

Every Day Counts (EDC-3) Smarter Work Zones Webinar Series Webinar #1 Transcript

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Please stand by for real-time captions. Good afternoon welcome everyone all lines have been placed on mute. If you would like to ask a question, precious -- press star one. Nicole, you may begin your conference.

Welcome to this first webinar. A comprehensive overview on smarter work zones. Before I go any further, for those of you calling in, please mute your speakers. Today we have five presenter -- presenters. Jawad Paracha, Martha Kapitanov, Todd Peterson, W.D. Baldwin and, Neil Boudreau. Jawad Paracha has over 18 years experience and previously served as the assistant chief of the Maryland Highway administration. 10 six is a transportation specialist. Todd Peterson is a transportation specialist on the work zone team in the FHWA office of operations. Heat is currently the lead Champion and promoting works on strategies. W.D. Baldwin eight is the Northwest region traffic leader. He is a member of the FHWA one implementation team can't --, championing the development of technology. Neil Boudreau serves as a director of traffic and safety of Massachusetts DOT. He also serves on a committee of traffic and engineering. Today's seminar will last 90 minutes. The first 70 minutes are allocated to speakers and the last 15 minutes will be for questions. If during the presentation, you think of a question, type it into the comment area. Please indicate which speaker the question is for. They will be unable to answer questions during the presentation. We will pause halfway through, to answer the questions in the chat box. You may also type in questions at the end of the presentation. Will also open up the phone lines for questions and comments. This will also be available for download. The presentation will also be available online within the next few weeks, along with the recording and a transcript. Will notify all attendees when these are available online. I will now turn it over to Jawad Paracha Thank you Nicole. I would like to thank and welcome all departments who have joined us today. This webinar is a first in the series of smart work zones webinar that we will be conducting in the next few months to help implement smarter work zone strategies and achieve goals. As we get more information for other events, such as webinars and events and training courses, we will be updating the clearinghouse website. I am emphasizing it, and we will do so again towards the end. This is information related to the smarter work zones and events, including webinars. The main purpose of today's webinar is to provide a comprehensive overview of the smarter work zone initiative. Also, to enable a common understanding of the program, its goals and implementation. We have had several webinars before, during the summit with the agency. Internally, also, highlighting the different elements of a smarter work zone. We here are highlighting what are the strategies and funding opportunities, as well as the resources and technical opportunities that are available. What do we mean by smarter work zones? It is innovative strategies for optimizing work zones and mobility. We kept it very simple. We identified two strategies. Under the smarter work zone, the first being project coordination. We defined as coordination within a single project and or among multiple projects within a corridor, network or region. Possibly across agency jurisdiction -- jurisdictions. Will have examples later on. The second strategy we have called the technology application. It is dynamic management of

work zone traffic impacts, such as queue and speed management. As I mentioned earlier, we will be talking about goals today. This is something that we have not discussed in more detail in earlier webinars. The goals were stated. To bring everybody to the same page, we are discussing in more detail. The first goal is related to the project coordination. It states that by December 2016, we should have 25 states DOTs incorporating work zone project coordination strategies into agency documentation of business processes. We mean an agency implementing a project strategy should typically perform a review of their current agency project practices to identify strengths and weaknesses. The second one is to do a review of best practices of other agencies. Then the agency identifies strategies that help them improve project coordination, as defined in the last slide. Within a network, corridor or region and across the agency jurisdiction. We are stating some examples of these strategies, such as software based systems to coordinate right of way construction activities and minimize traffic impacts. Use of corridor-level transportation management plans to minimize traffic impacts. We are mentioning some examples here. Every agency needs to look at what their business processes are. What they are going to be using, and find out what other agencies are doing. What are best practices, and try to identify what project coordination they want to implement. Towards the end, they need to develop agency documentation and business processes. The second goal related to the project coordination is related to the WISE tool. WISE stands for work zone implementation strategies estimator software. Under the every day counts program, the goal is to have five states DOTs. By piloting, we want agencies to use this WISE tool for its purpose. To optimize project schedules and analyze mitigation strategies to minimize work zone traffic impacts in the operation stage. It is definitely more of a planning tool. It does have operational impact. The second thing we want is that the agency evaluate the system effectiveness and demonstrate its value for work zone management. Especially project coordination, as defined under the every day counts program. Suggest enhancements for the tool. The second strategy under this program is technology application. It has two elements in it. It states that by December 2016, 35 states DOTs have implemented business processes for work zone ITS technologies, as identified in the work zone ITS implementation guide. What they want, is to have a well-documented agency policy and processes meant to streamline consideration and use of work zone ITS technologies to minimize traffic impacts. We want that process to be streamlined. We wanted to be well documented so that it become standard practice in the agency. Healthy consider the use of ideas -- how they consider the use of ideas. The system design, procurement and how it is deployed. We want established procedure and processes, related to the use of ideas in the agency. The second element, under this goal, is related to field application of the Work Zone ITS & Technology. The purpose there is dynamic management of work zone impact. It has to be a dynamic impact. What do we mean by dynamic management? Later on in this webinar, Todd Peterson will go into more detail. It needs to be more than a simple sensor. It needs to be fulfilling a need. In the first bullet, I am referencing the implementation guide. Keep those six steps in mind. Whatever strategy is being used, it needs to be fulfilling a need. It needs to go to proper operations and system design. It needs to have proper procurement and there needs to be a performance measurement or eat effective net's. Ultimately, whatever is learned through that field application gets into agency documentation and business processes. It helps the agency institutionalize the technology application element. I will hand it over to Nicole. Either any questions related to this -- are there any questions related to this?

We will now move over to Martha Kapitanov.

Good afternoon. I will go over the project coordination strategy. Jawad Paracha already shared with you the project and goals on the every day account initiative. To ensure good implementation, we need to understand that the transportation system is a network. Work at one location will impact other locations. Also, since the highway infrastructure is aging, and congestion is increasing, states, counties and cities are facing more management. Remember, road users may not be able to understand why our road is being cut by a utility company. This is may be done six months after road maintenance. They know they are stuck in traffic, and most likely they will blame the traffic agency for not coordinating both projects. Therefore, project coordination is important for road activities. Project coordination needs to occur at the planning stage because it allows agencies to identify early on the right group during the development of the project. Coordination also helps agencies to identify, analyze and mitigate individual and accumulated work prior to construction. Project coordination can help your agency reduce street cuts, save money, and mitigate conjunction. Let's go over project coordination examples. The district department of transportation has worked on management coordination. The benefits of the system include better coordination among working projects by the DOT. It has the ability to track performance measures, including works own ability, safety, customer satisfaction and contractor performance. And assist in the development of citywide transportation demand management strategies. Before I go over this example, I need to give background information. The Michigan DOT I-94 Corridor has 274 miles and is managed by three different regions. Within those three regions, are nine transportation service centers in nine different counties. And 2010, Michigan DOT policy, set a threshold of 10 minute delay for each project. When you look at projects in isolation, that is not a significant number. However, Michigan was going to have 19 projects within the core door, bringing the total to 190 minutes. This equaled three hours. Certainly, this was unacceptable. Therefore, the DOT, decided to meet and establish a travel delay time for work sons. At that point, it was a maximum delay of 40 minutes. They agreed that the traveling public could support this time. To bring coordination, they divided the core door into three segments. They separated the highway into three points and established alternate routes. In 2011, they floated the project onto this map. They summarized the delays. Another example, is in Washington State DOT. The Washington State Department of transportation is a collaborative, multiagency construction traffic planning effort. These coordination efforts include long-term, midterm, and short-term information sharing. As a result of their coordination efforts, Washington state the DOT and the local agencies recognized benefits. Had reduced road closures -- they had reduced road closures and shared resources. They had enhanced public information dissemination, reaching a greater number of stakeholders. It was an easier way for maintenance staff to see what activities they could perform during the already planned link closures, reducing lane closures. Here we are discussing a new soft where tool, developed under the two ran 21 project -- developed under the SHRP2 R11 project. It has two modules. The planning module minimizes delays to the public. The operation module uses a simulation tool platform that evaluates the impact of individual strategies at the impact level. For grants were recently awarded to plan the tram four tool. -- 4 grants were recently awarded to pilot the tool. The use of tools is a good practice to share information with other stakeholders. Through the smarter work zone strategy we would like to improve works own safety in your state, and ultimately statewide. This concludes my presentation.

Thank you Martha. We will now move on to W.D. Baldwin.

My presentation is not so much to go over the details of the Oregon program. I think you have heard it before. My goal is to give you an idea of how to implement coordination along the corridor. You can use the Oregon program as an example. Martha did a great job of explaining the Michigan DOT corridor. I think there are similarities between the two programs. If you want to look more at another example of what they did, much of what we did is similar. There are five bullet points that I broke down of what I saw taking place on the Oregon program. It took place over five years and I backtrack to see what stood out. Establishing some type of vision at a high level for the corridor. When you start to do that, it is developing the details of how that coordination is going to take place with the right stakeholders and the right agency participants. Educating and informing your personnel, who are going to be implementing this. Letting the stakeholders know how this will affect them. Going through the implementation and the details and there. Also, refining the process. For background on our program, in 2004 the program unfolded. Prior to that, Oregon had identified hundreds of bridges across the state that needed to be repaired or replaced. This was due to weight limitations, cracking, or potential for needing to be replaced over time. They group them together in one large program. The company that I am with right now, was one of the firms that helped from a program management perspective to implement this. It was a statewide program that took place over 10 years. This was from 2004 to 2014. We finished up some of the last bridges. The height of the activity was in 2006, 2007, 2008. If you are familiar with the state, you know that this is a major core road here, running from Portland to California. I 84, runs east to west across the state. We had several key corridors that needed to be maintained. We had parallel routes that help take care of detours. Even though this was a state program, there were core elements that needed to be addressed for mobility across the state. I mentioned establishing a vision for the system. That starts with top management. Either from the director of the agency, or even from the legislature or Governor. This was the case of what we did prior to our arrival. It had buy in from a lot of important stakeholders. I mentioned weight restricted bridges. At was limiting freight movement across the entire state. At the top level, you have the director, involve stakeholders in the trucking industry, wanted to make sure that the implement it a program that was going to take care of the bridges. At the same time, you could not have the restrictions that were taking place for construction, limiting the mobility of loads across the state either. With that, a mission statement came out, that was one of the five goals of the program. It was goal number three, to keep traffic moving during construction. In my role as the mobility manager for the program for us, not the statewide mobility manager, but for our program. My task for the work zones was to make sure that we kept traffic moving during the construction activity. I mentioned the critical routes that we had to deal with. We needed to keep freight moving. When one of the routes was under construction and had restrictions on them, we need to create parallel routes. There was a scheme that had to be set up, to make sure that if one route was under heavy construction, another route would be unencumbered or had minimal restrictions. Martha mentioned before, establishing work zone delays or delay thresholds needs to be done. One of the calculations we had at one point was that it would have taken additional three hours to get from Portland down to the California border. Like Martha said, that is something that would have been tolerable. We had to establish delay thresholds for work zones. When you added them up aggregate, it had to be an acceptable amount of delays. It was set up at a program level for what we're going to do. Want to get to that point, getting more people involved -- and our case, it was a statewide committee made up of decision-makers they could help flesh out how these goals were going to be addressed or

maintained. These kinds of programs affect everybody across the board. We brought in construction maintenance, design people, and several different people had to be brought in. Date put together the details -- they put together the details. Woman got into the technical details, everybody did not want to sit through those. We've broke out into subcommittees to address and resolve the things that needed to be considered. Along with this, you need to develop guide documents. You need to explain to people how these are going to take place. In the case of Oregon, was a highway development manual. In the back, were associated memorandums. Here is the intention of the program, here is what we will do. We had a guidance document, or a playbook, to explain to people how you would carry things out. In dealing with the details of how it is going to be carried out, what needs to be managed within those work zones? In many cases, it may be travel times, but that ties that two things like delays, travel volume and capacity that you have along that route. Straightforward traffic engineering and analysis that needs to be performed. There is also load sizes and the hole in the air. How do we get these loads moved from one point in the state to the other? If you are familiar with bridge construction, when you build it, sometimes your opening only be so wide for a certain duration. That creates restriction. You need to understand that when those get implemented and the scheduling of those. We had to manage that hole in the air. We developed tools to plan and manage these activities. I will talk about them a little bit further here. One of the things that is also critical, is the TMP concept. They transportation management plan. In our case, we developed one that was the playbook for the whole state, and how we were going to execute the bridge program across the entire state. That trickled down into planning a corridor level TMP. And 19. It referred back to things that were spelled out in the corridor level guidance. Again these projects ran night teen -- project level TMP spell out how are going to work in these work zones. We subdivided the state into different segments. In this case we are looking at a segment of I-5, just next to California is that 55 miles. The delay threshold is about seven minutes. The aggregate additional travel time, or delay, along this route would be seven minutes. We had to design and manage our work sounds to me this type of requirements. We did that utilizing a work zone traffic analysis tool. We were able to go in and look at background data from all and determine what types of delays we would experience through the work zone, based on traffic volume and construction activity. There is been a lot of information out there, we took a process that normally took four hours for one individual in the traffic permit to do and rolled it down to spreadsheet activity that took 10 to 15 minutes. Because we had to do this hundreds of times for all of the bridges, and a lot of people had to do it for projects across the state, it made sense for them to develop a tool to help with this activity. I mentioned the physical restrictions of maintaining the routes. When we had the construction in place prior to a showing up, they gave the horror story of people having to detour to your hundreds of miles -- D2 were hundreds of miles. We needed to make sure that we could get that hole in the air to cover the height, length and weight. We had a lot of different loads that we had to accommodate in the state. Manufactured housing is an important industry for moving vehicles through work zones. There was also an explosion of the windmill industry when our program is taking place. We had to get those loads across the state during our program. What you have a program establish and understand what you want to do, you need to get out there and inform your personnel and educate them. They need to know what is expected. An activity like this is not going to be business as usual. You may need to point them back to the letter from the director. Here is our obligation and here is what we promised. It may be, that this program could take place over a number of years. You may need to be educate your staff were up eight them. There may be turn over and new people and new positions that need to understand the rules. We

also found it useful to have stakeholders participate. Have them sit in on some of these meetings and the trainings that took place. It was neat to see them share their experiences and understanding of why their freight load needed to move from one point to another point in what time of day they moved. It was insightful for the agency people to see it from the perspective of the road user. For them to see what it is they needed. It gave them some context when they implemented the program. Training is important on these tools. The works own tools and how to use TMPs. It all takes place as part of an education process. If you get through that in your in the implementation. The coordination meetings that Martha mentioned are so important. From a regional perspective, we had to get people at the table for a bridge program. You also need the DOT staff to share information and how you may potentially be a conflict. You need to work to resolve the conflict. If we could not work it out amongst ourselves, or needed to be an escalation process in place. How does this get resolved if we cannot resolve it here? Is there someone in the director's office or along the line to make a decision on how the project goes forward? Which one gets scheduled ahead of another? There needs to be a way to escalate things or recognize that as part of your process. The coordination meetings were made up of a variety of a personnel. You have planning people, construction, maintenance, and other agencies that would be affected. Tracking the projects is one of those things that you need to continue to do from the planning process and long-term. Need to look at the impact that those are going to create. The nearer term, the maintenance people need to be involved. There are things that need to be discussed and resolved. You need to have tools, processes and communication to cover the full gamut. Lastly, those tools that you do develop, you need to develop resources to keep them up. Especially project tracking tools. Who was going to be responsible for inputting information into those tools as you go along? Always, the refinement of the process. We were refining even at the beginning of the project, to understand the larger committees. We have an idea of how things might work and you need to modify those processes. During our training, we had just spent to spotted problems that we went back and retooled and refined. During implementation, all of this needs to be taking care of. And needs to be sent back to people and shared with the participants. As you build a program to manage mobility and coordinate each work zone. That covers my information and I will turn it back to Nicole.

Might now we have one question in the chat pot -- pod. What tools did you use?

It is based off of the all procedures there is more information. You can get in touch with me and I can share that with you. It is a modification of the highway capacity manual tools that are there. It was not any micro simulation activity. It was spreadsheet activity that was easily performed.

Since we do not have any more questions, we will move on to trying to seven -- and seven, Todd Peterson

I want to talk about technology application. I want you to think of that as shorthand for using a -- using ITS and work sounds -- zones. Specifically talking about systems that demonstrate dynamic operations and providing actionable information. We will talk a little bit more about these stations in the coming slides. Technology applications, when you talk about the capabilities of the systems, what we're really trying to do is capitalize on the ability of using data to inform works own traffic operation work zones. We do this two different ways. First is improving driver awareness. You want to get as much detailed information to downstream to drivers. That type of

information involves changing traffic patterns, changing lane configurations, closures etc. changing traffic patterns, changing lane configurations, closures etc. Presence of downstream congestion, we want to convey the information to drivers. If there is a lot of heavy vehicle activity coming in and out of the work zone, that can be a hazard to mainline traffic. We want to be able to get that information out to drivers so that they can react to it. If there is an unexpected delay -- if we can get the information to drivers, that can help to plan their activities or alleviate anxiety that they may have about potential delays. If they are commuting to work and they know specifically how long it will take to get through their work zone, that is good information to have. As far as dynamic and actionable guidance -- when we talk about this, it is important for driver information. The idea is to give information that they need. To this end, from a driver perspective, when you think about agencies that have an area that they have posted up and there is a message that says road work in progress, watch out for construction zones. Is a general message to let you know there is roadwork and progress. It is great for outreach to conduct. But it does not tell drivers anything specific about how to react to a work zone that they may be coming up on. It is more useful to tell a driver that traffic is stopped 1 mile ahead versus a generic roadwork ahead. If we can tell them specific information about how long the delay is, let's give them the information. Where specifically does that delay start? If they need to reroute their trip, or call ahead to let someone know, they can do that. That is part of the driver information. From the agency perspective, technology application tools provide enhanced tools -- toolset. The benefits of making real-time decisions about active work zones can inform policy for management strategies in the future. Some of the specific benefits of technology application that we are trying to leverage are using the availability to empower drivers to make better decisions. Whether it be reacting to congestion, or traveling -- changing their travel plans. The benefits from an operations standpoint include safety and mobility. A better informed driver can slow down, change their route to lessen congestion. Another benefit, -- some examples is we can see the reduced need for on-site enforcement and improved mechanism. You are telling drivers how fast they are going before you give them a speed violation. We are giving drivers feedback to improve their behavior in the work zone. You see an integration of real time decision-making. At the end of the day what we're trying to do is improve the quality and quantity of available data. It is part of a long-term effort towards performance measurement regarding the work zones. When we talk about soft benefits of technology applications -- getting information to drivers that is current and reliable relieves driver anxiety quite a bit. You are heading down the road and you're told that there is a work zone five minutes ahead. It is easier to handle when you find yourself in traffic and you have no idea why or how long it's going to last. It reduces driver anxiety and consequently, reduces frustration and road rage. That boils down to improve safety. We talk about the generalized benefits of technology application. Are going to talk about a couple examples the first is the queue warning system. It is designed to provide that advanced guidance to drivers that are approaching a work zone, where it has been shown that we expect queues to develop. Traffic will back up on the approach to the work zone. This can be dangerous where the work zone creates queues that extend past the beginning of the warning signs sequence. You may have a rural freeway that goes down to one lane. Work zone queue may backup three miles on cue may backup 3 to 5 miles. The queue may be on the opposite side of the hill. This creates a hazardous situation. We have seen major collisions result, particularly when there are heavier trucks involved that cannot stop in time. The idea is to install a system that protects travel speeds approaching the work zone. We want to really get that information upstream that can tell upcoming traffic what is going on. Maybe there is slow traffic ahead, or stop traffic 1 mile ahead. We give

them actionable guidance through the queue warning system. We want to change their behavior. Another example is a variable speed limit. This is a different spin on it. Yet is a sequence of variable speed limit signs, with each of those limits measuring speed at that location. What that can provide is harmonizing the speed to a reduced speed condition closer to your works on. Instead of going from -- if you're on a 70 miles per hour freeway, this sequence of variable speed limit signs can vary speed over a longer distance, so that they are approaching the works own editor more appropriate speed. It is reducing the speed differential, thereby improving safety. There is a better understanding of what is happening and what drivers need to be doing as they approach the traffic condition of the works on. Another example is a dynamic lane merge. There are two different flavors of the dynamic lane merge in and in an ideal situation. And a lower traffic situation, you have traffic traveling at a higher speed. What typically happens, in a lane reduction there is not a whole lot of traffic. People want to get in front of the other person and they speed up. You end up in a situation where they are trying to make the last minutes lane change at the merge point. That is not a safe situation. The idea is to encourage people to make that lane change earlier, so there is not that last-minute thing happening. A different situation, with heavier traffic, the traffic is slowed down and the queue build up from the merge point. You will have a long line of traffic where people have decided to merge over and get in the lane. You have people who want to zoom down to the end and make the most use of the open lane. They cram in at the merge point. The people who got in early feel like people are breaking the rules. This causes anxiety. What this does, it -- it says everybody use your lane. The incentive in the high-volume situation, is your maximizing your lane capacity. You're reducing the length of the stopped queue. That is the benefit. It shows, depending on the traffic, you are giving the benefit to all. Going back to the first slide, technology applications uses assistive technology approach. To that end, and 2014, we published a new guide. The work zone intelligent transportation systems implementation guide. There is a six step system. It starts with identifying what the need for the system is. What are you trying to accomplish with this investment that you're ready to undertake? What do you want to do, what are your goals and objectives? Once that is defined, you can carry this over to your concept of operations. Plan a detailed system. There are some challenges to procuring. Depending on the situation, it can warrant a different strategy than your normal design. Once the system is up and operational, unit go back and evaluate how well the system works. How well it met its goals. It is a continuous process of improvement that builds on lessons learned and the data obtained and performance measures generated the last time. That is what we mean by the whole systems engineering approach to this. That is how we want to help agencies learn from their past experiences with the work zone ITS. That wraps up a summary of what technology applications is. I will turn it over to Neil.

I am going to do some information on the case study we did in Massachusetts. ~Mr. how use this technology to coordinate. As I walked to this case study we did on the Callahan Tunnel rehabilitation project. Use that for how we took the project from start to finish. In the winter of 2013 to 2014, the Massachusetts projects close the Callahan Tunnel. At the parted downtown Boston heading towards Logan international Airport to points on the North Shore. This narrow two-lane tunnel carries 1200 vehicles during the a.m. and 2300 vehicles during the p.m. Planning for that full tunnel closure presented a challenge for us. How would we managed to displace traffic during this construction, with already congested roadways. We decided to use a full scale project coronation effort with our partner agencies. And working on the development, we developed the need to develop real-time traffic feedback on the conditions, to get information on

the displaced traffic. This project was deemed to be the perfect candidate for the Smart zone work system. It allowed MassDOT to develop goals in three key areas. Mobility, we wanted to minimize congestion through queue warning providing travel delay times encouraging traffic diversion. Safety, minimize the number of severity of traffic related incidents come injuries and fatalities in the works on. We wanted to ensure that we kept roadways open. Planning and monitoring. We wanted to use the data to update or traffic management plan. After two weeks of this project in effect, we modified to better serve the public and move traffic better. Unlike traditional construction projects that are established, we needed to rely on three sets of alternate routes, instead of one detour route. This map shows an overview of these alternate routes and provide specific guidance for traffic coming from the north. We completed some early action items to ensure that we would better be able to manage traffic. One, a median barrier was moved on section 1A, the area that would be most impacted by disclosure. This was to allow traffic. Improved -- we evaluated our existing operations at 25 intersections along Route 16 on the key alternate routes. We upgraded equipment and timing implement routes to make sure this alternate route met needs. Using a technology application, we developed a comprehensive Smart zone work since the -- system for the best route selection. The following screenshot is from her Callahan Tunnel project system that we use the smart work system for. This shows the coverage area that was used on the project. Specifically, we had 15 portable cameras, six boards, five message boards use probe censored data, which helped us to highlight the alternate routes. In this project area, we already have reoccurring congestion and queuing throughout the morning and afternoon peak hours. We needed to rely on this information to deliver the best travel route information and alerts our motorists where the commutes were happening. This shot shows how we used the queue management system, which is delivered by the delay threshold logic. This was developed by a free float traffic conditions that as a baseline. Depending on various conditions of how long the travel time would increase, we established logic thresholds where we would change the messaging based on how was impacting traffic. The green in this situation, represents the free flow conditions. Yellow is moderate travel time. Red represents heavy travel time. Following through, this graphic showed the two-tier message system. This was based on the three categories. Under free flow, we would tell folks the tunnel was closed and give direction to what the best route would be. As travel increased, we would change that message, delivered -- delivering them to the best alternate route. We tried to place them on the best alternate routes. This screen shows the system dashboard that was used to manage the system during construction. It provides a quick snapshot of the traffic conditions. Here the color codes reflect the current travel conditions. Green reflects at or close to the posted traffic speeds. We rerouted traffic accordingly. There is a corresponding camera view to the debt -- dashboards. You could observe what was going on in the cameras to ensure what traffic was doing. It was time of day specific and developed a reduction in the queue lanes. As I mentioned before, this system was used continuously to evaluate the traffic conditions along the various routes. Based on predefined thresholds, the message would direct motorist to the best route. The camera on the top left showed one of the key locations. The monitor provided access to the keywords. One required motorists to traffic on the left, and the other one would send them down through central downtown Boston on I 93 to get to the same destination. Throughout the evening commute, we would switch the travel time message to direct people, depending on which routes provided the best travel time. We had a dedicated website that monitored the situation. We used it, and shared it with our stakeholder agency, so that they can better manage their systems, as well as we are doing RRs. The conclusion of the project evaluated our system. This is what we witness to the

Smart zone system. Monitoring traffic and evaluating the feedback, helped to lessen driver frustration about travel conditions. We received very few negative comments. Using the Q1 system, especially in the areas that did not. Congestion, helped prevent unwanted crashes. Are construction office staff, had the benefit of using the Smart zone system to manage the public's expectations. It allowed them to concentrate on their primary job. Finally, sharing that access with partner agencies in the Metro Boston area, allow them to better manage their own network and transportation system. It created a sense of partnership on this aggressive construction project. The big question that we get asked, is what does this technology cost? And each project it is unique. We had projects that were bit as lump sum or some that came in as it cost. Under a lump sum permit we have seen jobs as low as 125,000 Under a lump sum permit we have seen jobs as low as \$125,000 and some that come in as high as \$950,000. Our average has been around 400 and some that come in as high as \$950,000. Our average has been around \$400,000. On a traditional bid process, MassDOT has seen monthly cost range based on product duration, quantities, location and expenses. There is also web software, and level customized in any integration of data sources. These are key elements that dictate what the project costs. In summary, we wanted to cover some of the lessons learned and how we use the work guide. Step one is the assessment of need. We evaluated the need of the portable ITS technology as we considered the mitigation strategy to help us address the impact of the displaced traffic from the Callahan Tunnel. We use it to better developer traffic management plan. The concept and feasibility. The expected impact should drive the scope of your works on. It is good to start developing a concept of operations early. Step three, detailed system planning and design. Here is where we used a very detailed item of specification. It is necessary to help and ensure that you get the Smart works own system that you need. You have to clearly define the specific equipment that you want, how you want the system to operate, what data information you need, and how the deliverable. Using non-descriptive specs vacation can lead to Smart zone system that does not meet your expectations and it will not help you establish a successful program for your agency. Finally, step six, system operation maintenance and evaluation. You need to capture the data collected for your Smart zone system and generate the performance measures that will help you sell the benefit of Smart zone system to your upper management and the public at large. A successful system that has gone through system operation needs to be thought out and it is there is an easy way to do that. Finally, this is an example for you smarter works own system in the interagency coronation to help mitigate traffic in our system. Femur information, please contact me. Here is my email address.

We will now go back to Jawad Paracha for closing remarks.

The next two slides we will cover a few points that we believe are important from the perspective of successful implementation of smarter work zones. The first point you want to make is related to the State implementation plan. Some of these states have developed these implementation plans, which are being used as a product management tool, by listing activities and a schedule. This will ensure your successful implementation. We understand these plans are not required. These plans are helpful to keep the agency on track. It helps us get a better understanding to assess what their technical assistant needs are and to track their progress. I want to re-emphasize the importance of these implementation plans. I will show a simple table that demonstrates what type of plan you are looking for. On this slide, I included a table that explains the different stages that are related to the tracking of your every day program. Starting in the

development phase, demonstration phase, assessment phase and institutional face. You need a goal of where you want to be. It may be institutionalized, assessment, it varies every state. How you move from one phase to the next phase is where these implementation plans are helpful. The states that have developed these plans have gone through the process of thinking about to meet and who to involve. They have thought of when to go out. Looking at the procurement ways of a six steps of ideas. All of that needs to have a well-defined timeline. I just wanted to share this implementation table line. We are not looking for anything complicated. It needs to have a simple list of activities and a timeline. It helps to track the progress. Thing next couple of slides, I will talk about funding opportunities that are available. Some states have already used these funding opportunities. We are sharing these again. The first one are breathe related to the state transportation innovation Council's incentive program -- the first one is related to the state transportation innovation Council's incentive program. The list of activities include developing standards, design manuals, evaluations, implementation plans, workshops, etc. These are up to \$100,000. The two examples that I have seen are from Missouri and Massachusetts. They are trying to divide it to help them implement them. They have used this funding opportunity. They are looking at performing a scan. In the case of Massachusetts, they are looking at holding workshops relating to project coordination for informing stakeholders. Wanted to share these couple of examples. The second opportunity is related to the accelerated innovation dove payments demonstration program -- related to the accelerated innovation deployment demonstration program. It is a competitive grants with a maximum of \$1 million. There are a couple of requirements. The project needs to be ready to go within six months. There are monitoring of -- assessments. One grant has been approved. It was related to the smarter work zones. And application was received from Utah the OT. It was variable speed limits and work zones. Again, I want to encourage others to make use of this opportunity. I believe we have up to three awards available. I believe the ceiling is up to \$30 million. Make use of this opportunity. If you need help, feel free to contact the program. You can also contact any of us in the work zone team. I wanted to share some of the resources and technical assistance opportunities that will become available in the next few weeks. We are in the process of developing kits. It will be a one-stop information resource for everything. It will be available in the literature. It will be available on the clearinghouse. And addition to that, we will be having some virtual and in person training events. There will be the one to two day training workshop. These will be based on the request that we received from the agencies. We will have some opportunities for virtual and in person exchanges. The main purpose is to meet experts from other agencies that have successfully adopted works on strategies. We are in the process of scheduling exchange workshops to be attended by agencies to discuss Smart zone implementation. I wanted to make sure to emphasize for all information related to the events or implementation, please go to workzonesafety.org. Towards the left side of the front page, you'll see a link. We already have a lot of resources available. We will continue to update the website. I also wanted to thank the SWZ implementation core team. I wanted to talk about our second webinar, which will be on Tuesday, September 29. It will be from 1 PM to 2:30 PM Eastern standard Time. It will be related to using the implementation guide. There will be examples that go with all of the steps. It will be a good starting point for anyone looking at the business processes or deployment. At that time, we will announce our next webinar. We are still the process of finalizing some of the regional exchanges. We do know some of the locations. One might be in the Des Moines area. The north one will be in Springfield, Massachusetts. They are tentatively scheduled at this point. We are finalizing the South and West regions. As soon as they are finalized, we will provide this

information on the website. With this, the webinar concludes. The call, you will moderate the questions and answers.

For WD, did you encounter any resistance trying to get buy-in into this activity?

We were working with people. With any agency, when people are used to doing things one way, there are going to be some people who are resistance or cannot understand. That was my point for the need of having a directive from higher up. Sharing that, as you go through the education process with the participants, you need to build to say this is the directive that the agency has made. Any time you implement something that is a change in the way you do business, you will encounter that. We had most who were willing an understanding that saw the benefit.

This is for Todd. What section of Highway Capacity Manual, where these calculated?

I would have to go back and look. Most of the implementation was more associated with freeway application, open roadway. The analysis was not micro simulation related. It was simple lane drop on the interstate conditions, without a lot of access or turbulence. I would have to look to see what specific section. It was the previous version that we were drawing anything from.

How is dynamic lane merge applied in the field?

Dynamic lane merge -- there are different ways that you can do it. At a basic level, involves a sequence of portable signs that are installed in advance of the works own. The channeling device is the same. It is a static that does not change. It depends on whatever layout you want to have for the construction zone. They are strategically placed in advance to the merge point. The messaging displayed will provide the direction to drivers, as to whether or not they need to merge early or continue losing both lanes up to the merge point. We have diagrams on how to lay that out, that shows the operation in both the low volume and high-volume situations. We have diagrams like that if that would be helpful.

Neil, did the SWZ supplier provide the dashboard as part of the project?

Yes. The system and software that comes along has it. We had to modify it to our specifications. I stress the fact that you need to understand what you are looking for. We asked for certain things. The separate camera feed is something we added on and paid extra for. It allowed us to share the camera images with our partner agencies. They were able to better monitor their system. The city of Boston could watch their streets. The airport could watch their shuttles. Having that camera allowed us to better operate.

There was a monthly cost for system operations. Did this include labor costs? Was a temporary control center implemented, or was SWZ operated as existing?

For this project, we did operate a nightly. Our district operated a many operations center. Members from state police joined, and they manage the system from there. Throughout the process, members of my staff and the district staff, continue to monitor what was going on. Are operations center was monitoring the cameras, but they did not manage the smart work zone

system. This was because we do not have an integrated traffic management system. We will soon. It was one more activity for them to take on. We handled it with a traffic engineering staff.

Would you consider pavement marking to be part of SWZ? With the experimenting of temporary pavement markings in a large interchange that is occurring year-round, the markings help drivers in the winter conditions. I hear on Terrier -- Ontario uses them in long duration projects.

This is Jawad Paracha. As we define the technology application, -- even though this might be a useful application it does not meet the requirements of the way we are defining the technology application. I would say it can't be considered in the smarter work zone initiative.

Our last question, what actions were taken when the delay threshold was exceeded?

Typically they were not. We did a fantastic job of planning. If they were exceeded, it was because of things that were outside of the control of the agency. Either some equipment failed and a project had lane closures. It was addressed on a case-by-case basis with individuals. I cannot think of times that anybody flagrantly went out and said we're going to close lanes and we do not care. It was along the lines of something broke down. I think there was understanding when those things occurred and there was discussion about how to prevent those things from happening and having backup. They did what they could to try to keep the delays minimized. Another --

What type of sensors were used for the queue management system?

For the Callahan project, because of the three alternate routes, we used a combination of old vehicle data and locations where we thought we were going to have queuing issues, we supplemented that with radar. We had two detectors and portable trailers. We could not put those detector trailers everywhere. Those were strategically placed.

That is all of the questions that we have in the chat pot. If you would like to ask a question over the phone please push star one. Is a reminder to everybody, this presentation is available for download in the right-hand corner of your screen. The recording and presentation will also be available online. At this time, we do not have any questions in the chat pod or over the phone. There is one more question. Will alternate callers for highway markings in construction zones ever be considered and recognized in the in the MUTCD?

I think this question should be directed to that team. They would be in a better position to respond.

If I may, in Wisconsin they have been approved to experiment with them. This is been done by the Wisconsin in DOT. I agree, for more information you should contact them.

At this time, we do not have any more questions in the chat pod or over the phone. We will conclude today's webinar. Again, recording will be available of this webinar.

That concludes today's conference. You may disconnect. [Event Concluded]