Accelerated Construction Webinar Transcript
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Jennifer Symoun

Good afternoon or good morning to those of you to the West. Welcome to today's webinar on Accelerated Construction. My name is Jennifer Symoun and I will moderate today's webinar.

Before I go any further, I do want to let those of you who are calling into the teleconference for the audio know that you need to mute your computer speakers or else you will be hearing the audio over the computer as well. For those of you calling into the phone line, please note that your phone lines are listen-only.

Today's webinar is scheduled to last 90 minutes. We will have three presenters: Seema Javeri of the Federal Highway Administration Work Zone Management Program, Neil Boudreau of the Massachusetts Department of Transportation, and Steve Gillen of the Illinois Tollway.

If during the presentation you think of a question, please type it into the chat area. Please make sure you send your question to "Everyone." Presenters will be unable to answer your questions during their presentations, but we'll take a few minutes throughout the presentation for questions. If we run out of time and there are unanswered questions, we will attempt to get written responses from the presenters that will be emailed to all attendees.

The PowerPoint presentations used during the webinar are available for download from the file download box in the lower right corner of your screen. The presentations will also be available online within the next few weeks, along with a recording and a transcript of today's webinar. I will notify all attendees once these materials are posted online.

We're now going to go ahead and get started with our first presenter, Seema Javeri of the Federal Highway Administration Work Zone Management Program.

As a reminder, if you have questions during the presentation, please type them into the chat box and they will be addressed following each presentation.

Seema Javeri

Thank you, Jennifer. My name is Seema Javeri and I'm with the Federal Highway Administration (FHWA). I've been here for six months in the Office of Traffic Operations and Work Zone Safety. Prior to this, I was with Washington State Department of Transportation and Florida Department of Transportation. I will be speaking about the overall national perspective on accelerated construction.

In my portion of the presentation, I'll be talking about the history of accelerated construction and accelerated construction options, benefits, and success stories, and then I'll go into questions at the very end.

A typical highway project can take 10 to 15 years to complete. This time duration has real consequences for the public. Agencies are looking at acceleration options to deliver projects to the public faster. Work zones account for nearly 24 percent of non-recurring congestion, or about 482 million vehicle hours of delay. Work zones also have adverse impacts on traveler and worker safety. Between 1982 and 2002, the route miles of highway increased 3 percent while vehicle miles grew by 79 percent, as shown in the graph on this page. Rush hour is no longer an hour; between 1982 and 2002, it increased from 3 to 4 hours to 6 to 7 hours.

You may have heard the phrase "get in, stay in, get it done right, and stay out." Agencies are looking to manage traffic in work zones and develop traffic management plans. As they're looking at this, they are looking at accelerated construction, and it's becoming more popular as efforts are taken to minimize the impacts of construction to roadway users and worker safety. By advancing 21st century solutions, we can improve safety, reduce congestion, and keep America moving and competitive.

The accelerated construction options I'll be talking about are 3D engineered models for construction; accelerated bridge construction; construction manager/general contractor; design-build, including alternative technical concepts; intelligent compaction; and prefabricated concrete panels.

Three-dimensional (3D) modeling technology has been widely used for contractors on non-highway projects, and its potential for highway applications is just now being realized. The overall benefit of this technology is that it can increase productivity and efficiency of some construction operations by up to 50 percent. An example is GPS-enabled construction equipment that when combined with the 3D terrain model can run all day and night while achieving accurate grades on the first pass. The goal is that by December 31, 2014, FHWA division offices will partner with State departments of transportation (DOT) and/or local public agencies, and Federal Lands highway divisions will partner with Federal agencies and/or tribal nations, to obtain the following two independent goals: 1) create and apply 3D engineered models for construction, consisting of a digital model representing features within the roadway prism, to construct 50 projects nationwide, and 2) have nationally 25 or more construction agencies use 3D engineered models for construction. The goals for implementation are based on a more widespread use of 3D models by owner agencies during design or by contractors who develop 3D models. Given the varying levels of use of 3D engineered models for construction, the first goal is to use it on projects, and the second goal is aimed at transitioning from the 2D plan to the 3D digital models.

A 4D model looks just like a 3D model but it adds a time equation into the project management process. It contains even more information about installation rates, productivity rates, crew sizes and costs. 4D scheduling is simply linking your Primavera P6 schedule to your 3D design model. A program called Synchro can be used. Synchro is a program that is very easy to use and provides a great tool for analyzing your schedule as well as explaining it to other non-technical third parties such as cities, counties, local jurisdictions, and the general public. It allows you to either hit play, which will show the project develop as the timeline moves through the schedule, or to select any point in time and visually see what the project will look like at that point.

A 5D model looks just like a 3D model but it includes cost. The model enables an accurate quantity survey of materials and components with the quantities linked directly to a cost database.

Accelerated bridge construction technologies allow transportation agencies to replace bridges faster, only delaying traffic during construction for hours rather than months or years. The three technologies that I'll talk about are prefabricated bridge elements and systems, slide-in construction, and geosynthetic reinforced soil.

Prefabricated bridge elements and systems are where entire structures or their components are manufactured off-site and moved into place in a matter of hours. It offers a wide range of advantages, including savings in cost and time, enhanced safety for both construction workers and the driving public, and increased quality and potential for cost savings. To date, there have been 2,500 bridge replacements, and 39 states and three Federal Lands divisions have used the prefabricated bridge elements and systems on at least one project.

Slide-in bridge construction is a construction technique for deploying the prefabricated bridge elements and systems where a bridge is built adjacent to an old structure and slid into place once the old facility is recovered. That's what you see in these pictures.

Geosynthetic reinforced soil-integrated bridge system is a concept for using a closely spaced geosynthetic reinforced and granular soil as a composite bridge material to build and enhance approach embankments for bridges. The technology offers unique advantages in the construction of small bridges, including reduced construction time and cost, with cost reduced 25 to 60 percent from conventional construction methods. It's easy to build with common equipment and materials and easy to maintain because of fewer parts. It has a flexible design that's easily modified in the field for unforeseen site conditions, including utilities, obstructions, existing structures, variable soil, and weather. To date, 90 bridges have been built or designed using this method.

The construction manager/general contractor (CM/GC) is another method where the project owner hires a contractor to provide feedback during the design phase, before the start of construction. The CM/GC process is broken down into two contract phases. The first contract phase is the design phase that allows the contractor to work with the designer and project owner to identify the risks, provide cost projections, and refine the project schedule. Once a design is complete, the contractor and project owner negotiate the price for the construction contract. If all parties are in agreement with the cost, then the second contract phase, the construction phase, is kicked off and construction begins. There are advantages to using the CM/GC process. The contractor acts as a consultant in the design process and can offer new innovations and best practices and reduce costs and schedule risks as a result of years of proven experience with doing the actual work. This process also allows the project owner to employ new innovations, assist in the design process, and make informed decisions regarding costs and schedules. With CM/GC, State DOTs have greater control over price, schedule, and scope in comparison with design-build. During the CM/GC design process, the construction manager makes price, schedule, and constructability input, analysis, and recommendations. CM/GC offers more accurate price information since real-time pricing is inherent to the method compared with traditional owner-developed estimating processes. More accurate and stable pricing information creates better budgeting and financing opportunities, allowing State DOTs to improve their transportation planning process. Utah is a leader in CM/GC contracting, with more than 20 highway construction projects that have used this method.

There are three phases in conventional highway construction projects known as design-bid-build. This process begins with the design of a facility, followed by a request for contractors to bid on constructing the facility. Generally the lowest bid wins the job, and the construction phase begins. This process can lead to lengthy project delays because it must be completed in sequential order, and delays can occur from the lack of sharing of expertise between the designer and contractor. Design-build allows the process to be accelerated dramatically. In the design-build process, the State identifies what it wants constructed, accepts bids, and selects the contractor who will assume the risk and responsibility for both the design and construction phases. With design-build, agencies generally have the option of selecting a contractor on a best value basis, allowing DOTs to consider other factors beyond lowest price. The design-build contractor may also have the foresight or experienced team to develop different MOT phases to minimize the impacts to the traveling public.

Alternative technical concept is a suggested change by the contractor to the contracting agency's basic configuration, design, scope, or construction criteria. The proposed concept provides a solution that is equal to or better than the requirement in the request for proposal document. If a proposer's concept is acceptable to the contracting agency, the proposer may incorporate that concept into its technical and price submittal. ATCs provide competing teams with the opportunity to suggest innovative cost-effective solutions. The photo that you see here is an example I've seen firsthand of where a contractor has come up with a design that cuts the costs and the duration of the project by proposing an alternative technical concept. This was a project where the owner had presented a stacked tunnel for ramps in the request for proposals due to tight right-of-way in this area in downtown Bellevue, Washington. The contractor was able to come up with side-by-side design where the tunnel was eliminated so ramps were side-by-side instead of stacked. They were able to cut the cost by $20 million and reduce the duration of the project by six months. This was in an area where it was really important to get traffic relief because it was one of the busiest interchanges in the greater Seattle area.

Compaction is one of the most important processes in road reconstruction. It is needed to achieve high quality and uniform pavement materials, which in turn enhances long-lasting performance. The current process using conventional compaction machines may result in inadequate or non-uniform material densities, which can result in premature failure of the pavements. Intelligent compaction delivers a modern approach to compaction with the use of special vibratory rollers equipped with accelerometers, an integrated measurement system, a map-based global positioning system (GPS), and on-board display and computer reporting system. By integrating all of these components, the use of intelligent compaction rollers can accelerate product delivery as well as improve quality. Intelligent compaction rollers can also collect enough data to display continuous records of the number of roller passes, material stiffness, measurement values, and precise location of the roller. The overall result is a more consistent pavement, and projects can be constructed quickly if there is less re-work needed.

Prefabricated concrete panels are where concrete panels are precast in a controlled environment and brought on site for assembly and placement. Smaller/simple bridges can be replaced in as little as 12 days as opposed to 100 days. Concrete panels on roadways can be replaced expeditiously. The bottom picture shows the placement of jointed precast concrete panels on Trunk Highway 62 in Minnesota.

Accelerated construction can reduce traffic impacts. It can improve safety to workers and the public. It's safer since construction workers are not working near active traffic for days on end, as with traditional approaches. It saves the traveling public time in traffic delays and road closures, and it reduces construction season and time. With cost savings, there's improved quality of the product, and the accelerated project times can potentially reduce project costs. With sustainability, there are reduced economic and business impacts and there are reduced environmental impacts since components may be prefabricated off-site. Because bridges or their components are manufactured off-site in controlled environments, quality is increased and bridges can last longer.

Here is a picture of a success story. This is an award-winning structure called the Christopher S. Bond Bridge and it utilized innovative design and construction methods such as design-build and prefabricated bridge elements and systems. This saved Missouri DOT up to $89 million and more than five years of construction-related traffic congestion.

With that, I'd like to open it up to any questions, with the one caveat that if anyone has any specific questions on guidance for using any of these methods, you'll need to contact your State FHWA division office.

Jennifer Symoun

How would an agency decide when to use these strategies, and would they be included in a TMP?

Seema Javeri

They would need to be decided early on. Well, which of the strategies?

Jennifer Symoun

Any of the strategies.

Seema Javeri

It depends on the type of contracting that's out there. Some of this would be done during the design phase. Some of it would be up to the contractor to be specified in the contract. If you go with the design-build or the CM/GC, that's in the planning phases.

Jennifer Symoun

Somebody just asked if you could clarify the difference between CM/GC and design-build.

Seema Javeri

With design-build, the agency will put out a request for proposal. They will specify what it is that they want, and the contractor knows what they're looking for up-front. CM/GC is where a contractor is on-board and works with the agency during the design phase and they can provide input in it before it goes to the construction phase. So there are two different phases with the CM/GC, and with design build there is one phase – they go out for bid once and the contractor gets both the design and the construction.

Jennifer Symoun

Going back to the question on when you would use the strategies, it's any of the accelerated construction strategies.

Seema Javeri

That can be specified in the construction contract, and 3D engineered models would start early on in design. A lot of this would be up to the contractor, unless the contracting agency specifies what shall be used.

Jennifer Symoun

We're now going to move on to our next presentation, given by Neil Boudreau of the Massachusetts Department of Transportation.

Neil Boudreau

Good afternoon or good morning. I'm Neil Boudreau, Sate Traffic Engineer at Massachusetts DOT. I'm going to walk you through what we felt the road user benefits of accelerated construction were in terms of our Fast 14 project.

Interstate 93 runs north to south, feeding into the metropolitan Boston area. Our bridges are about 50 years old. We started a resurfacing project in 2008 where we were working on the southbound bridges and realized that we had severely deteriorated bridge decks. We did patching and resurfaced those decks to buy us time; however, we initiated a feasibility study to actually look at the long-term replacement of those decks. In July 2010, we had a major deck failure that exposed just how bad conditions were, and we knew that we couldn't do long-term traffic closures. The decision was made by our higher-ups that we had to move forward and accelerate our feasibility study to get something going.

Here is a picture of a small hole that opened up in the middle of the day on I-93, and that's what it turned into, trying to chase an area where we could actually put in a decent patch. This caused major gridlock and chaos for the metropolitan Boston area – miles and miles of delays on multiple routes with traffic trying to exit the city.

Here is an overview of the bridges that we scoped out for our project. There are 14 different bridges. Each of these bridges is structurally independent of each other, so you could work on one, demolish one, and replace one while you kept the other bridge intact. All of these bridges are within the City of Medford, about 3 miles north of Boston. They carry up to 200,000 vehicles a day in each direction.

We looked at conventional construction as part of our feasibility study and quickly realized that it wasn't the way to go. Essentially, we were looking at five stages, a minimum of four years of construction, and increasing delay. One fender bender crash in this corridor during the a.m. or p.m. peaks creates havoc, and travelers who do that commute every day know that they can jump off and go through the secondary roads and local streets to try to get into Boston. To do conventional construction would be creating that condition for four years straight. One of the other key negative components was that we would have to use unsafe traffic splits, which we try to avoid where possible. We would lose our acceleration/deceleration lanes because our shoulders weren't wide enough to accommodate both those and the reduced cross-section. This led us to looking at accelerated construction.

We had all of our decision makers put together on a task force and they made a decision that we wanted to try to rapidly replace these bridges over the course of summer months when our volumes were slightly less, avoiding 4th of July. We went design-build and we were generous and gave our contractor two weekends of float in case they had severe weather or construction material issues. The big decision was can we accommodate traffic in one barrel of the highway, and we did that by using a crossover, as you see in the bottom picture.

What were our initial project goals? We decided that prefabricated bridge units were the way to go. We ended up going with a composite deck beam that would allow us to accelerate our process. We identified an aggressive 55-hour weekend schedule starting at 8 p.m. on Friday night, and we had to have the road open for traffic by 5 a.m. on Monday morning. It was all to try to minimize the impact to motorists and local communities. When you have more vehicles that want to be on the roadway than you really have capacity for and you have no good secondary detour routes, it poses an extensive challenge. But we took it on and decided we wanted to try use all mediums to effectively communicate travel delays to the public to let them know what to expect and allow them to make an informed decision. We really wanted to sell the benefits in the long-term of using accelerated construction to allow us to get in there, take the impact, get out of there, and not have to go back.

During the weekends, we are looking at between169,000 and 181,000 vehicles per day in each direction. The peak hours on Saturday and Sunday were around 5,500 vehicles per hour in each direction, which was all well and good when we had four travel lanes, but when we tried to take that down to two lanes, we definitely had to figure out something to do. The only secondary highway, Route 28, has two lanes in each direction and was carrying 1,700 to 1,800 vehicles on the weekend, so there was some capacity in that except for the fact that you had to go through 16 traffic signals along this detour route. All other secondary roadways in the area were also heavily populated and very busy during the weekend travel times.

We knew diversion was necessary and we had to try to get that two-lane capacity down to what we projected from the TTI chart – 2,960 vehicles for the two lanes. Try picturing 5,500 and getting that down to just about 3,000. We also knew that queuing and longer travel times were inevitable no matter what we did – conventional construction or accelerated construction. We just had to identify a means to try to mitigate that. Our goal was to try to reduce the congestion periods by using new innovative techniques and avoiding gridlock at all cost.

Here is a chart where we used a queue formula to figure out what our diversion would need to be. When you look at the northbound direction, both Saturday and Sunday, we only were looking at trying to divert 15 percent. That's doable. On most construction jobs we can shoot for 10-20 percent diversion. However, in the southbound direction we were in for some big trouble. We needed to divert 35 percent of the existing traffic that was traveling that roadway if we were going to allow traffic to not gridlock the system.

We decided we needed to look at road user cost projections. We set up an incentive/disincentive program for the design-build contractor that won the job to have them think outside the box and plan out their schedule and construction methodologies in order to meet the 55-hour schedule. There wasn't a lot of float time in that schedule if something did go wrong, so we built these road user costs with a goal of getting the road open by 5 a.m. on Monday. For every 15 minute interval after that period there was a penalty.

This gives an overview of the incentives and disincentives. We based it on a $70 million total cost of the project (it ended up being higher than that) and we put a cap of $7 million for an incentive. The majority of that, $6,450,000, was based on meeting the 5 a.m. opening time for all 14 bridges. If they successfully did that, they got a nice payday. If they were late one weekend there was a series of penalties that would knock down that value. If they were late on three consecutive weekends for the whole duration of the job, the bonus would have been down to nothing. The contractor had to weigh the risk of trying to do this job with the reward of having that big payday at the end.

We started right off the bat by forming a traffic working group so it wasn't just MassDOT and our consultants trying to figure this out. We reached out to the State police, local police, local fire, local DPW and engineering, our transit authority, anyone that we could think of that had a stake in the matter, and we set up a working group. We got together and discussed all the alternatives. We knew that the best option was to take one half of the highway out of commission and divert traffic using a crossover to the other barrel. That gave the contractor a really safe area to work and it got vehicles out of there. Safety was one of our key focus points. It was a tough battle between construction and the traffic side. We wanted to keep a local access lane open to as many ramps as possible on that closed barrel. We had to construction that we were going to create gridlock if we didn't do this, so it was a compromise. The State police were very effective in giving us guidance on what they see day-in and day-out when they do traditional traffic lane closures on that roadway. They have experience with what does and doesn't work.

Through the group effort, we put this plan together. It was a new way of doing things. Generally, DOT just puts something together and throws it out on the street. By working with the State police, we determined that we wanted to use the incident command structure for quick clearance. We couldn't afford to have a major incident in the area during construction. We reached out right away. We knew we had to use a moveable barrier, so we contacted them and asked for their assistance in trying to help us fit a 4.5-mile moveable barrier crossover in between all the ramps we wanted to try to keep open. We also asked for the assistance on where to store the vehicles and all the other nuances behind using the barrier. They came in right away and helped us with our challenge. We developed site-specific crossover TMPs. In the MUTCD there is a figure for using a crossover, and that's all well and good unless you have ramps like we did, and we wanted to try to keep as many of those ramps open to avoid gridlock in the local roads. Again, working with the State police on what has worked in the past, we were able to do that and create a specific TMP.

We also wanted to set a work zone speed limit that was safe, recognizing we were dropping an interstate from four lanes down to three, down to two, and then running them through a crossover. We set a regulatory speed limit of 45 mph. We used speed monitoring boards so we could actually see what the speeds were on the website. We shared that with the State police and we monitored and tracked how things were working.

Another key component was work area protection. I got the construction side of the house to give in and allow me to have a local access lane, which you can kind of see with the cones on the far right side of the picture, but at what cost? You can see all the truck mounted attenuators (TMA) that are out there. We had to make sure that we had that road locked down. Nobody was getting through, so if you chose not to follow or get out of that local access road, you were going to meet up with the TMAs and then several State police officers on the other side.

As I mentioned, we had a 4.5-mile crossover, end-to-end. Because every ounce of capacity was necessary for us, we couldn't afford to have breakdowns or a collision inside the work zone impact our operations, or else we would have gridlock conditions feeding the city. We installed two emergency access points that allowed us to get quickly into the work zone should we have to extricate a vehicle from the area.

This is a map of the 16 traffic signals along the corridor that was our local access route. Other than a couple signals on the southern end, they were all either locally controlled or under a different State agency, so I actually had to get a permit to take over control of the signals during the duration of this project. We went out and inventoried all of them. We had to replace a couple control cabinets and we developed a progression timing plan to try to keep traffic moving on the local detour route.

Again, we have 14 different bridges – seven in one direction, seven in the other – and each one had its own unique traffic control plan depending on which bridge we were closing and what other local roadways we were closing. We had local detour routes planned for each bridge. One of the benefits of having the local police, fire, construction, DPW, etc. on the task force working group was we got buy-in right from the beginning. It wasn't a case of rolling out the plan and getting complaints. Everybody was on-board with what we were proposing to do. It made it go a lot smoother.

This is a picture of some site-specific bridge maps that we created. These are on our website. We handed them out to local businesses and residents. Anywhere we could distribute these, we did. These were specific to each particular weekend. We wanted our public to know what they should be doing each weekend. It wasn't the same work zone. Every weekend was a new challenge, and to try to keep the public happy, we went out of our way to assist them.

I mentioned before that we used the incident command structure. The only way we could do this job was to treat it as an incident and use the National Incident Management System (NIMS) structure. We brought in the State police command center and we made that our hub of operations for communications. All the local detours between the local roadways and the State highways were all run based out of that. We had constant communication. We also had someone from the local fire department sitting in there. We had a representative from the contractor and we had a DOT person in there, all weekend long for the 55-hour schedule. If something happened on the roadway, it was immediately was called in from the eyes on the road, whether it was just a detail or something with construction operations. We were able to quickly respond and address the incident.

We had a lot of State police and local police detail. This is just the interstate. On the local roadway system where we had the 16 intersections, we had numerous officers as well. How do you get an officer that lives out in the central part of the State familiar with where we he's supposed to be, what ramp he's responding to, how to call in an incident, etc. For each bridge, we created site-specific templates. We listed the officers' names next to which ramp or post they were working and we had that in the command center so that if we had a call about a fender bender near ramp 30, we knew exactly who to call, where they were going to be, and where back-up resources were. This was another successful component of the job.

This is a screenshot of our real-time traffic management smart work zone. This is the first major smart work zone that we did in Massachusetts. As you can, see there's a lot of equipment out there, and we realized that in order to get the public informed of what was going on, we needed to provide information. We had 35 message signs; four portable camera trailers, in addition to the camera coverage we already had; three Bluetooth sensors in the central artery tunnel; two speed radar trailers; and the "CHIPS" program, which is ASTI's program for managing a spot work zone. All of that was up and running and calibrated before we started, and it was a great resource during the construction.

Here is a screenshot of the dashboard that we had at our fingertips. All of my traffic staff members that worked on this project were trained in how to use this. We taught the State police what the different symbols meant, what the sensors were, how to read and understand them, and how to work a camera, etc. so that everyone was involved in the project.

Here is a picture of what we called our "traffic war room." We set up a full-time traffic operations center during the weekend hours, so each of the 10 weekends we had the center manned with a traffic engineer 55 hours through the weekend. It could have been a junior to a senior person, but they were in charge of being on the ready in case we had to change message boards, move a camera, etc. We had staff that were driving the detour routes as well as the crossover, doing travel time runs, checking to see where we had congestion, making changes on the fly, all with the goal of keeping the public happy, moving, and not stuck in gridlock conditions.

This is what was on at the command post. Again, this is where we helped the State police understand what we do and how traffic engineers do their job in planning work zones. At the same time, we were learning a little bit more about how they manage traffic control points from a police perspective.

We used include highway advisory radio (HAR). We had six key interchanges where we wanted to get the message out as to what was happening on the job. We had different series of messages, such as advanced advertising the job, saying coming up this weekend we're doing this bridge, these hours, etc. Once we went live with the construction we changed that message, and then we had a couple other threshold messages set. Should we have had congestion, we wanted to encourage diversion to a different route. If we had an incident and we lost one or two lanes of capacity in either direction, we had hazard messages already programmed and recorded so we could just change them to get the public up-to-date as quickly as possible.

Another unique thing that we use was the 511 system. They created a specific text message system that would allow construction alerts. We only had 825 users that signed up for this, but we gave them specific messages to whichever bridge we were doing. During the week, we notified them about upcoming weekend activity. On Friday night, once we went live to construction, we gave a reminder of what was open and what was closed on the ramps, and we also did that during Saturday and Sunday to keep people alert. We also did a voiceover. If you called a general 511 looking for information on the I-93 corridor or other corridors that feed the interstate, you heard a voiceover reminder of what construction we were doing.

Working with the State police, we wanted to have contingency planning and to be ready for the worst conditions. Luckily, none of that happened, but we had a representative from our commercial motor vehicle team on call at all times throughout the weekend. They worked with the local towing companies and Hazmat teams so should we have an incident we had a quick deployment and quick clearance plan already intact. In addition, our collision accident reconstruction team was brought into the mix, and we had a plan with them so that should something happen we could quickly clear an incident.

Tow services were our savior. I recommend that any State that's going to do an aggressive construction project where you'll have reduced capacity and need to maintain that capacity should contract with towing services and have them on standby. We had wrecker tow trucks and regular tow trucks, and we were clearing fender benders and minor injury crashes in minutes. We also had the Hazmat trailer ready to go should there have been a spill. Luckily we didn't have that issue.

Monday through Friday, we have a motorist assistance van that helps in the metropolitan Boston area if somebody breaks down, runs out of gas, overheats etc. We decided we want to contract them for the weekend period as well, so we kept them until 10 p.m. Friday evening and for 12-hour shifts on Saturday and Sunday. They weren’t driving through the construction zone – we had that covered. They were covering all the roadways we were feeding or asking motorists to detour to. If we asked you to take a detour and not come through the city or on I-93, we couldn't have gridlock on the detour roadways as well. Through the course of 10 weekends, the motor assistance van made 747 stops and helped just under 400 vehicles.

We tried to push people to public transportation. If you were in the area of Medford where we were doing the projects, it was easier to take the subway system, but if you had to drive to that subway, you'd still be on the same roadways. We decided to go further out and use the regional transportation center, where we offered free parking for the weekend. We worked with the Logan Airport Express to try to encourage airport travelers to park there and get on the bus; one bus coming through versus 15-20 vehicles trying to get to the airport was a big benefit. This was a very successful program.

You can't take bridges out of commission on a roadway that splits the city in half with metropolitan bus service and not expect heavy impacts. We worked with our transit authority right from the beginning and figured out ways to detour routes and change routes, and then we reached out to the public. We handed out fliers at businesses, senior centers, and anywhere else we could think of to let them know what was going on. We had the flier on the buses and at the stops. Each weekend was a completely different plan because we had different bridges and different ramps closed.

So how did it all work? We were able to manage interstate traffic without long or excessive delays. We kept local detour routes moving with acceptable levels of delay. There were a few periods we had some issues with that, but we utilized our State police and local details and we even taught our Sheriff’s Department how to better direct traffic at some of these intersections to keep things moving. Aside from a few very minor issues, we protected our workers from the hazards of the work zone as well as the roadway traffic. While we did have a little uptick on fender benders in the corridor, we avoided any serious injuries and had no fatalities, and we had no Hazmat spills. We achieved our goals. We planned for some contingencies, but we didn’t have to exercise them. The job was successful.

Jennifer Symoun

How did you handle IAP reporting for those shut down weekends, and are you using mobile communications for the CMS units?

Neil Boudreau

I'm not sure what IAP reporting is. For mobile communication, each one of those 35 message boards was tied into one central processing system. We used the ASTI CHIP system. They all had modems and communication. We used them as billboards during the week. I advertised the jobs we’d be doing and what bridge would be closing. Once we went live, we provided some sort of travel information, which was much more refined as you got closer to the city and more general farther out.

Jennifer Symoun

With regard to having tow service and Hazmat on standby, were they paid in advance or paid as they got called?

Neil Boudreau

They were hired by the contractor. They were paid hourly rates just to be there. They were staffed 24/7 from Friday at 8:00 p.m. through the end of the job on Sunday night/early Monday morning.

Jennifer Symoun

How was the work itself accelerated?

Neil Boudreau

We use prefabricated bridge elements, a composite deck beam. On Friday evening, once we closed the barrel of the roadway, the contractor demolished the existing bridge over the course of Friday night and into early Saturday morning. By 6 or 7 a.m. on Saturday, the road was pretty much clear. They were working on the bridge seats, which were already set and fixed ahead of time. The substructure was prepped and ready to go. Cranes were mobilized, set up and ready to go, and by early afternoon Saturday, we started putting composite deck pieces in and building the jigsaw puzzle. Once all of the deck pieces were in, they started framing and doing splices for a closure pour. They were usually done late Saturday into early Sunday. We used an extremely high early strength concrete, very expensive but very effective, that was poured through the course of early Sunday into mid-Sunday. After the concrete cured, it was tested. We milled over the approach slabs and prepped the approaches. We ground up the approaches so that we had a smooth finish. Once it was all swept, all of the other equipment was moved out of the area and we restriped the road. All but one weekend, we were open well in advance of 5 a.m. There was one weekend just before we flipped from going the northbound bridges to the southbound bridges; that's the only weekend we went into Monday morning (4 a.m.).

Jennifer Symoun

Going back to the previous question to clarify, IAP is incident action plan.

Neil Boudreau

In working with our traffic working group task force, we developed individual weekend incident action plans for each weekend. We had a number of contingencies. We did tabletop drill exercises on what construction would do, what the highway department would do, and what police and fire would do. For each weekend, we had a bridge-specific plan set up. After we worked 55 hours all weekend, we met Monday morning at around 10 a.m. to get a quick after-action on what went wrong that weekend and what we needed to change for the following weekend. Later in the week, we brought the group back together and tweaked the incident action plans so that we were ready to go for the upcoming weekend. The State police did a fabulous job of handling their side of things. They made sure they had all of the details and key positions filled, and worked with the local police as well.

Jennifer Symoun

You claim that you provided an incentive of about $7 million. What was the total value of the work, and how much of the incentive did the contractor receive?

Neil Boudreau

The contractor got the full $7 million. They would get $6,450,000 if they got all 14 bridges done within the 12 weekends that we gave. The other two chunks of money were if they had all the finished work by October 15th – all the parapet walls back, the crossovers they dismantled rebuilt, the exterior lighting system removed, etc. Essentially, if the roadway was pretty much done by October 15th, they got another chunk of money, and then they had to get the finished paving done by November 15th. They achieved everything. The total value of the job ended up being $90 million because we had an add alternate to do a sound barrier, which was done the following June.

Jennifer Symoun

Thank you. We're going to move to our final presentation, given by Steve Gillen of the Illinois Tollway.

Steve Gillen

My name is Steve Gillen, Tollway Materials Manager and Pavement Management Manager with the Illinois Tollway. I've been will the Tollway for 23 years. I thank you all for listening in on this presentation, which will give you an overview of how the Illinois Tollway is applying accelerated construction both for rehabilitation and construction projects, using precast concrete pavement systems for our roadways.

For those of you who are not familiar with the Tollway system, let me give a little description. The Tollway system currently includes four interstates, with 286 miles of roadway across 12 counties in northern Illinois. Those four interstates are the Tristate Tollway, which is I-94, I-294, and I-80 all combined; the Reagan Memorial I-88 Tollway; the Jane Addams Memorial I-90 Tollway; and the Veterans Memorial I-355Tollway. The system was built as a bypass around Chicago in 1958, and the Tollway system first served just 66,000 daily drivers. Today, 1.4 million daily drivers across the 12 counties in northern Illinois are served by the Tollway. With more than 86 percent of the tolls paid electronically, the Illinois Tollway operates the largest electronic tolling system in the nation. It's a user fee system that receives no State or Federal tax dollars to fund maintenance or operations of the system.

We are currently in the first part of two capital development programs that total to an overall 22-year, $18 billion capital development program that will reconstruct and widen most of the expressways on our system. However, many miles of the pavement will remain to be maintained, which is why we're looking into utilizing precast pavement slabs for rehabilitating or maintaining those sections of road. Most of the Tollway system consists of jointed plain concrete pavements, which makes the application of precast paving much easier compared to applying it to a continuously reinforced or jointed reinforced concrete pavement.

I think you heard this phrase earlier in the presentation: get in, get out, and stay out. That's common all across the country and becoming more common. Because the Tollway is totally a user fee system with no dependence on tax dollars, traffic is our only source of revenue. Therefore, accelerated construction is critical to minimize lost revenue due to traffic being diverted to other routes during construction. Serving 1.4 million daily drivers, mostly commuters, our system is not easy to maintain when rehabilitated or when new construction is needed. With this presentation, I will focus on how we minimize traffic impacts and reduce safety risks during the rehabilitation or reconstruction of our concrete pavements with the use of precast pavements.

Our system-wide traffic levels are high, with wild driving commuters making it all the more dangerous for us to repair and construct roadways during peak traffic hours. Splitting traffic around middle lane construction or repair operations during the peak hours of traffic can be devastating to our system relative to traffic back-ups induced or as a result of reduced safety to both the motoring public and our construction crews. Too often when middle lanes of our expressways are being shut down for repair work and the traffic is diverted around the construction operation, situations such as what is shown on this slide here would be too common an occurrence. As a result, overnight precast pavement patching or new construction applications were seen to be needed on the Tollway system within the last 10 years in particular. Much effort has been taken to get precast systems developed for many applications on our system besides just middle lane patching. It's a very unique and technical system with a lot of detail to it. The first night, a contractor can go in and do his saw cutting, the second night he can go in and do his removal and set the slab, and the third night he can come back in and finish off under-grouting, grout the hardware connections, and seal the joints. Basically it's a three-night operation to get it done.

This is a picture from 2002 when we set our first slab. This was the actual first precast slab we set using the Uretek method. Uretek a major national supplier of polyurethane foam material used to stabilize sub-bases under pavements or to jack settled slabs. This was proposed to the Tollway to try their product under a precast slab. It was a free demonstration at the location of a shattered slab on I-355 and was the Tollway’s first learning experience of how an emergency repair could be performed using precast pavements. The slab is still in place under a recently placed overlay with no evidence of distress yet to be shown on it.

The first and primary precast system that was being used over the last 10 years in states all across the country was the Fort Miller system. It is a proprietary system that operates out of the State of New York, and the Tollway witnessed operations of placement using this system all over the country. The Fort Miller system was the primary system we used to develop initial standards for precast pavement. A demonstration pad using the Fort Miller system was analyzed with falling weight deflectometers to verify an efficient load transfer across the joints was being provided with such a system.

In 2008, the Fort Miller system was formally approved by the Tollway for application to both new construction and rehabilitation contracts around the system. Unfortunately, it was value engineered out of most of the contracts that year. Being a proprietary system, too much of the cost to produce the product was going to the Fort Miller organization and not to local contractors. Therefore, the contractors took every political route possible to get the concept killed. This taught the Tollway that an alternative non-proprietary system was needed to make it a practical application economically in the Chicago environment.

This slide shows the initial placement of the Tollway's generic system in one of our maintenance yards in 2009. Just like the Fort Miller system, it was tested for load transfer efficiency across the joints to allow for formal approval of the procedure. The original Tollway system was designed using the standard dowel bar retrofitting procedure to connect all slabs, shown in the photo on the left side of this slide. The wide mouth dowel slots are saw-cut through the top of any slabs, chipped out, and the dowel is set on chairs across the joints before being backfilled with high strength mortar. With the Fort Miller system, the patented process requires dowels to be pre-drilled and epoxied into adjacent slabs. Then the precast slab with pre-formed slots on the underside is placed within the opening, and the dowel slots are grouted through the port holes on top of each slab.

With the wide mouth retrofitting that we use, it was learned that the open slots were somewhat of a burden to the contractors. Because of safety, the wide mouth slots had to be retrofitted and filled immediately after placement with high early strength grout or filled with a temporary fill material before being open to traffic the next morning. With the help of the FHWA SHRP2 R05 research team, we developed a design for pre-formed narrow mouth slots in the precast slabs that would not require the slots to be retrofitted immediately or temporarily filled. This made the installation process much more efficient. The photo on the right shows the Tollway's generic narrow mouth method being applied.

The photo on the left of this screen shows our first application of the Tollway's generic system in 2010, using the original wide mouth slot option. Continuous slabs were placed on the ramp of an interstate-to-interstate interchange as an overnight repair method for around 100 feet of shattered slabs. The photo on the right shows a more recent 2012 placement of isolated precast slab repairs or replacements that use a narrow mouth slot option. Nearly 700 precast slabs were placed during overnight hours on this project alone. No impact to the morning or afternoon commuters resulted from either of these projects; it was able to be done totally during overnight hours. As you can see on the photos, the surfaces could then be diamond ground after placements to ensure good smoothness and ride-ability.

Let me summarize how we commonly apply precast pavements on our system and how other agencies commonly do it as well. Isolated repairs are our most common need for precast applications on high volume ramps or in the middle of lanes of expressways where long life, full depth repairs are needed overnight. That's where we most commonly apply this concept. Cast-in-place patching can be performed using high performance, accelerated cast-in-place concrete in the outer lanes and only on weekends, when lower volume traffic levels exist and traffic can easily be shifted to the shoulders. Our objective is to eliminate split traffic on our expressways as much as possible for safety reasons.

This slide shows an existing Tollway ramp where the ramp was being reconstructed on a new path. This was in 2008. Both photos show the new ramp sections being built up to either side of the existing ramp using current standard cast-in-place method. When the cast-in-place concrete ramp pavement was ready to be open to traffic, the ramp was shut down for a weekend, the old ramp pavement was excavated, and the gap was filled in with precast pavements – all for the purpose of maintaining revenue. There was a toll plaza at the bottom of this ramp and therefore we couldn't afford to shut this ramp down for weeks; it could only be shut done for a few days. This worked out very successfully. You can't even see where the precast pavement sits on the finished pavement.

The photo on the left side of this slide shows a long stretch of shattered slabs in the middle of our Tristate I-294 corridor that resulted from design oversights when the roadway was reconstructed under two separate contracts. The outer lanes were designed under one contract, the inner lanes under another. As the photo on the left shows, nobody accounted for the middle section of the roadway, which resulted in immediate breakup. We needed an emergency replacement of these lanes during nighttime hours, and precast was the only choice. The photo on the right shows the repaired pavements after precast patching was applied, and the photo shows hints of snow off the shoulders. Another benefit of precast paving is that it can be applied under almost all weather conditions as long as the base is not extensively frozen to a great depth.

Long sections of our ramps carrying high volumes of traffic will be partially reconstructed only during the nighttime hours using precast pavements. This photo was taken in 2010 on a typical interstate-to-interstate interchange ramp where the contractor used the Tollway's generic system. There was no shoulder under the bridge, as shown in the left photo, and the precast paving was the only long-term repair alternative unless we wanted to shut the ramp down for weeks. This year, a similar application will be applied to another interstate-to-interstate interchange ramp on a super-elevated curve, where the Fort Miller system will be applied. That project construction will be starting in a few months.

Another application that the Tollway will apply this year is where a short distance of a ramp needs to be reconstructed between existing plazas on the ramp and local road intersections at the end of the ramp. There are commonly is little, if any, room for traffic to be safely diverted to end zones like this. To prevent long-term shutdowns of these ramps or intersections, overnight reconstruction using precast pavements is our only choice. Replacing or reconstructing high-volume, urban intersections overnight has been performed numerous times in the Northeast using the Fort Miller system.

To give you an example of how extensive the application of precast paving can be in one year, this slide shows the projects we will be applying precast reconstruction or repair techniques to this year alone. As the slide indicates, both flat and warped/non-planar slabs will be applied to as many as five contracts this year, requiring approximately 1,000 or more precast slabs to be produced and placed on our system. As we implement more of these projects annually and the contractors become familiar with the complicated procedures for slab installation, the prices for precast pavements have been steadily declining with each bid. Originally, prices three to five years ago were in the area of $100 or more per square foot of area to repair or reconstruct. Today, our prices are in the area of $50 per square foot. I know in California and New England states where precast has been used more commonly, the prices have dropped to well below the $50 per square foot price that we're currently seeing here in Illinois.

On the Tollway system, we foresee the need for even more applications to be coming. Our existing bridge approach slabs built in the last 10 years were not designed properly, and settlement and resulting failures are becoming more common every year. The Tollway is in the process of establishing a way that pre-stressed precast slabs can be used to replace failed approach slabs overnight. A few other states have already applied it. We're going to look into applying it something similar to our system as well. As integral abutment or jointless bridges become more common in Illinois, to relieve concrete stress as such bridges are constructed, the approach slabs next to such jointless bridges are being designed with precast slabs being implemented. Toll plaza reconstruction on our ramps is coming down the road, and replacing them with precast pavements with loop detectors preinstalled in the slabs is a likely route that we'll be taking.

If anybody wants to get further information on the Tollway's non-proprietary or generic precast system, the standards can be found on the Illinois Tollway's website, www.illinoistollway.com. Go to the construction section and standard drawings; you'll find them under the A18 drawings. Will that, I conclude my presentation and will take questions.

Jennifer Symoun

Thank you. What is the percentage of slab failure in these installations?

Steve Gillen

Up to this point, there has only been a handful. Probably less than half a dozen have failed, and most of those were due to constructability issues– cases where the contractor didn't place them right, didn't use the right shims, opened them to traffic without proper construction, etc. Typically the first night or first several nights of construction is when that would occur.

Ultimately then they have to be replaced, but otherwise we have not seen any issues or failures on our system yet to this date.

Jennifer Symoun

Are the precast slabs made with high performance concrete? If yes, have you had any problems with cracking during curing?

Steve Gillen

No, they are made with standard concrete, typically with strengths in the area of 4000 PSI. Because of the fact that they are cured at precast plants not in the field, curing or shrinkage cracks haven't been seen on the system. Therefore, shrinkage cracks haven't been a problem. Also, a crack in a precast slab is not that all that critical a problem because of the fact of reinforcement that exists within the slabs. You have to typically put one to two maps of steel reinforcement within a slab in order to support traffic on it temporarily as well as prevent damage during placement.

Jennifer Symoun

What is the cure temperature of the pre-slab?

Steve Gillen

Cure temperature of the pre-slab would be what's typically required or specified by the State for precast operations. They aren't steam cured. Typically they are air cured or covered with burlap, depending on whether it's an indoor or outdoor operation.

Jennifer Symoun

Did you only deal with square/rectangular slab replacement or have you worked with any trapezoidal and pie-shaped or curved segments to accommodate horizontal and vertical curves, radii, ramps, slopes, super-elevations, etc.?

Steve Gillen

I showed a photo of one ramp that was a slight curve that used flat panels on a slightly super-elevated curve that resulted in 1-inch offsets at the corners. The surface grade that was needed was accounted for with grinding; about 1 inch of the surface concrete had to be grounded off in some sections to maintain the grade that was needed. On a project this year we will be doing warped slabs extensively on a two-lane ramp that will be built using the Fort Miller proprietary system. They have a patented process of producing those slabs and that will be applied in that case.

Jennifer Symoun

I am going to go back to a question for Neil that we didn't get to. With the incentive program, if there was an accident on-site, did they get penalized on the incentive?

Neil Boudreau

In the contract, we had 30-plus different contingencies that we required the contractor to plan for. Many of those were construction-related incidents, like a crane toppling over. In that case, if it was a contractor error, they were at fault. They would have been held liable if they weren't open and off the road by 5 a.m. Had there been a vehicle incident or Hazmat spill or something that caused us to shut down operations or delay the contractor in any way, we would have removed that restriction and the contractor wouldn't have been held liable for the disincentive penalty.

Jennifer Symoun

Thank you. I'm going to turn it over to Ken Wood from FHWA to give some additional remarks.

Ken Wood

First I'd like to thank the presenters for participating in the webinar. Seema provided a good overview of different technologies that are considered accelerated technologies and the benefits that can be gained from using those. Neil talked about accelerated bridge construction on a large, complicated project, driven by the need to complete the work quickly due to some emergency repairs and failures that they saw in the structures. Also, I think the decision to use accelerated construction was somewhat focused by the amount of traffic that they had to continue to serve with no good alternative routes available. Steve presented something more on maintenance activities, such as patching and trying to maintain the systems that are out there. The Tollway is very customer-focused, as you could tell. They don't necessarily want to impact their road users a lot and they are not really looking to divert a lot of traffic off the Tollway, so they try to do things to minimize those delays while maximizing safety for the workers and contractors that are out there.

Accelerated construction is just one strategy that can be considered to manage traffic through construction projects and maintenance activities. We're not building a lot of new facilities, so everything is done under traffic. Most of the time there are traffic impacts, mobility impacts, and safety impacts when the work is being done. As these presentations have shown, accelerated construction is not going to eliminate traffic impacts completely, but hopefully it will minimize them to an acceptable level, in addition to speeding up the completion of the project without sacrificing quality. That's one concern I think a lot of people have had with accelerated construction, but it is being shown that it can be done without sacrificing quality.

There is more information about accelerated construction on the FHWA work zone webpage. There are a few other examples as well as some tools that can help you determine when accelerated construction could possibly be a good option, looking at road user delays, the type of construction that's going on, road user costs, and things like that.

I'd like to again thank the presenters and thank everybody for participating today and hope you enjoy the rest of the day.

Jennifer Symoun

Thank you, Ken. The webinar recording will be posted online in a few weeks, and I will send an e-mail once it is available. I don't see any other questions at this point, so I think we'll go ahead and close out. I’d like to thank all of our presenters and everybody for attending today. Enjoy the rest of your day.