all selections are made, the user then clicks on the CAST report tab at the top of the screen. The information contained in the next tab is composed of a series of data charts and tables based on commonly requested data queries. There are 26 pages of facts and figures in all, and over 80 different figures. This example shows heat maps of date and time of crashes.

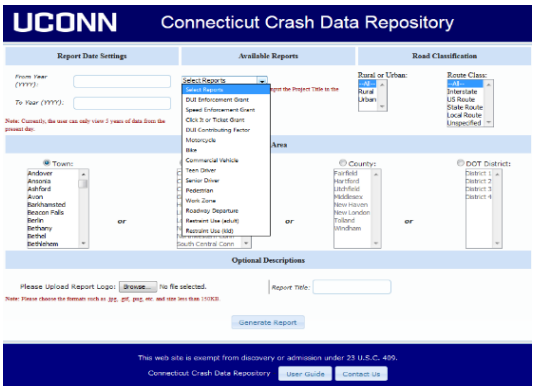


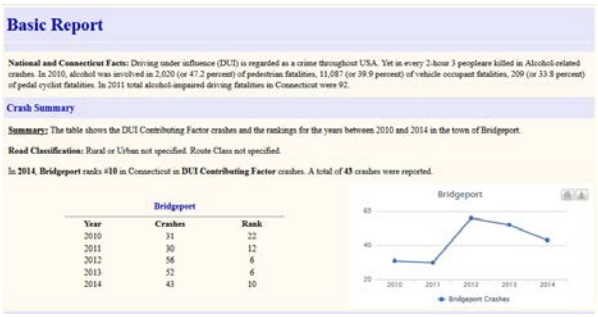
This can be done for individual towns, roads or even intersections.



Basic Report Tools

The basic report tool allows users to generate simple reports for the previous 5 years by individual towns. The reports indicate where the requested town ranks within the state based on the query in question (DUI, speed, seatbelt use, etc.). Furthermore the basic report tool allows police departments to generate the data for the crash statistics page of a grant application. This reduces work for each police department and provides a uniform database and tool to generate crash data for grant applications.

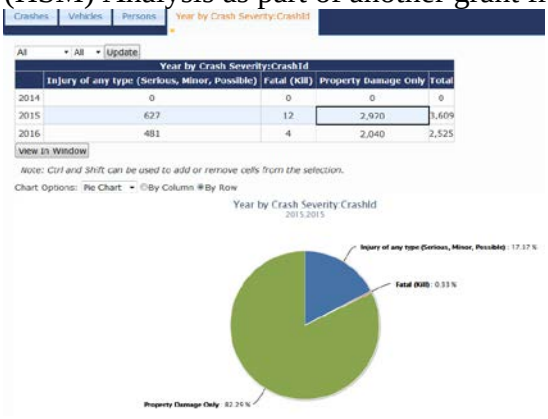


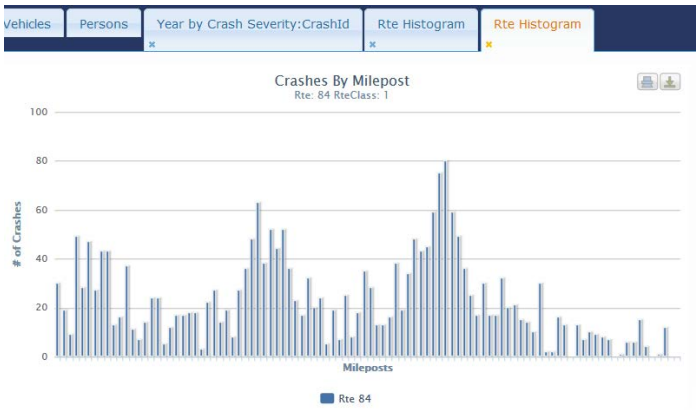


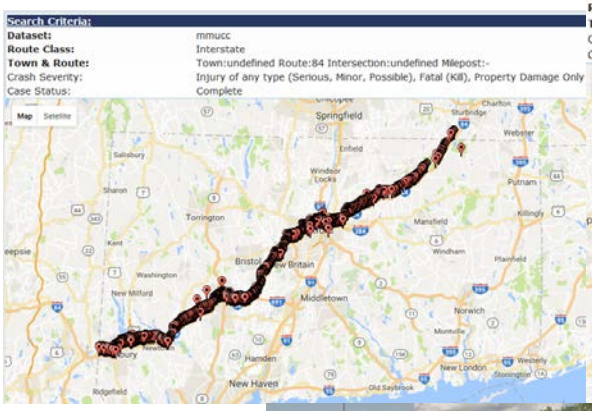
Advanced User tools

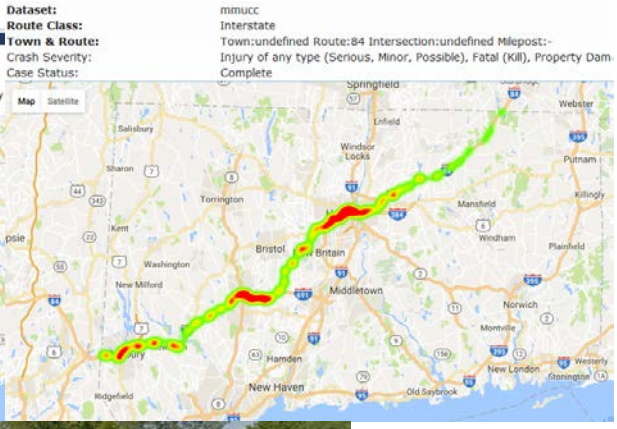
The advanced user tools provide full query and analysis capabilities for crash data. Users must register on the site to have access to these tools. Once registered and logged in, the user can make query selections via a simple user interface. The options on this interface mirror all the options on the Connecticut crash report. After submitting for results the user can perform a number of analyses. Cross tabulations, route histograms, mapping and crash density mapping are products that can be obtained with an analysis. The user is also provided with the ability to view the crash location in Google Street View and to view an image of the crash diagram. These are just a few of the features of the Crash Data

Repository, and we are currently expanding the functionality to include a full Highway Safety Manual (HSM) Analysis as part of another grant from the CTDOT.









AASHTO Innovation Initiative

Nomination of Technology Ready for Implementation

<table>
<tr><td>Sponsor</td><td>Nominations must be submitted by an AASHTO member DOT willing to help promote the technology</td><td colspan="3">1. Sponsoring DOT (State): Wisconsin</td></tr>
<tr><td rowspan="5"></td><td rowspan="5"></td><td colspan="3">2. Name and Title: Ryan Luck, SE Freeways Construction Chief</td></tr>
<tr><td colspan="3">Organization: Wisconsin Department of Transportation</td></tr>
<tr><td colspan="3">Street Address: 141 NW Barstow Street</td></tr>
<tr><td>City: Waukesha</td><td>State: WI</td><td>Zipcode: 53187</td></tr>
<tr><td>E-mail: ryan.luck@dot.wi.gov</td><td>Phone: 414-750-1461</td><td>Fax:</td></tr>
<tr><td></td><td></td><td colspan="3">3. Is the sponsoring State DOT willing to promote this technology to other states by participating on a Lead States Team supported by the AASHTO Innovation Initiative? Yes or No: Yes</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">4. Name of Technology:

Enhanced Plans, Specifications, and Estimates (PS&E) review process using Autodesk BIM 360 Field</td></tr>
<tr><td colspan="3">5. Please describe the technology.

WisDOT SE Freeways design and construction teams developed a collaborative process to improve the bid-ability, constructability, and overall plan quality of their Mega program lets through the implementation of an enhanced PS&E review process. This process was successfully implemented on the $1.7B Zoo Interchange Reconstruction Mega Program, an FHWA Project of Corporate Interest (POCI). The effort includes milestone plan reviews by contractors and construction oversight engineers, as well as the continued participation of the WisDOT ad-hoc teams to support the design development. In addition to the expanded participation in the review efforts, the team is also utilizing technology to support the review efforts. 3D model reviews are being conducted within the process effort to detect and resolve conflicts with existing and proposed improvements. Also, Autodesk BIM 360 Field (Field360) is being utilized to track, organize, and document plan review comments and the resulting decisions, to ensure better follow through on addressing critical items in the plans.</td></tr>
<tr><td colspan="3">6. 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 list your attachments here.

Background files in pdf format include the following:

• WisDOT Enhanced PSE Process Exhibit
• WisDOT Field360 – Training Guides
• WisDOT Enhanced PSE Review – Report Exhibit</td></tr>
</table>

State of Development (30 points)	Technologies must be successfully deployed in at least one State DOT. The AII selection process will favor technologies that have advanced beyond the research stage, at least to the pilot deployment stage, and preferably into routine use.	7. Briefly describe the history of its development. Over the past decade, WisDOT SE Region has successfully completed two Mega projects, which included several lets with overlapping and adjacent construction packages being let. As the Zoo Interchange program began, it was evident through review of lessons learned, that better hands on coordination between design, construction, and contractors was critical to future successful project delivery. With the anticipated size of let plans (5000+ sheets), and highly complex staging, sequencing, and construction activities envisioned, WisDOT believed it would be difficult to capture all the value added comments and meaningful changes that the current PS&E review process would accommodate. A process with better coordination had the potential to create better quality projects, while avoiding costly change orders, and ensuring consistency between sequenced lets within the program. As a result, WisDOT developed an enhanced plan review process for their SE Freeways Mega Program with milestones to include key stakeholders early and throughout the project development process, including designers, contractors, and construction oversight staff to ensure that projects being put out for bid would be of the highest quality, are biddable, and constructible. Construction oversight staff with experience in previous and ongoing Mega Projects were included in the review effort, creating a feedback loop that was lacking in the existing process. This feedback loop ensured that any ongoing issues identified in field conditions would be adequately addressed during the plan development process, and helped bridge the knowledge gap that would occur when the project shifted from design to construction. In addition, early availability of the plans sets to the construction industry has enabled contractors to have adequate time to better determine what resources they may need to effectively bid on large let contracts, as well as assist in the identification of alternative solutions to proposed plans and enhance the bid-ability. This approach provides the best possible outcome for a successfully completed project. The Zoo Interchange team leveraged technology in two forms within their process improvement. The incorporation of 3D model technology, and the ability to see design plans while under development, helped the design team to identify any conflicts and enhance the plans, while allowing the construction team to better visualize the staging conditions proposed by the plans. This provided an extra dimension during PS&E review efforts. With the increased participation of construction staff in plan reviews, the team needed an organizational solution to collect, track, and document the large volume of comments (over 1500 per plan set) being provided. This tracking would ensure critical items were addressed as the plan development progressed. The team identified a software solution, Field360, which could be customized to meet the team's needs for organization, as well as provide efficiency with keeping the review process on a compressed time frame. The cloud based solution allowed the team to make comments in real time, and were accessible to all reviewers. This feature resulted in fewer redundant comments, greater validation of the process by the reviewers, minimized review time, and reduced cost. The combination of the enhanced process, along with the utilization of the technology identified, helped to create a comprehensive and efficient process that allowed integration of plan improvements into the design process.
		8. For how long and in approximately how many applications has your State DOT used this technology? The overall enhanced PS&E review process was introduced in summer of 2013. The incorporation of 3D model reviews and the use of Field360 into the process occurred in fall of 2014. Since implementation, there have been four PS&E reviews that have utilized the process with the software enhancement. In addition to the PS&E reviews, WisDOT SE Region began to utilize Field360 in spring of 2015 for additional tasks including: • punchlist tracking for field review • issues tracking for other projects and public contacts • lessons learned database management • report queries for all items

<table>
<tr><td></td><td></td><td>9. What additional development is necessary to enable routine deployment of the technology?

The enhanced PS&E review process is being continually monitored for improvement, and revised as necessary to maximize the return on investment. Different technology tools are being evaluated to support the PS&E review tracking and documentation, but the enhanced process implementation is continuing within the entire SE Region.</td></tr>
<tr><td></td><td></td><td>10. Have other organizations used this technology? Yes or No: No If so, please list organization names and contacts.
<table>
<tr><th>Organization</th><th>Name</th><th>Phone</th><th>E-mail</th></tr>
<tr><td></td><td></td><td></td><td></td></tr>
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</table></td></tr>
<tr><td>Potential Payoff
(30 points)</td><td>Payoff is defined as the combination of broad applicability and significant benefit or advantage over other currently available technologies.</td><td>11. How does the technology meet customer or stakeholder needs in your State DOT or other organizations that have used it?

Utilization of the enhanced review process and the implementation of the technology solutions have helped increase communication between the design and construction teams to ensure everyone is working towards a common goal of the best plan set possible. This helped enhance trust, conflict commitment, accountability, and results.

Early availability of the plans sets to the construction industry (a step within the enhanced process) has enabled contractors to have adequate time to better determine what resources they may need to effectively bid on large let contracts, as well as assist in the identification of alternative solutions to proposed plans and enhance the bid-ability, which provide the best possible outcome for a successfully completed project.

WisDOT adapted out of the box software systems by developing unique workflows to accommodate the software used. The Field360 software was leveraged with the existing interfaces to support the current workflow for the PS&E review efforts. Previous WisDOT projects utilized Microsoft Excel spreadsheets to track and organize the plan comment feedback process. Due to the large scale of the Zoo Interchange project, the number of reviewers participating, and the quantity of comments anticipated, this enhanced process improved the efficiency, quality, and effectiveness of the feedback. An additional benefit of the portability and search functions of the Field360 platform allowed the information to be easily referenced for future projects.

The Zoo Interchange design development was completed with full 3D design capability. The process was adapted to include these models in the PS&E review effort. The Field360 workflows were established to provide feedback in both 2D and 3D environments. This technology solution far exceeded the previous process capability.

Due to ability for rapid deployment and the availability of mobile applications, the technology for both the 3D modelling and Field360 have served the construction field staff and external users easily.

With the Field360 software being used for additional applications as noted above (Q8), it is an excellent tool to track, catalog, sort, organize, and query reports on data needed, allowing faster response time for external questions about specific issues, saving valuable time.</td></tr>
</table>

		12. 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. WisDOT is committed to a comprehensive internal plan review process as part of the Zoo Interchange project. WisDOT has found that the return on investment for plan review efforts has been favorable. While it is difficult to quantify what the return on investment is from the process implementation, it is fair to say that this enhanced process has resulted in noticeable improvements in efficiency, quality, and cost for a comprehensive plan review. WisDOT has experienced let savings on projects following implementation of the process, and believes the enhanced process is a contributing factor to these savings. In addition, WisDOT has observed a noticeable decline in change orders on the Zoo Interchange program compared to previous programs, however the projects are currently ongoing, and we are unable to provide any final data until the projects are complete. To put the potential savings in perspective on the Zoo Interchange program, a mere 0.25% reduction in contract change orders on the $1.1B let value of the program translates to a savings of $2.75M. Incorporation of additional construction expert plan reviewers and the use of the 3D model reviews into the process was an added cost to the overall effort. However, as noted above, WisDOT believes that this expenditure was offset by the let savings and reduced change order costs that are occurring on the active projects. However, there were direct cost savings that resulted from the implementation of Field360 which were realized with the coordination of the review comments being developed in a searchable, organized format. Less time was spent compiling, sorting, and organizing comments in a spreadsheet format, which was able to be allocated to reviewing comments for quality and completeness. The comparison is based on the two largest plan reviews, one done with Field360, and the other by compilation of multiple spreadsheets from individual reviewers. It is estimated that approximately 100 hours were saved by the interface engineer (comment coordinator) by utilizing Field360. In addition, there were time savings for the designer, who then spent less time clarifying comments, and responding to duplicative items. It is estimated that approximately 140 hours were saved between the same plan reviews noted above.
		13. 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 implementation of this process and technology has been currently limited to the Zoo Interchange projects within WisDOT. However, it has the ability to be expanded across other Regions within the WisDOT, as well as integration with consultants and contractors, to develop a seamless approach to plan development, review, and implementation. The enhanced process can be utilized for projects of all sizes, and is scalable based on the complexity and available resources.
Market Readiness (30 points)	The AII selection process will favor technologies that can be adopted with a reasonable amount of effort and cost,	14. What actions would another organization need to take to adopt this technology? The process can be implemented through development of a team structure between design and construction teams, to communicate the shared vision of the projects. This helps enhance trust, conflict commitment, accountability, and results. The key component to implementation of the software tool is to develop a system that fits the needs of the organization to collect, track, and follow through on plan review comments, and provide accessibility of the software chosen to all users.

	commensurate with the payoff potential.	15. What is the estimated cost, effort, and length of time required to deploy the technology in another organization? The process integration was developed through coordination of the design and construction management team, and implemented through policy expectations. This was done through several meetings over the course of 4 months with the design and construction management groups, to develop an agreed upon process. Implementation of the overall process to achieve full participation has a limited cost, with greater benefits of communication and coordination. Deployment of the software was completed with hands on training. Following two weeks of training development, users were trained over a one month time frame. Approximately 120 users were required to attend a one hour training session, with staff available during the PS&E implementation for issue resolution. Assumed cost for training is minimal based on the number of users being trained to utilize the software. Assumed costs for software is $2500 per license to utilize Field360 on an individual user basis. This can be a scaled cost based on the size of project, and range of implementation. Strategic partnerships with enterprise licensing agreements allow agencies implementing this process to significantly offset typical single user license costs. This cost reduction, compared to the efficiency, quality, and cost savings of the enhanced plan review process make the payoff potential significant.
		16. What resources—such as technical specifications, training materials, and user guides—are already available to assist deployment? Documents that outline the enhanced PS&E review process, as well as a basic training manual to provide plan review comments in Field360 are developed, and have been used to train staff for previous efforts. In addition, a flow chart was provided to establish the steps taken during the comment creation. Prior to each PS&E review, a detailed schedule was developed to ensure the efforts met the overall expectations developed for the enhanced process.
		17. What organizations currently supply and provide technical support for the technology? WisDOT has contracted with a construction management consultant to provide support and administer Field360.
		18. Please describe any legal, environmental, social, intellectual property, or other barriers that might affect ease of implementation. The main barriers to implementation of the enhanced process were internal in nature. Implementing a new process was a culture change that requires cooperation. Culture change affected both the reviewers and the designers. Reviewers with varying levels of computer literacy were required to learn a new software to provide their comments. Designers had to be willing to accept a more comprehensive and thorough review that is highly documented. Documented responses to the feedback were required, which validates the reviewers' time, and documents the incorporation or non-incorporation of the comments. Past culture has been that, at times, there was dismissal of challenging or difficult comments with no record of resolution. This new level of accountability and transparency is in everyone's best interest, and requires willing participation resulting in enhanced quality. The owner needs to champion the process to sustain trust.
Submit Completed form to		***http://web.transportation.org/tig_solicitation/Submit.aspx***

AASHTO Innovation Initiative

Nomination of Technology Ready for Implementation

<table>
<tr><td>Sponsor</td><td>Nominations must be submitted by an AASHTO member DOT willing to help promote the technology</td><td>1. Sponsoring DOT (State): California</td></tr>
<tr><td></td><td></td><td>2. Name and Title: Nick Compin Chief, Office of Strategic Development
Organization: California Department of Transportation
Street Address: 1120 N. Street
City: Sacramento | State: CA | Zipcode: 95814
E-mail: Nicholas.compin@dot.ca.gov | Phone: 916 653-4575 | Fax:</td></tr>
<tr><td></td><td></td><td>3. Is the sponsoring State DOT willing to promote this technology to other states by participating on a Lead States Team supported by the AASHTO Innovation Initiative? Yes or No: Yes</td></tr>
<tr><td>Technology Description (10 points)</td><td>The term “technology” may include processes, products, techniques, procedures, and practices.</td><td>4. Name of Technology:
Intelligent Transportation Systems System Builder (ITS-SB)</td></tr>
<tr><td></td><td></td><td>5. Please describe the technology.
The Intelligent Transportation Systems System Builder (ITS-SB) tool is an interactive database that contains a library of both Caltrans and regional ITS architectures built using the Federal Highway Administrations’ (FHWA) Turbo Architecture, context diagrams and other helpful related documents.
Stakeholders now have the ability to access the ITS-SB database to upload, modify and maintain individual regional architectures
All users have the ability to not only search their own ITS plans and elements of uploaded information, but they can also search any architecture that has been uploaded into the database.</td></tr>
<tr><td></td><td></td><td>6. 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 list your attachments here.
Home Page - http://149.136.20.175/NetApps/Systembuilder/Default.aspx
Search Architectures Page - http://149.136.20.175/NetApps/Systembuilder/SearchText.aspx</td></tr>
<tr><td>State of Development (30 points)</td><td>Technologies must be successfully deployed in at least one State DOT. The AII 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>7. Briefly describe the history of its development.
In 2004, the California Statewide ITS Architecture and System Plan was created which laid the ground work for planning, programming and deploying future generations of ITS.
The result was a graphical and textual representation of regional architectures within and across Caltrans Districts and boundaries.
In 2011, ITS-SB was created to provide a clearinghouse of ITS transportation technology and provide the ability for stakeholders to upload, modify and maintain individual ITS architectures.
The database sat dormant for a period of time until a final location was located within Caltrans
In 2016, the database was revised, enhanced and permanently housed within the Caltrans Network with an external internet link.</td></tr>
<tr><td></td><td></td><td>8. For how long and in approximately how many applications has your State DOT used this technology?
ITS-SB was only recently revised and enhanced, therefore Caltrans and Regional stakeholders are just now becoming more familiar with the functionality of the ITS-SB tool.</td></tr>
<tr><td></td><td></td><td>9. What additional development is necessary to enable routine deployment of the technology?
ITS-SB requires ongoing effort to enable the inclusion of additional ITS architectures and the latest version of the FHWA Turbo Architecture database.
Ongoing maintenance is also necessary to ensure that ITS-SB remains functional during any necessary security patch installations and/or other minor fixes as needed.</td></tr>
<tr><td></td><td></td><td>10. Have other organizations used this technology? Yes or No: No If so, please list organization names and contacts.
To our knowledge, no other state has this ITS database tool, functionality or capability
<table>
<tr><th>Organization</th><th>Name</th><th>Phone</th><th>E-mail</th></tr>
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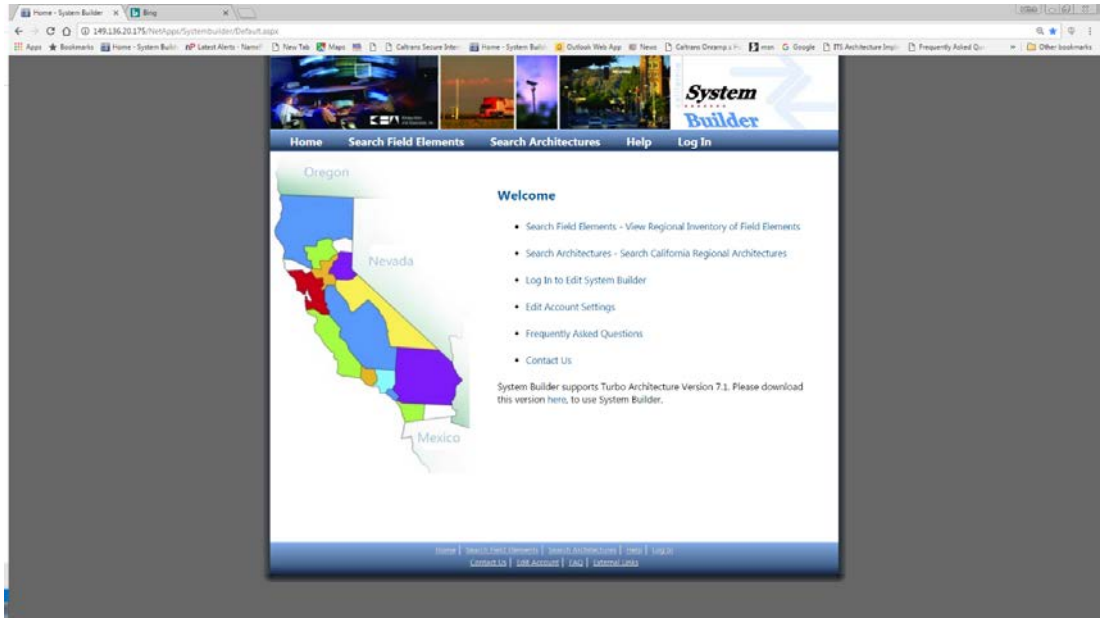
<table>
<tr><td rowspan="4">Potential Payoff (30 points)</td><td rowspan="4">Payoff is defined as the combination of broad applicability and significant benefit or advantage over other currently available technologies.</td><td>11. How does the technology meet customer or stakeholder needs in your State DOT or other organizations that have used it?
ITS-SB enables stakeholders to efficiently and effectively;
Comply with Federal Regulations (23 CFR 655 and 940) by ensuring ITS projects conform to the National ITS Architecture
Share both existing and planned ITS deployments with partner agencies
Develop regional ITS Architectures that are consistent with the National ITS Architecture
Develop regional ITS Architectures that are consistent with the Statewide or Metropolitan planning process
Develop Regional Transportation Plans (RTP)s and a host of valuable plans
Develop required programs: State Highway Operations and Protection Program (SHOPP), Regional Transportation Improvement Program (RTIP), Transportation Improvement Program (TIP), Regional Transportation Improvement Program (RTIP), and State Transportation Improvement Program (STIP)
Develop asset management plans that include ITS elements</td></tr>
<tr><td>12. 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 ITS-SB and the Statewide ITS Architecture (SWITSA) will play an important role in all phases of ITS life-cycle including the planning, design, procurement, deployment, and management phases as follows:
Planning: An ITS project's inclusion in the ITS-SB displays commitment and readiness for funding.
Design: Each step of the regional architecture process results in guidelines for design.
Procurement: Functional requirements can be extracted directly from ITS-SB and inserted into a Request for Proposal (RFP).
Deployment: Results in improved ITS projects as the process of developing the regional architecture requires projects to be designed using the Systems Engineering process
Management: Results in more efficient system integration and management as data exchange requirements that reflect stakeholder consensus are included.</td></tr>
<tr><td>13. 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?
ITS-SB has the potential to be implemented at regional, state, and national levels across the US given that is uses the FHWA ITS Turbo Architecture as the platform.</td></tr>
<tr><td></td></tr>
<tr><td rowspan="4">Market Readiness (30 points)</td><td rowspan="4">The AII selection process will favor technologies that can be adopted with a reasonable amount of effort and cost, commensurate with the payoff potential.</td><td>14. What actions would another organization need to take to adopt this technology?

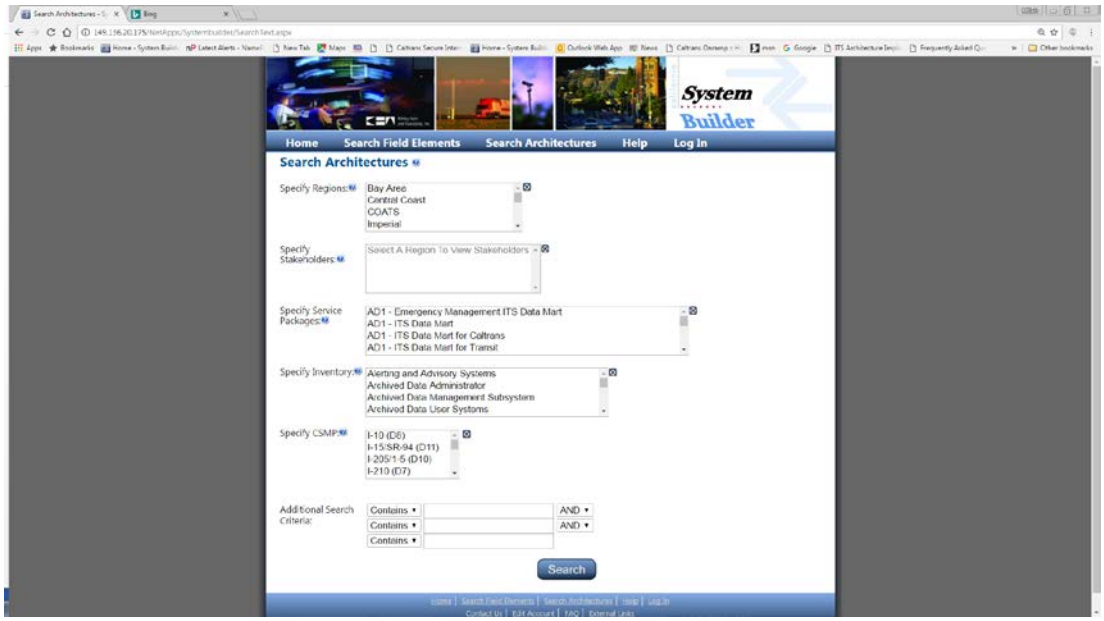
They could either obtain a copy of ITS-SB from Caltrans and stand the tool up locally or load their architecture into the version at Caltrans. The organization would also need to be able to modify ITS-SB to accept their architecture. No matter where ITS-SB is housed, the most likely action would be for the organization to pursue a consultant contract to modify ITS-SB to accept their architecture.</td></tr>
<tr><td>15. What is the estimated cost, effort, and length of time required to deploy the technology in another organization?</td></tr>
<tr><td>16. What resources—such as technical specifications, training materials, and user guides—are already available to assist deployment?
Caltrans has created the technical, training and user documents necessary to provide ITS-SB across Calfiornia. has training material available and training via webinar is to be provided within 2016</td></tr>
<tr><td></td></tr>
</table>

		17. What organizations currently supply and provide technical support for the technology? Caltrans statewide and the majority of Metropolitan Planning Organizations statewide
		18. Please describe any legal, environmental, social, intellectual property, or other barriers that might affect ease of implementation. None that we are aware of.
Submit Completed form to		***http://web.transportation.org/tig_solicitation/Submit.aspx***

http://149.136.20.175/NetApps/Systembuilder/Default.aspx



http://149.136.20.175/NetApps/Systembuilder/SearchText.aspx



AASHTO Technology Implementation Group

Nomination of Technology Ready for Implementation

Sponsor

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

1. Sponsoring State DOT: Texas
2. Name: Martin Rodin

Title: Division Director

Mailing Address: 125 E. 11th St.

City: Austin	State: Texas	Zip Code: 78701
E-mail: martin.rodin@txdot.gov	Phone: 512-416-2038	Fax: N/A

3. 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.

4. Name the technology:

Federal Safe Harbor Indirect Cost Rate

5. Please describe the technology:

The Texas Department of Transportation (TxDOT) is one of ten state DOTs identified to participate in a Financial Management Improvement (FMI) initiative to test and evaluate the availability and utilization of a safe harbor indirect cost rate. Texas submitted the proposal to the Federal Highway Administration (FHWA) as a proposal for the FMI Plan to explore and test financial management efficiencies, who in turn approved the plan for testing to evaluate the concept for consideration in future regulation, policy, and/or guidance. The test ran for three years and was successful enough to extend to the rest of the state DOTs for implementation. Official regulation changes are still pending.

6. 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.

Please list your attachments here.

State of Development (30 points)

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

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

Smaller firms, including many DBE firms, often lack the financial sophistication to produce an indirect cost rate, or they may not have the resources to hire a CPA to produce an audited Federal Acquisition Regulation (FAR) compliant indirect cost rate. This proposal will greatly benefit new or start-up firms which generally do not have a contract cost history to use as a base for development of an indirect cost rate. A lack of cost history often creates the necessity for a development and use of provisional indirect cost rate with follow-up audit and contract billing adjustment once they obtain sufficient cost history. In addition to the additional audit resources needed for new and existing small firms, the current audit requirements can place an undue burden on some consultants and may create a barrier for otherwise eligible firms in competing for federally funded contracts.

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

The test began on July 1, 2013 and concluded on June 30, 2016. FHWA has provided an extension on utilization of the Federal Safe Harbor Indirect Cost Rate for an additional six months, pending a formal adoption.

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

TxDOT was required to revise their rules in the Texas Administrative Code related to consultant services indirect cost rates. TxDOT believes that the implementation of this idea will reduce the workload within their Professional Engineering Procurement Services Division and throughout the agency in the monitoring of this program.

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

If so, please list organizations and contacts.

Organization	*Name*	*Phone*	*E-mail*
Alabama DOT	Carissa Adams	334-242-6366	adamsca@dot.state.al.us
California DOT	Nancy Shaul	916-323-7940	nancy.shaul@dot.ca.gov
Michigan DOT	Carol Rademacher	517-373-3382	rademacherc@michigan.gov
Ohio DOT	Lyle Flower	614-466-7618	lyle.flower@dot.ohio.gov

		Washington State DOT	Laura Trainer	360-705-7020	trainel@wsdot.wa.gov
Payoff Potential (30 points)	*Payoff is defined as the combination of broad applicability and significant benefit or advantage over other currently available technologies.*	11. How does the technology meet customer or stakeholder needs in your State DOT or other organizations that have used it? 23 USC I 12(b)(2) requires architecture and engineering (A/E) firms to annually submit an indirect cost rate prepared in accordance with the FAR Cost Principles. This program will allow this requirement to be set-aside and enable states and consultants to use an established safe-harbor rate. The use of a safe-harbor rate by A/E firms will be completely optional as each firm providing a FAR compliant rate based upon its actual indirect costs is still the preferred methodology. The use of a very conservative safe- harbor rate should encourage firms to work toward this preferred outcome. This program provides a significant benefit for those firms that cannot produce a rate and broaden the pool of consultants competing for Federal contracts.			
		12. 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 greatest reduction in overall costs will be to the individual consultant firms. The cost of obtaining a CPA FAR audit and of implementing a relatively complex cost accounting system may be insurmountable to some smaller firms, and may prevent them from competing for state and local agency administered federally funded contracts. FHWA and states should also see a significant cost reduction when contracting with firms that accept the safe-harbor rate since the rate will be lower than the industry average and will not necessitate use of extensive validation procedures. This also provides an opportunity for smaller firms to participate on TxDOT contracts where they may not have otherwise been able to do so due to a lack of an overhead rate. Use of an established indirect cost rate may, in some cases, decrease contracting times and eliminate the need for establishing a provisional rate thus reducing delays in commencing work on the project. Accountability will improve as a number of A/E firms will be using a specific pre-determined indirect cost rate that will not be subject to errors or the need to recover funds due to large fluctuations in the rate. The use of the safe-harbor rate will allow firms time to develop organizational procedures and establish a cost history that will better lend itself to the eventual development of an actual indirect rate.			
		13. 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 use of a safe harbor rate will greatly reduce the workload of the state DOT audit staff. Newer and smaller firms will generally have fewer and/or smaller dollar contracts, but often require more scrutiny. The safe harbor rate will allow states to better manage a risk-based audit approach by allowing them to focus on higher dollar, or otherwise higher risk firms. The technology need only be deployed within the resident DOT's Overhead Auditing Section.			
Market Readiness (30 points)	*The AII selection process will favor technologies that can be adopted with a reasonable amount of effort and cost, commensurate with the payoff potential.*	14. What actions would another organization need to take to adopt this technology? This program is an integral component of a state's risk based oversight framework related to A/E firm indirect cost rates. Adoption of the safe harbor rate should then be incorporated into the written risk based oversight procedures developed by state DOTs. A model of this framework is currently under development by the AASHTO Audit Guide Task Force.			
		15. What is the estimated cost, effort, and length of time required to deploy the technology in another organization? This program can likely be acted upon almost immediately with little or no cost and minimal effort after receiving FHWA authorization; however, it may require several years to fully realize the benefits of implementation. The potential of this program can be easily gauged by the number of A/E firms who decide to take advantage of this optional methodology and the corresponding shift in emphasis to higher risks within the state's audit workload.			

		16. What resources—such as technical specifications, training materials, and user guides—are already available to assist deployment? TxDOT has information available on its web site with regard to the specific eligibility requirements, as well as the FHWA web site for implementation of the program. A request to FHWA will provide more comprehensive guidance.	
		17. What organizations currently supply and provide technical support for the technology? FHWA currently provides all support for the program.	
		18. Please describe any legal, environmental, social, intellectual property, or other barriers that might affect ease of implementation. The program requires FHWA authorization; however, there are no proprietary limitations for implementation currently.	

AASHTO Innovation Initiative

Nomination of Technology Ready for Implementation

Sponsor	Nominations must be submitted by an AASHTO member DOT willing to help promote the technology	1. Sponsoring DOT (State): Missouri Department of Transportation		
		2. Name and Title: Jon Nelson		
		Organization: Missouri Department of Transportation		
		Street Address: 105 W Capital Avenue		
		City: Jefferson City	State: MO	Zip code: 65102
		E-mail: Jonathan.Nelson@modot.mo.gov	Phone: 573-751-1157	Fax:
		3. Is the sponsoring State DOT willing to promote this technology to other states by participating on a Lead States Team supported by the AASHTO Innovation Initiative? Yes or No: Yes		
Technology Description (10 points)	The term "technology" may include processes, products, techniques, procedures, and practices.	3. Name of Technology: Field Traffic Alert System		
		5. Please describe the technology. Historically, MoDOT has only had access to live traffic data in metropolitan areas like St. Louis and Kansas City. This data was collected via a combination of roadside sensors or loops in the pavement along the regions most heavily traveled roads. While beneficial, this approach was costly to both install and maintain. For years, MoDOT has desired to have live traffic flow information on other roadways in the state, particularly along major corridors like I-70 and I-44. Due to the cost and maintenance demands, it was not feasible to install sensors, loops, or other detectors across the state. To accommodate this need, MoDOT contracted with HERE in 2014 to receive access to live traffic data on over 11,000 miles of roads in Missouri via wireless technologies. Through this contract, MoDOT was able to obtain the live traffic data it desired without the expense or maintenance demands of roadside detection. While the HERE data has been beneficial on many fronts, two particular issues have been addressed through innovative uses of the HERE data. 1. MoDOT can only respond to a problem or inform travelers of a problem once it has. Even where CCTV cameras exist, there is not enough personnel to watch all available Cameras 24/7. To address this, MoDOT developed a field text alert system using the HERE data to notify staff of issues that should be investigated and may require a response. MoDOT receives a continuous, live traffic data from HERE 24/7. A program was developed by MoDOT staff to monitor this data and alert individual users when certain conditions are met. This program is highly personalized meaning users of the system can establish their own preferences for when and how alerts are received. Users can select individual road segments/corridors/entire regions, specify certain days/times they wish to receive alerts, and establish the traffic speeds at which they want to receive an alert. 2. MoDOT can only warn the traveling public about traffic backups once the issue has been detected and recognized. Once alerted, MoDOT can respond accordingly through various means, such as posting messages on dynamic message signs (DMS). However, even with the alert system, it still takes time for MoDOT staff to verify the event, gather the pertinent information, and then push the information to the traveler. Recognizing the need to provide some type of immediate warning to travelers while additional information is being gathered, MoDOT worked with TransCore to develop a method for auto-populating rural DMS along I-70 with congestion warning messages as soon as they are detected. This system works similar to the text alert system describe above. The software being used to push messages to the DMS on I-70, TransCore's TransSuite, was programmed to monitor the HERE data 24/7. When certain conditions are met, the program automatically sends a warning message to the appropriate DMS depending on the traffic speeds and location. These warning messages are instant and provide information to warn the motorist of what they should expect to encounter.		

		6. 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 list your attachments here. Please find below: Photo of selections screen, Photo of Sample Segment Choice, Photo of report, Photo of sample text alert.
State of Development (30 points)	Technologies must be successfully deployed in at least one State DOT. The AII selection process will favor technologies that have advanced beyond the research stage, at least to the pilot deployment stage, and preferably into routine use.	7. Briefly describe the history of its development. For years, MoDOT has desired to have live traffic flow information on other roadways in the state, particularly along major corridors like I-70 and I-44. Due to the cost and maintenance demands, it was not feasible to install sensors, loops, or other detectors across the state. To accommodate this need, MoDOT contracted with HERE in 2014 to receive access to live traffic data on over 11,000 miles of roads in Missouri via wireless technologies. Through this contract, MoDOT was able to obtain the live traffic data it desired without the expense or maintenance demands of roadside detection.
		8. For how long and in approximately how many applications has your State DOT used this technology? We've been using the text alerts for about a year and a half. They are used for a variety of purposes: traffic management in work zones, traffic incident management, detection of incidents, recurring congestion, and weather issues.
		9. What additional development is necessary to enable routine deployment of the technology? None
		10. Have other organizations used this technology? Yes or No: No if so, please list organization names and contacts. There are organizations using our text alert system but we still maintain all the data. We are simply sharing the information we have.

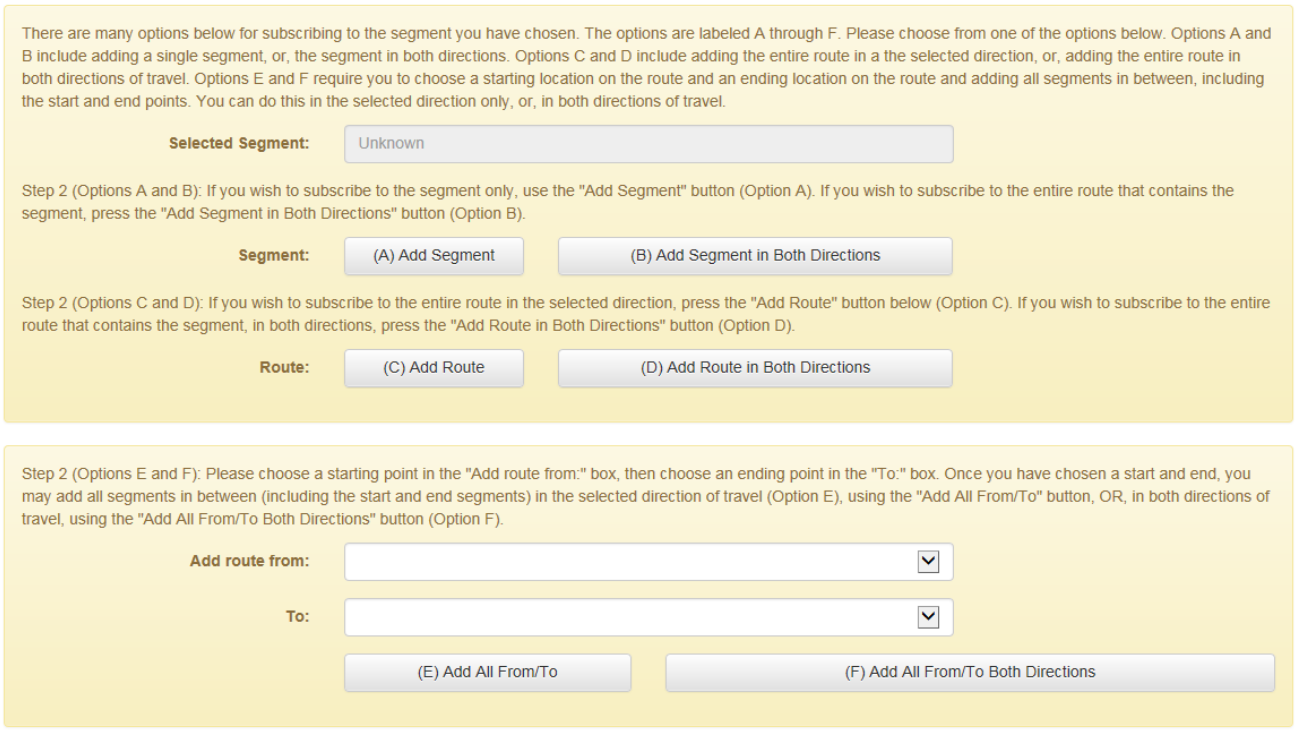
Organization	Name	Phone	E-mail

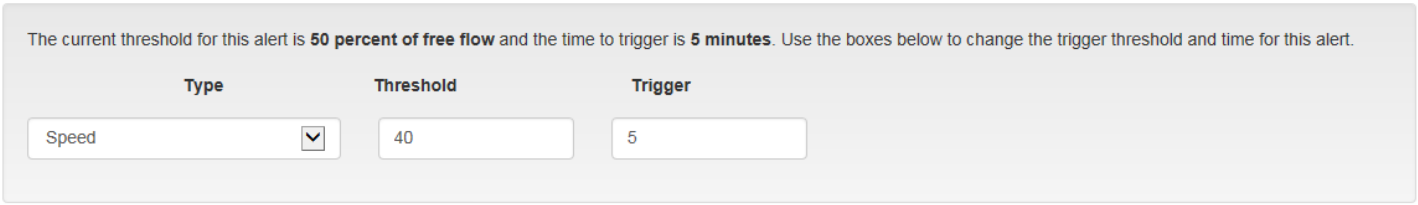
Potential Payoff (30 points)	Payoff is defined as the combination of broad applicability and significant benefit or advantage over other currently available technologies.	11. How does the technology meet customer or stakeholder needs in your State DOT or other organizations that have used it? Prior to this project, MoDOT had limited capabilities to learn of traffic issues along the roadway in a very timely manner. While roadside detection and cameras provided this ability in the metro areas, issues aren't typically learned about until a call is received from a customer, law enforcement, or MoDOT staff that happened to be in the area. The field alert system instantly expanded MoDOT's ability to receive notification of traffic issues throughout the state without the burden of installing and maintaining equipment in the field. This, in turn, has allowed MoDOT to respond in a quicker and more informed manner than what was previously possible. The use of this technology has allowed MoDOT staff to exceed previous expectations in responding to adverse traffic conditions such as crashes, weather and road construction.

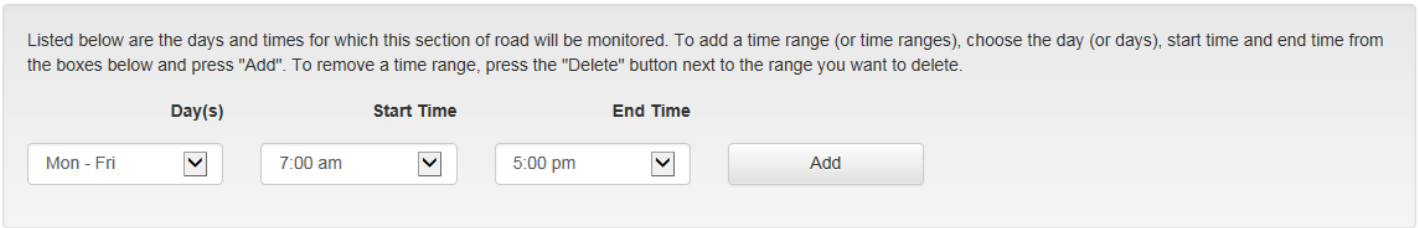
		12. What type and scale of benefits has your DOT realized from using this technology? Include cost savings, safety improvements, transportation efficiency or effectiveness, environmental benefits, or any other advantages over other existing technologies. The field alert system saves time in that staff is notified instantly of adverse conditions along their roadways of interest. This, in turn, improves MoDOT's ability to respond and set up necessary traffic control to manage the event. MoDOT can also more quickly notify the public of these events. The overall process is improved by giving individual responders the tools and information they need while lessening the dependence on receiving a call about an event. The system has also allowed MoDOT to not spend money on deploying roadside devices to collect this data in other locations. It could even be used to replace some of the existing detectors in St. Louis and Kansas City in the future, thus reducing the ongoing maintenance costs of these devices. This program has greatly enhanced MoDOT's ability to receive earlier notification of adverse traffic conditions due to an incident, road construction, weather, or recurring congestion. Earlier notification means MoDOT can respond quicker on the ground (traffic control) and also provide earlier warning to the traveling public (traveler information.
		13. 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 alert system, while designed for use by MoDOT staff, has also been shared with contractor personnel working on MoDOT right of way as well as law enforcement partners.
Market Readiness (30 points)	The AII selection process will favor technologies that can be adopted with a reasonable amount of effort and cost, commensurate with the payoff potential.	14. What actions would another organization need to take to adopt this technology? MoDOT contracts with HERE to get the data, and that data cost about $200,000 per year. The text alert tool itself was developed internally. Labor was estimated to be about 80 hours of staff time from IS.
		15. What is the estimated cost, effort, and length of time required to deploy the technology in another organization? We spend about $200k a year for the data. The text alert tool itself was developed internally. Labor was estimated to be about 80 hours of staff time from IS (mostly program development).
		16. What resources—such as technical specifications, training materials, and user guides—are already available to assist deployment? We have instructions for how to use our alert system that is made available to MoDOT users; however I don't think there is any material of specifications available to provide to others interested in a similar deployment. They could always talk to MoDOT's IS Division via telephone or video conference.
		17. What organizations currently supply and provide technical support for the technology? The IS Division at the Missouri Department of Transportation provides technical support.

		18. Please describe any legal, environmental, social, intellectual property, or other barriers that might affect ease of implementation. As long as an organization has permission from their data provider (HERE in our case), we are not aware of any barriers.
Submit Completed form to		***http://web.transportation.org/tig_solicitation/Submit.aspx***

PROJECT PHOTOS:

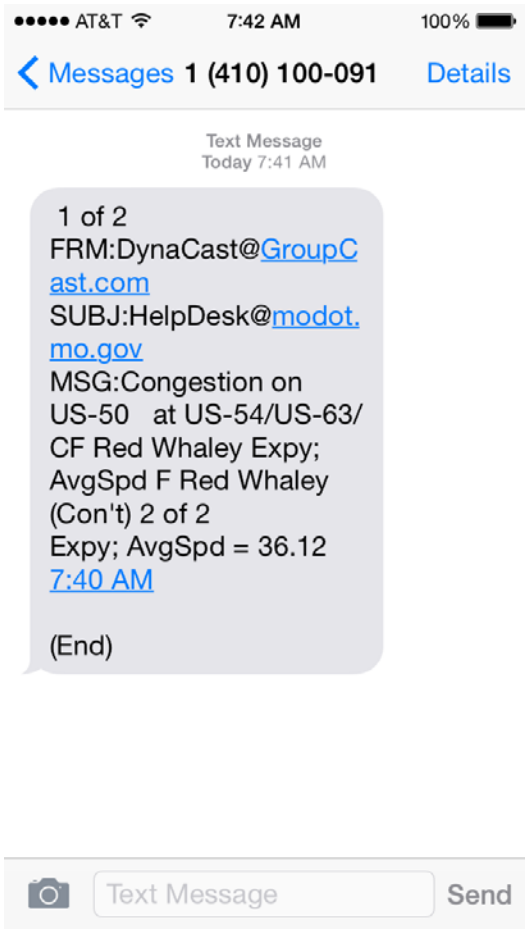






I-70 [00162] - Select Group - Un-select Group

Select	TMC	Dir	Threshold	Trigger	Mon	Tues	Wed	Thu	Fri	Sat	Sun
☐	Boonville Rest Area	E	10 mph	5 min	Midnight Midnight	Midnight Midnight	Midnight Midnight	Midnight Midnight	Midnight Midnight	Midnight Midnight	Midnight Midnight
☐	I-70-BL/MO-87/Exit 106	E	40 mph	5 min	Midnight Midnight	Midnight Midnight	Midnight Midnight	Midnight Midnight	Midnight Midnight	Midnight Midnight	Midnight Midnight
☐	I-70-BL/US-40/MO-5/Exit 101	E	40 mph	5 min	Midnight Midnight	Midnight Midnight	Midnight Midnight	Midnight Midnight	Midnight Midnight	Midnight Midnight	Midnight Midnight
☐	I-70-BR	E	40 mph	5 min	Midnight Midnight	Midnight Midnight	Midnight Midnight	Midnight Midnight	Midnight Midnight	Midnight Midnight	Midnight Midnight
☐	I-70-BR/Exit 125	E	40 mph	5 min	Midnight Midnight	Midnight Midnight	Midnight Midnight	Midnight Midnight	Midnight Midnight	Midnight Midnight	Midnight Midnight
☐	MO-163/Providence Rd/Exit 126	E	40 mph	5 min	Midnight Midnight	Midnight Midnight	Midnight Midnight	Midnight Midnight	Midnight Midnight	Midnight Midnight	Midnight Midnight
☐	MO-179/Exit 111	E	40 mph	5 min	Midnight Midnight	Midnight Midnight	Midnight Midnight	Midnight Midnight	Midnight Midnight	Midnight Midnight	Midnight Midnight



AASHTO Innovation Initiative

Nomination of Technology Ready for Implementation

<table>
<tr><td>Sponsor</td><td>Nominations must be submitted by an AASHTO member DOT willing to help promote the technology</td><td colspan="3">1. Sponsoring DOT (State): Idaho</td></tr>
<tr><td></td><td></td><td colspan="3">2. Name and Title: Reed Hollinshead, Public Info. Specialist</td></tr>
<tr><td></td><td></td><td colspan="3">Organization: Idaho Transportation Department</td></tr>
<tr><td></td><td></td><td colspan="3">Street Address: 3311 W. State Street</td></tr>
<tr><td></td><td></td><td>City: Boise</td><td>State: ID</td><td>Zipcode: 83707-1129</td></tr>
<tr><td></td><td></td><td>E-mail:
reed.hollinshead@itd.idaho.gov</td><td>Phone: 208 334-8881</td><td>Fax: 208 334-8563</td></tr>
<tr><td></td><td></td><td colspan="3">3. Is the sponsoring State DOT willing to promote this technology to other states by participating on a Lead States Team supported by the AASHTO Innovation Initiative? Yes or No: Yes</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">4. Name of Technology:
Innovate ITD program</td></tr>
<tr><td></td><td></td><td colspan="3">5. Please describe the technology.
This is an employee-driven, grassroots initiative by ITD to solicit improvements from all of our employees across the state.

Spurred by Director Brian Ness’ vision to operate more like a business, and motivated by an annual funding shortfall in the hundred of millions, in 2014 the department launched a strategy to engage employees to find solutions to everyday problems. The centerpiece of this innovation strategy is an employee-driven effort branded “Innovate ITD!."

Rather than rely on the brainpower of a select group of leadership-level people, ITD is harnessing the creativity of all 1,500 employees statewide. Employees at every level are encouraged to submit ideas for time and money savings and making processes more efficient. But this is not just an old-fashioned suggestion box. From there, employees work to implement the best ideas that have a measurable impact.

The results have been impressive: 405 ideas for improvement have been implemented statewide. Savings and efficiency improvements amounting to $2 million have stretched the money that can be applied to Idaho roads, bridges and delivering improved transportation services. ITD employee-initiated and reported innovations have also saved more than 66,000 labor hours of contractor and employee time across the state. Of the reported innovations, nearly 150 are customer-service improvements.

Since ITD’s ultimate customer is every one of the Gem State’s more than 1.1 million drivers, the ultimate winner is the Idaho taxpayer.</td></tr>
<tr><td></td><td></td><td colspan="3">6. 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 list your attachments here.

PDF of sample innovation stories
PDF of innovate ITD logo (critical for “branding” the program)
JPG of Innovation posterboard
JPG showing sample scorecard</td></tr>
</table>

<table>
<tr><td rowspan="5">State of Development (30 points)</td><td rowspan="5">Technologies must be successfully deployed in at least one State DOT. The AII 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>7. Briefly describe the history of its development.

The initiative started in early 2014, rolled out to employees in April of that year, and continues to grow with each passing month.

It was decided early on that we needed to focus on creating a culture that fosters innovation. We outlined the elements of what we needed to do and started penciling together a concept that quickly took hold and grew roots. In February of that first year, we had a working concept and announced the Innovate ITD program first to the executive team, then to the senior leadership team, and completed the roll out to the Board. In March we worked on process refinement and quickly realized we needed to innovate ourselves as the submissions started flowing in faster than we anticipated. In April, we created the Innovate ITD Sharepoint (intranet) site and evolved from manually sorting e-mails to capturing submissions in a database format. In May, we developed the awards, certificates and ribbons that bear the innovate ITD brand and handed them out at board meetings and other in-person staff events. In June, ID leadership started walking from desk to desk to thank people for their submissions and deliver certificates and ribbons in person. Shortly thereafter, innovation stewards in each region of the state were tasked with helping facilitate the flow and submission of ideas from their administrative districts.</td></tr>
<tr><td>8. For how long and in approximately how many applications has your State DOT used this technology?

Since 2014, there have been 607 ideas submitted statewide and 408 implemented.</td></tr>
<tr><td>9. What additional development is necessary to enable routine deployment of the technology?

None – with the supporting computerized funnel created so that ideas can be submitted, the program could be started immediately.</td></tr>
<tr><td>10. Have other organizations used this technology? Yes or No: No If so, please list organization names and contacts.
<table>
<tr><th>Organization</th><th>Name</th><th>Phone</th><th>E-mail</th></tr>
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<tr><td rowspan="2">Potential Payoff (30 points)</td><td rowspan="2">Payoff is defined as the combination of broad applicability and significant benefit or advantage over other currently available technologies.</td><td>11. How does the technology meet customer or stakeholder needs in your State DOT or other organizations that have used it?

Absolutely – it is a morale-booster for our employees in the field, and ultimately serves our chief customer, who is the Idaho road user and taxpayer.</td></tr>
<tr><td>12. 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 results: 408 ideas for improvement. Savings and efficiency improvements amounting to $2 million have stretched the money that can be applied to Idaho roads, bridges and delivering improved transportation services. ITD employee-initiated and reported innovations have also saved more than 66,000 labor hours of contractor and employee time across the state. Of the reported innovations, nearly 150 are customer-service improvements.</td></tr>
</table>

		13. 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? This program could be implemented anywhere – there would be no boundaries.
Market Readiness (30 points)	The AII selection process will favor technologies that can be adopted with a reasonable amount of effort and cost, commensurate with the payoff potential.	14. What actions would another organization need to take to adopt this technology? The buy-in from the highest levels of the organization is key, as is the computer backbone. The success, though, really relies on encouraging employees and promoting the program and results whenever possible. For instance, many of these innovations are discussed in stories in our weekly newsletter, which is posted to our website for the public to see. The innovations are also often discussed in news releases sent statewide to media and industry magazine/journals. They are routinely posted on the department's social-media sites, Facebook and Twitter, which are then shared and re-tweeted by the public. This allows ITD to reach stakeholders and build credibility. Recognition of individual efforts are also often part of a monthly staff meeting at the regional level, so employees are recognized in front of their peers.
		15. What is the estimated cost, effort, and length of time required to deploy the technology in another organization?
		16. What resources—such as technical specifications, training materials, and user guides—are already available to assist deployment? Our Chief Administrative Officer, Charlene McArthur, is the architect of the program and would be available to help someone get started.
		17. What organizations currently supply and provide technical support for the technology? There are a lot of innovation programs in existence on the private-sector realm, but not many this successful in state agency.
		18. Please describe any legal, environmental, social, intellectual property, or other barriers that might affect ease of implementation. None.
Submit Completed form to		***http://web.transportation.org/tig_solicitation/Submit.aspx***

AASHTO Innovation Initiative

Nomination of Technology Ready for Implementation

<table>
<tr><td>Sponsor</td><td>Nominations must be submitted by an AASHTO member DOT willing to help promote the technology</td><td>1. Sponsoring DOT (State): Idaho Transportation Department (ITD)</td></tr>
<tr><td></td><td></td><td>2. Name and Title: Steve Spoor, Program Manager
Organization: Idaho Transportation Department, Highways Division, Mobility Services Group
Street Address: 3311 W State Street
City: Boise | State: Idaho | Zipcode: 83703
E-mail: steve.spoor@itd.idaho.gov | Phone: 208 334 8413 | Fax:</td></tr>
<tr><td></td><td></td><td>3. Is the sponsoring State DOT willing to promote this technology to other states by participating on a Lead States Team supported by the AASHTO Innovation Initiative? Yes or No: Yes</td></tr>
<tr><td>Technology Description (10 points)</td><td>The term “technology” may include processes, products, techniques, procedures, and practices.</td><td>4. Name of Technology:
Winter Automated Reporting System (WARS)</td></tr>
<tr><td></td><td></td><td>5. Please describe the technology.
WARS is a maintenance support system that combines snowplow spreader data, plow position and AVL data into meaningful information that is utilized to improve the quality of winter operational reporting, reduce operator data input time, and improve ITD’s winter operations. The snowplow truck spreader, plow position and AVL data is generated by Certified Cirus Controls (Cirus) Spreadsmart^{RX} spreader controllers which includes an on-board data recorder that is connected to ITD’s network via WiFi communication protocols. The information is then stored on ITD servers using Cirus software. The WARS system imports and converts the data into a meaningful report format that is then used by operators, road foreman, and management personnel for improving winter operational efforts. The WARS system was developed by ITD using contract programmers. ITD defined winter operational activities based on a combination of various truck sensors. Data collected from the snowplow truck on-board data recorder is converted to these operational activities while GPS data is processed to display route/milepost ranges within ITD’s highway network. The WARS system creates activity/route records that include the operator, labor hours, truck number and miles/hours, material types, total quantity of material used, and completed work units. Upon operator validation, the data is interfaced directly to ITD’s Agile Assets - Maintenance Management System (MMS). During the interface, work orders, day cards for labor, equipment, materials, location, and accomplishments are automatically created eliminating the need for operator input of this information into the MMS.
During the operator validation step, the WARS system displays an Operator Daily Summary screen summarizing all data derived along with a map showing the routes and truck data for specific points on the routes.</td></tr>
<tr><td></td><td></td><td>6. 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 list your attachments here.
a. Daily Summary Report and Truck Activity Maps
b. Data Flow Diagram
c. Photos</td></tr>
</table>

<table>
<tr><td rowspan="5">State of Development (30 points)</td><td rowspan="5">Technologies must be successfully deployed in at least one State DOT. The AII 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>7. Briefly describe the history of its development.
In 2012 ITD initiated a project to utilize snowplow and AVL data to improve winter operations and streamline the reporting of winter maintenance activities. ITD tried various spreader controller and data recording partners before finalizing our WARS partnership with Certified Cirus Controls, Agile Assets, and contract programmers from Experis. Software development was managed by ITD's Enterprise Technology Systems Group. The project was ranked second amongst all IT projects developed in 2015 as providing the best return on investment. ITD's existing infrastructure included WiFi communication capability at all Maintenance Stations around the state. Due to Idaho's topography and rural setting, it was determined that cellular communication would not be a statewide solution for communicating data. Cirus was chosen due to the fact their product included all necessary hardware integrated within a single hardware device and WiFi communication was the standard protocol of the hardware. The team worked with Cirus on enhancements to their standard software to meet communication and database configuration goals and objectives. Once these software products were activated and controllers were installed in snowplow trucks, ITD began collecting and reporting data for validation by management for process improvement, utilizing Cirus' standard reporting software. Very early in the deployment and use of the software, the team recognized the need for enhanced reporting capability, and the benefits to be received from interfacing the data collected by the trucks directly to our Agile Assets Maintenance Management System. The team defined the requirements for the enhanced capability and contracted with Experis to develop the WARS software that offered enhanced reporting and the ability to import the truck data directly into the MMS. This development effort began in the fall of 2014 and was deployed the fall of 2015. The team established the data interfaces and the database configuration, along with the query and report formats. Enhancements were identified through use of the software and completed throughout the 2015/2016 winter season.</td></tr>
<tr><td>8. For how long and in approximately how many applications has your State DOT used this technology?
The system was deployed statewide in Idaho for the 2015/2016 winter season in five (5) of the six (6) Districts on approximately 250 trucks. For the upcoming season, the system is fully developed and will be utilized by all six (6) Districts on ITD's entire fleet of 409 trucks statewide. All snowplow operators will be required to use the system this winter season insuring data consistency and accuracy statewide.</td></tr>
<tr><td>9. What additional development is necessary to enable routine deployment of the technology?
Minor bug fixes have been made but otherwise the system is performing as planned. Additional reporting capability has been identified and is being considered for development. Otherwise, the system as currently developed will be utilized and could be deployed in other DOT's.</td></tr>
<tr><td>10. Have other organizations used this technology? Yes or No: <u>No</u> If so, please list organization names and contacts.
<table>
<tr><th>Organization</th><th>Name</th><th>Phone</th><th>E-mail</th></tr>
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<tr><td></td></tr>
<tr><td>Potential Payoff (30 points)</td><td>Payoff is defined as the combination of broad applicability and significant benefit or advantage over other currently available technologies.</td><td>11. How does the technology meet customer or stakeholder needs in your State DOT or other organizations that have used it?
The WARS system met the goals of improving data quality, reducing operator input needs, improving winter maintenance management tools, and reducing winter maintenance costs. The system provides operators with a user friendly interface to review their daily work efforts and submit the information electronically to the MMS which creates their payroll and updates material stockpile quantities. This has reduced operator data input from 30 to 60 minutes daily to approximately 5 minutes for review and validation only. ITD now has granular data to review current state operations and costs versus results in an effort to evaluate and investigate potential increases to winter operation efficiencies. District management is able to accurately understand current winter operations and make necessary changes to achieve overall performance improvements and cost reductions. It is anticipated the system including software development and the deployment of all related spreader controller hardware will have a payoff of approximately 2 to 3 years. This payoff is primarily attributed to material savings, but labor and equipment cost savings will also be realized.</td></tr>
</table>

		12. 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 has only been deployed for a single winter season, so the total cost savings and benefits are yet to be fully determined. Pilot studies conducted by ITD demonstrated that through data analysis accompanied by process improvement resulted in a minimum 10% savings of winter operations chemical materials. For ITD, we anticipate materials savings of approximately $1M/year upon the full deployment of the system in 2016/2017. Other direct cost savings include a reduction of operator input time equating to approximately 7,500 labor hours/year and reduction of equipment costs through improved efficiencies. The cost savings associated with equipment has yet to be analyzed. Four (4) years prior, ITD implemented Winter Performance Measures that has resulted in improved winter operations performance, enhancing safety, mobility, and reducing severe winter weather crash events. By deploying the WARS system, ITD now has the ability to validate consistent performance from operators across all sections of highway. We anticipate further improvements in safety and mobility. Lastly, we have begun the process of integrating WARS data with other management systems in an effort to improve our overall efficiency and expect further cost reductions above the values stated above.
		13. 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 opportunity for replicating the WARS model elsewhere could include state DOTs, local government entities responsible for winter maintenance, and foreign countries. The primary ingredients needed are the snowplow controller, ability to capture and record the applicable truck data, an AVL system, and an asset management system in which to import operational data.
Market Readiness (30 points)	The AII selection process will favor technologies that can be adopted with a reasonable amount of effort and cost, commensurate with the payoff potential.	14. What actions would another organization need to take to adopt this technology? Another organization would need to assess their data sources for fusion potential and determine the feasibility and cost for performing this project. The technology as deployed is an enterprise solution requiring consistency across the entity. This requires the entity to determine a hardware, communication protocol (WiFi or cellular), network capability for communication, and the ability to automate data transfer between various systems.
		15. What is the estimated cost, effort, and length of time required to deploy the technology in another organization? The WARS system was developed to be compatible with current hardware choices within ITD. The hardware choice which then dictates the data format will be a key element is estimating the cost of deployment into another agency. Other potential costs include updating spreader controllers, establishing communications, and the potential deployment of a MMS. However, these costs are not directly related to using the system as designed. Costs specific to the software system itself would be those to update the code for the specific hardware decisions and existing software systems of the entity. This effort will vary depending on the entity and their current state of practice. For reference, the ITD WARS project development budget was $1.2 Million, excluding the truck hardware upgrades, and required 18 months to launch.
		16. What resources—such as technical specifications, training materials, and user guides—are already available to assist deployment? ITD developed the following training materials: WARS Training Guide Multiple WARS Overview Training Videos WARS Introduction video for new employees Cirus Log Definitions Document UTC Time Conversion for Cirus Logs vs WARS Data Document Cirus/WARS support and contact information document

		17. What organizations currently supply and provide technical support for the technology? ITD, Certified Cirus Controls, Agile Assets and Experis are all able to provide guidance to any interested agency.
		18. Please describe any legal, environmental, social, intellectual property, or other barriers that might affect ease of implementation. The intellectual property of the WARS system is owned by ITD and was developed by ITD utilizing contract programmers from Experis and Resource Data Inc. The system utilizes software licenses from Certified Cirus Controls, and ESRI. Entities deploying the system would be responsible for establishing their own software licenses for the use of these companies' products.
Submit Completed form to		***http://web.transportation.org/tig_solicitation/Submit.aspx***

COLORADO
Department of Transportation

Region 1 - Lone Tree Residency
7328 S Revere Parkway, Suite 204A
Centennial, CO 80112

AASHTO Nomination

Innovation Initiation Submittal

Problem Statement:

For every single Engineering and Local Agency construction project that CDOT creates, the designer must create and prepare a specifications package. Within this specifications package, there are Project Special Provisions (PSP) and Standard Special Provisions (SSP). Currently, the PSP is comprised of individual Word documents that the designer must select, open, copy and paste into a master file. There are hundreds of specifications that a project may need. It is up to the designer to work through each one and decide on its applicability and intent. Depending upon the size and complexity of the project, the PSP could be as small as 25 special provisions or as much as 100+. The designer must also step through a similar process when selecting the applicable SSP as well.

In addition to building a specifications package, the designer will create a title sheet, which indexes all the applicable specifications listed, with the specific specifications listed and the corresponding sheet numbers. This is another manual process where the designer will either manually type in the name of the specification or will copy and paste the title. Either way, it is time consuming and very inefficient. Through some rough calculations of the time needed to create a complete specifications package for a project, that includes the PSP, SSP and title sheet, it takes approximately 8 man hours per 25 specifications.

Because a project's specification package can be hundreds and hundreds of pages long, for convenience, a designer will often use specifications from previous projects and include them in new projects. This creates potential specification issues because the old specifications may not contain applicable content and could possibly be in conflict with new requirements.

Discussion of Solution:

To help automate and speed up the specifications creation process, the Project Specification Assembly Tool (PSAT) was created. PSAT is an Excel based tool that automates the assembly of the PSPs and the SSPs into a complete Specification Package. This tool offers the opportunity for increased efficiency and accuracy when preparing and creating project specifications. Depending upon the number of specifications, this tool can reduce the amount of time needed to assemble the specifications from 1 to 3 staff-days of work per project to just a few minutes. If fully utilized, this tool has the opportunity to save between $70,000 and $200,000 per year in CDOT staff time. Additionally, considering the numerous Local Agency's that use CDOT specifications, the amount of savings could increase significantly across the state.

Since PSAT always references the most current specifications, the risk of building a specifications package with conflicts or outdated content is minimized and reduced.

The How:

PSAT uses two programs: "SpecialSpecs" and "Standard Special Provisions Index", which are both Excel based, and can be downloaded at the Project Specification Assembly Tool Website. Once all the necessary specifications are selected, the designer clicks on 'create' and the program generates a new Word document that includes all the selected specifications and the index. Detailed operating instructions provided in the Project Specification Assembly Tool Website are available.

The designer enters applicable project information into PSAT and it uses the information to create the applicable headers. This saves additional time and improves the consistency of the specifications package.

The majority of Local Agency's in Colorado that perform transportation related projects, rely heavily on CDOT's specifications and standards. When CDOT revises or updates any aspect of the design and construction requirements of project delivery, it has a ripple effect across the state.

Key Benefits:

The development of this tool employs several Lean principles, including 1) using automation to speed up repetitive tasks, 2) reducing delays and confusion caused by errors, and 3) standardizing work. Using this tool, project designers reduce errors that often arise from copying, pasting and editing old project worksheets and reduce the time needed to create the specifications package. PSAT will be updated and hosted by the CDOT Standards and Specifications Group, which will ensure the most current specifications are always being referenced.

Idea/Innovation developed by: Jack Thorpe (EIT II), and Dole Grebenik (PE II), Lone Tree Residency, Region 1.

Submitted by:
Dole Grebenik, P.E.
Resident Engineer – Region 1
Dole.Grebenik@state.co.us
303-365-7234

This is a complete list of all the Standard Project Provisions to select from:

This is a complete list of all the Project Special Provisions to select from:


Project Special Provision Work Sheets

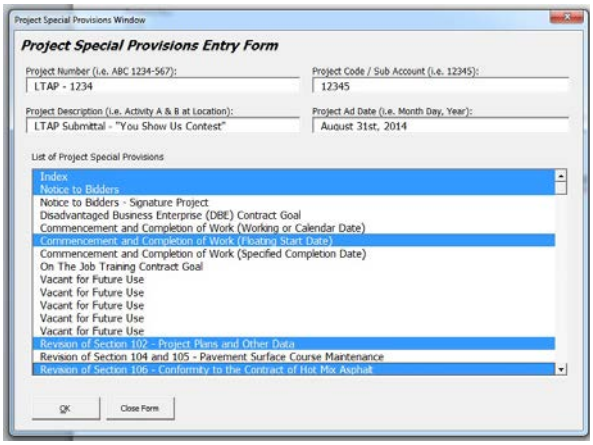
These work sheets are used to create commonly used project special provisions that modify Colorado DOT's 2011 Standard Sp

COLORADO DEPARTMENT OF TRANSPORTATION SPECIAL PROVISIONS

Index of Project Special Provisions Work Sheets

Index of Standard Special Provisions
NOTICE TO BIDDERS
NOTICE TO BIDDERS - SIGNATURE PROJECT
DISADVANTAGED BUSINESS ENTERPRISE (DBE) CONTRACT GOAL
COMMENCEMENT AND COMPLETION OF WORK (WORKING OR CALENDAR DATE)
COMMENCEMENT AND COMPLETION OF WORK (FLOATING START DATE)
COMMENCEMENT AND COMPLETION OF WORK (SPECIFIED COMPLETION DATE)
ON THE JOB TRAINING CONTRACT GOAL
REVISION OF SECTION 102 PROJECT PLANS AND OTHER DATA
REVISION OF SECTIONS 104 AND 105 - PAVEMENT SURFACE COURSE MAINTENANCE
REVISION OF SECTION 106 - CONFORMITY TO THE CONTRACT OF HOT MIX ASPHALT
REVISION OF SECTION 107 - PERFORMANCE OF SAFETY CRITICAL WORK
REVISION OF SECTION 108 SPECIALTY ITEMS
REVISION OF SECTION 202 - RECLAIMED ASPHALT PAVEMENT MILLINGS
REVISION OF SECTION 202 - REMOVAL OF ASPHALT MAT (PLANING)
REVISION OF SECTION 202 - REMOVAL OF BRIDGE
REVISION OF SECTIONS 202 AND 412 - REMOVAL AND REPLACEMENT OF CONCRETE PAVEMENT
REVISION OF SECTION 202 - REMOVAL OF STRUCTURES COATED WITH HEAVY METAL BASED PAINT
REVISION OF SECTION 203 - EMBANKMENT MATERIAL
REVISION OF SECTION 208 - PERMANENT WATER QUALITY BMP AS CONSTRUCTED SURVEY
SECTION 240 - PROTECTION OF MIGRATORY BIRDS BIOLOGICAL WORK PERFORMED BY A CDOT BIOLOGIST
SECTION 240 - PROTECTION OF MIGRATORY BIRDS BIOLOGICAL WORK PERFORMED BY THE CONTRACTOR'S BIOLOGIST
SECTION 240 - PROTECTION OF MIGRATORY BIRDS DURING STRUCTURE WORK
REVISION OF SECTION 304 - AGGREGATE BASE COURSE
REVISION OF SECTION 401 - ROLLER PASS STUDY - DENSITY
REVISION OF SECTIONS 401 AND 703 - STONE MATRIX ASPHALT PAVEMENT
REVISION OF SECTION 403 - HOT MIX ASPHALT
REVISION OF SECTION 403 - STONE MATRIX ASPHALT PAVEMENT
REVISION OF SECTION 405 - HEATING AND REMIXING TREATMENT
REVISION OF SECTION 409 - ULTRATHIN BONDED WEARING COURSE
REVISION OF SECTION 603 - REINFORCED CONCRETE PIPE
REVISION OF SECTION 606 - TENSIONED CABLE BARRIER (TL-3)
REVISION OF SECTION 606 - TENSIONED CABLE BARRIER (TL-4)
REVISION OF SECTION 608 - CONCRETE SIDEWALK (COLORED)
REVISION OF SECTION 614 - IMPACT ATTENUATOR
REVISION OF SECTION 614 - IMPACT ATTENUATOR (LOW MAINTENANCE)
REVISION OF SECTION 614 - IMPACT ATTENUATOR (REACT)
REVISION OF SECTION 614 - IMPACT ATTENUATOR (REACT) (WIDE)
REVISION OF SECTION 614 - IMPACT ATTENUATOR (SAND BARREL ARRAY)
REVISION OF SECTION 614 - IMPACT ATTENUATOR (QUADGUARD) (WIDE)
REVISION OF SECTION 624 - DETOUR DRAINAGE PIPE
REVISION OF SECTION 624 - DRAINAGE PIPE
REVISION OF SECTION 626 - PUBLIC INFORMATION SERVICES
REVISION OF SECTION 630 - COURTESY PATROL
REVISION OF SECTION 630 - IMPACT ATTENUATOR (TEMPORARY)
REVISION OF SECTION 630 - PORTABLE MESSAGE SIGN PANEL
REVISION OF SECTION 630 - PORTABLE MESSAGE SIGN PANEL (STATE PURCHASED VMS)
REVISION OF SECTION 630 - TRAFFIC INCIDENT MANAGEMENT PLAN
REVISION OF SECTION 630 - UNIFORMED TRAFFIC CONTROL (LOCAL AGENCY)
REVISION OF SECTION 630 - UNIFORMED TRAFFIC CONTROL COORDINATION (COLORADO STATE PATROL)
REVISION OF SECTION 702 - BITUMINOUS MATERIALS
FORCE ACCOUNT ITEMS
FORCE ACCOUNT PROJECT (Force account estimate)
FORCE ACCOUNT PROJECT (Actual materials labor and equipment)
RIGHT OF WAY RESTRICTIONS
TRAFFIC CONTROL PLAN - GENERAL
UTILITIES

So, you can either go and select each individual Word document, then copy and paste into a master file, or use:


Project Special Provisions Window

Project Special Provisions Entry Form

Project Number (i.e. ABC 1234-567): LTAP - 1234

Project Code / Sub Account (i.e. 12345): 12345

Project Description (i.e. Activity A & B at Location): LTAP Submittal - "You Show Us Contest"

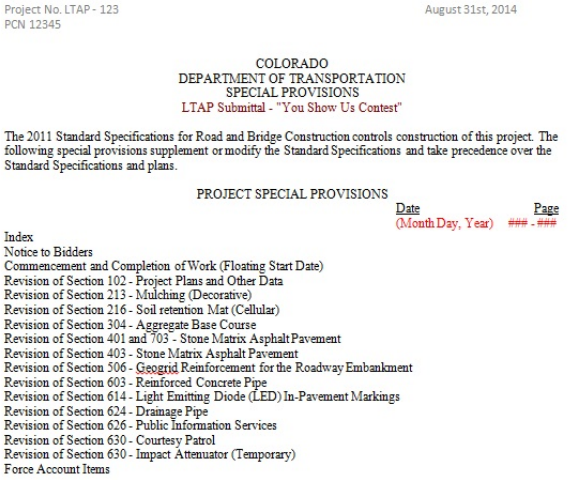
Project Ad Date (i.e. Month Day, Year): August 31st, 2014

List of Project Special Provisions

Index
Notice to Bidders
Notice to Bidders - Signature Project
Disadvantaged Business Enterprise (DBE) Contract Goal
Commencement and Completion of Work (Working or Calendar Date)
Commencement and Completion of Work (Floating Start Date)
Commencement and Completion of Work (Specified Completion Date)
On The Job Training Contract Goal
Vacant for Future Use
Vacant for Future Use
Vacant for Future Use
Vacant for Future Use
Vacant for Future Use
Revision of Section 102 - Project Plans and Other Data
Revision of Section 104 and 105 - Pavement Surface Course Maintenance
Revision of Section 106 - Conformity to the Contract of Hot Mix Asphalt

OK | Close Form

To create your specifications package:


Project No. LTAP - 123
PCN 12345

August 31st, 2014

COLORADO
DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISIONS
LTAP Submittal - "You Show Us Contest"

The 2011 Standard Specifications for Road and Bridge Construction controls construction of this project. The following special provisions supplement or modify the Standard Specifications and take precedence over the Standard Specifications and plans.

PROJECT SPECIAL PROVISIONS

Date (Month Day, Year) Page ### - ###

Index
Notice to Bidders
Commencement and Completion of Work (Floating Start Date)
Revision of Section 102 - Project Plans and Other Data
Revision of Section 213 - Mulching (Decorative)
Revision of Section 216 - Soil retention Mat (Cellular)
Revision of Section 304 - Aggregate Base Course
Revision of Section 401 and 703 - Stone Matrix Asphalt Pavement
Revision of Section 403 - Stone Matrix Asphalt Pavement
Revision of Section 506 - Geogrid Reinforcement for the Roadway Embankment
Revision of Section 603 - Reinforced Concrete Pipe
Revision of Section 614 - Light Emitting Diode (LED) In-Pavement Markings
Revision of Section 624 - Drainage Pipe
Revision of Section 626 - Public Information Services
Revision of Section 630 - Courtesy Patrol
Revision of Section 630 - Impact Attenuator (Temporary)
Force Account Items

Old way = 8 to 24 hours of staff time.
New way = 5 minutes.