Updated Proven Safety Countermeasures Initiative Webinar - Transcript

Rob Ritter:

Hi, everyone. Thank you for joining us today. Welcome to the rollout of the updated Proven Safety Countermeasures Initiative or, as we're referring to it, the PFCI Version 3.0. On behalf of the Office of Safety and our entire Safety Program, I thank you for your time and attention today.

I'm Rob Ritter, the Acting Director of the Office of Safety Technologies and Federal Highways Office of Safety, and I'm pleased to be kicking off today's webinar.

Where do I begin?

That's the core question repeatedly posed to all of us working to make our roads safer and to save lives. Answering it isn't always quick and easy and can be a heavy lift, as you all know. First we collect the data, analyze the data, consider different improvements to research, develop implementation scenarios to work through. In the meantime, we need to get something safer out on the roads. So it's good to have options available that are already vetted in advance…something to move ahead with quickly but with confidence.

That's where the Proven Safety Countermeasures come in…a list of treatments and strategies vetted by our Federal Highway Safety Team that we believe should be considered for widespread implementation. The PSCI provides choices for immediate actions to help save lives in your communities. Through the years, it's become evident that many of the PSCI treatments and strategies complement a systemic approach to safety, another way to enhance your safety program.

Today, we're going to present to you six new proven safety countermeasures for your consideration, but remind you about the 14 proven safety countermeasures that have been part of this program for a number of years. We've got a total of 20 that you'll see, and we'll give you the details on the 6 new. As we near this 10th anniversary of the first list of the Proven Safety Countermeasures, we're excited to rollout this latest update.

We're excited by the new countermeasures, about improvements to the initiative…all of which you will hear more about today from our technical area leads. I want to thank those technical leads for all of their work and their assistance in developing this program to this point, as well as our Federal Highway Safety staff that has helped review the Proven Safety Countermeasures Initiative and make various improvements that you'll hear about today.

With that, I'm going to hand the presentation over to Jeff Shaw, who has been our lead for all of these workgroups and for the overall initiative.

Jeff?

Jeff Shaw:

Thank you, Rob.

I'd like to echo Rob's welcome to everybody. We're really happy that you've all taken time out of your days to join us with this rollout of the Version 3.0 of the Proven Safety Countermeasures Initiative.

I'd like to just begin by running through quickly the agenda for today's webinar. After I provide a little bit of background on what has gotten us to this point today, we will go through based on the different technical focus areas. We will go through the new Proven Safety Countermeasures. We will quickly review the prior Proven Safety Countermeasures.

Then we've got just a few next steps and new resources to share with you and a special bonus for today's webinar is

we've got two guest speaker agencies. We will hear about the experience implementing reduced left-turn conflict intersections in Minnesota from Brad Estochen and Doug Carter from MnDOT. And we will hear about the efforts in the city of San Francisco in implementing the leading pedestrian interval, and we'll welcome James Shahamiri to share with us their experience.

Then after we hear from the last presenter, we will open up for questions and answers and discussion today. We anticipate having roughly 15 to 20 minutes for the Q&A at the end.

So just to quickly review what has gotten us to this point today, as Rob mentioned, we're coming up on the 10th anniversary of this initiative. The first Proven Safety Countermeasures list of nine treatments debuted in July 2008. That effort was originally envisioned to basically give a boost to implementation of several very effective and yet very underutilized safety treatments. So really, at that point in time, that July 2008 debut really marked a lot of new things for us.

One, we were specifically promoting highly-effective treatments; and, two, we were really starting to promote the systemic approach to safety and encouraging states and local agencies to look at how widely can you implement these treatments.

We also began tracking implementation progress. We wanted to see how people were doing in implementing these nine treatments, and we were very happy to see that it really clicked. It picked up very well. The campaign became widely known throughout the traffic and safety engineering communities, and we were seeing states and local agencies really work hard to make progress on implementing them. So the idea of tracking progress proved to be very beneficial.

In about 2011, we started to look at the progress; and we saw that things had been winding down a little bit. So we went through a process of updating the list of countermeasures. In 2012, we released an updated list or Version 2.0. In that list, we retained four of the original nine…four that we thought still had some potential progress to be made. But we also added five new countermeasures. We changed the approach to tracking progress.

At that time, we had established by that point the focused approach to safety; and we had lists of focus dates for different technical areas of our program. Also, at that point in time, all the states by 2012 obviously had strategic highway safety plans. Many, many states were in their second or even third iteration of the SHSPs, so we also linked the tracking to whether or not they had in their SHSPs emphasis areas that overlapped with the countermeasures. So we had a different tracking approach, and we found that it was helpful to us; but we also saw some opportunities for improvement coming out of that.

That brings us to our lead-in to today's Version 3.0. In about 2014, we started to see progress slow down on the Version 2.0 countermeasures. So we started talking about what's next for this initiative. We formed two internal working groups. The first group evaluated the overall initiative. What we heard from that evaluation where we canvassed all of our division offices, our field offices, and all the folks in the FH Safety discipline who are out there on the frontlines working with state and local agencies in the practitioner communities, we hear that this initiative is very popular, has an established and recognized brand. So the majority consensus was this initiative should be continued. No one wanted to see it sunset; no one wanted to see it take a break. In fact, everybody basically came back and said, "Yeah, let's update this; and let's roll out a third edition."

Now, we also heard that there were some opportunities to make it better, to tweak it a little bit. What we heard was people wanted to maintain the breadth and depth. In other words, they wanted to see countermeasures that were appealing to states, to local agencies of all sizes. They wanted countermeasures that spoke to roadway departure safety, intersection safety, pedestrians and bicyclists, and so on. So really what we heard is the past lists were great because there was something there for everyone and let's not lose that.

We also heard that we don't want to lose the past countermeasures. So there was a sense that with the rollout of a third initiative that maybe the countermeasures on the first two lists would somehow be deemphasized. And we deftly want to say that is not the case. So with the rollout of Version 3.0, we're very excited about the 6 new ones; but we also want to remind people that the 14 other countermeasures are still very worthy of more progress. And we wanted to take another look at the way we tracked progress. So we'll be working with our division offices and our field offices on assessing

progress using a more intuitive approach that happens to dovetail with the Every Day Counts innovation program.

Now, the second working group was basically the one that worked to vet candidates for the updates. That's what got us to these six countermeasures that we'll talk about today. That working group came up with 31 countermeasures and strategies. We vetted the crash modification factors. We vetted the potential benefits of pursuing the countermeasure, how does it fit with the national level efforts that are ongoing. We really did a very in-depth vetting of these 31 candidate countermeasures and strategies, and that process is what got us to the list we have today.

Now, throughout our process to update the Proven Safety Countermeasures, we throughout that process continued to remind ourselves that what we do with the safety program has to continue to be a data-driven approach. We want to remind everybody that that has not changed. So we will continue to support efforts to improve the quality of safety data, the availability of safety data, the analysis of the safety data. We will continue to provide the assistance and the encouragement to adopt more robust analysis tools…like the HSM or safety analyst. So by no means are we looking at leaving a data-driven approach in the rear view. This is definitely a part of where we go from here.

The bottom line though is that even while we're improving the data-driven approaches, our tools, and our capabilities, we want to encourage all of you to be looking at the Proven Safety Countermeasures through that data-driven lens as viable options.

So drum roll, please…here is the new list of Proven Safety Countermeasures. As Rob had mentioned, we've got six new ones. Again, we've got several specific treatments that align with our technical focus areas, as well as a couple cross-cutting. So we're excited to see on this list something that we truly believe will appeal to a very large audience across the country.

The first new countermeasure…systemic application of multiple low-cost countermeasures at stop controlled intersections.
The second countermeasure…reduce left-turn conflict intersections.
The third…roadside design improvements at curbs.
The fourth…leading pedestrian intervals.
The fifth…local road safety plans.
And the sixth…USLIMITS2.
So each of the technical leads in our office will go through these Proven Safety Countermeasures.

I'll begin by talking about intersections since that's my program area. At this point with the Version 3.0, we have seven Proven Safety Countermeasures that speak to intersection safety…everything from left and right turn lanes at unsignalized intersections to back plates with retro reflective borders that signalize intersections to roundabouts to access management, and of course the two new ones that I'll talk more about. So there are many choices on the current list that speak to intersection safety.

The first new one that I'd like to talk more about is the systemic application countermeasure. It's a mouthful of a name, and we understand that. We're not marketers, but we're very excited about this strategy nonetheless. The systemic application of multiple low-cost countermeasures consist mostly of signing and pavement-marking enhancements. The strategy relies on cost economy and treatment saturation. Those two things really go hand in hand because, number one, you need to be treating a large number of locations to really see the bottom line numbers in safety improve. So really, this is where you can add up to a significant number how many injuries can be prevented and how many lives can be saved on your network of roadways.

The other part of that, of course, is that the more treatments you do and the bigger the quantities of your project, the better prices you'll get on those signs and on those pavement markings and on the overall level of effort. So really, driving down the costs and treating as many sites as possible is a critical ingredient of this approach.

Now, I think if you look at this slide, you see to the right-hand side an average befit/cost ration of 12 to 1. That's an extraordinary number for a return on safety investment. For those of you who are implementing safety projects, think about what you're accustomed to seeing in terms of benefit/cost and consider how often can you get to double digits like that. It's not very often.

Now, the most exciting part about the systemic approach is the safety effectiveness. If we look at the reduction in fatal an injury crashes, you can see that's a CMF of 0.899 or basically a 10% reduction. Now, this is a very solid crash modification factor that came from a rigorous assessment of the experience in South Carolina, where the treatment sample consisted of 434 sites compared to 568 reference sites…very, very large dataset. It included a variety of different intersection types. We had two lanes by two lands; four lanes by two lanes. Each of those were three legs, some were four legs, some were two-way stops, some were always stop. And we had a range of before and after data of at least three years and, in many cases, more than that. So this is an excellent CMF. Notice as well the reduction in nighttime crashes of 15%...always a tough thing to address in places where it's difficult to get lighting.

Here's what that looks like just taking a sample from the South Carolina's DOT experience. A lot of it is oversizing, doubling up, using enhanced retro sheeting, adding fresh pavement markings, putting in some no-passing lines, some stop lines, pavement messages, and so all…so all very low-cost treatments. The nice thing about this is not only can you be addressing your intersection emphasis area in your strategic highway safety plan, it's also a great way to break into a systemic approach to your highway safety improvement program.

The other treatment we want to present to you today is the reduced left-turn conflict intersections. Basically, two U-turn-based intersections…the first is the median U-turn and the second is the restricted crossing U-turn. Now, both of these geometric designs change how certain left-turn movements occur. They both do them differently, but they both focus on left-turn movements.

What's common to both is that they simplify and modify the conflict points related to that left-turn movement and, in many cases, can reduce the number of conflict points as well. What's really great about this particular treatment is there are not only great safety benefits, but there are also excellent operational benefits in turns of reduced delay, better throughput of traffic, opportunities for pedestrian and bicycles that are not as easy to do when you have conventional intersections.

Of course the secret ingredient with many innovative intersections is this idea of reducing conflict points. In both of these cases, this reduction and this modification in conflict translates directly to bottom-line results in improving safety. So for the median U-turn, a 30% decrease in the severe crashes; and with the RCUT, a 54% decrease in severe crashes. So these are really, really effective intersection designs; and we'll talk a little bit more about each of those quickly.

With the median U-turn, it's the major route left turns that are the primary change to the intersection. So rather than allowing direct left turns along the major routes, they get rerouted downstream to U-turn locations, come back to the main intersections, and then make a right turn to complete that movement. Whether or not this same scheme is used for minor routes depends on the volume of the minor route…so it's basically an optional treatment. So this median U-turn scheme focuses on the major routes.

Now, most of the time these are signalized intersections. This opens up some significant advantages that can benefit all modes. So if you look at that simple phasing diagram that's shown here, that top graphics represents a conventional intersection cycle where you've got protected left turns and protected for both the major and the minor routes. You can see that there is a considerable amount of lost time. There's a lot more "don't walk" for pedestrians unfortunately, so they're not serviced as frequently. It's not as convenient for pedestrians.

Compare that to the bottom graphic, which is a typical median U-turn signal cycle, two-phase, no need for the protected lefts at the main intersection. And look at how much more walk time can be devoted to the pedestrian movement. And because the cycle is shorter, you can actually service all the movements…including the pedestrian walk phase…more frequently throughout the hour and throughout the day. So there's not only a safety and operational benefit, there's also just a convenience benefit to this design.

Now, with the RCUT design, it flip-flops. So it is focused on changing the movements from the minor route. Generally speaking, the major route movements all are permitted; so you can still make the direct lefts and the right turns and the through movements. Now, there are cases where an agency might choose to not allow the left and instead focus those movements and the U-turns as well; and that's fine. But the majority of the cases do allow those direct lefts.

What you can see from this photograph is that the interior space of that median gets very well-defined, highly-channelized. You eliminate the large pavement area that often produces a lot of confusion and, unfortunately, leads to many severe mistakes by motorists. This type of treatment is very beneficial for high-speed divided roadways…the type of expressway designs where we were twinning our existing two-lane roadways and knew that we did not have the funding to put out interchanges along facilities that look very much like interstates. So where we've got these accurate intersections, this really is such a hugely beneficial treatment that we'd like to see agencies consider this more and more often; and this is what we'll hear more about from Minnesota in a little while.

With that, I'd like to turn it over to Cathy Satterfield to talk about the roadway departure countermeasures.

Cathy?

Cathy Satterfield:

Hello, everyone. There are now five roadway departure initiatives under the Proven Safety Countermeasures umbrella. There are still some opportunities to implement rumble strips in many states because we're seeing that many states have focused either on center or edged rumble strips in the past, and they're just beginning to look into the other option. In addition, the new sinusoidal rumble strips have potential in expanding to areas where traditional rumble strips are not considered because of noise issues. Now, that's not a proven design yet as far as safety effectiveness. But there is an NCHRP study that's getting underway to look at that and other low-noise rumble strips and their effectiveness.

The median barrier countermeasure promoted a 2006 change to the AASHTO Roadside Design Guide, which recommended the use of barriers and medians that were wider than many states were considering for median barrier at that time. It also recommended cable barrier because it was more forgiving and it can be used on slopes. So that one… I'm not sure how much more implementation we can get.

Safety edge, however…although we made significant progress in implementing that during the original EDC back in the 2010 era, there were some states that did not make it a standard practice; and we've recently released CMFs that were developed; those are crash modification factors. And the crash reductions we're seeing are much greater than we expected. These are specifically for two-lane rural roads, but it's something that makes us think that probably those states that implemented that widely should start reconsidering that opportunity. In addition, local agencies in most states probably have an opportunity to use safety edge where they haven't been doing so.

The final existing Proven Safety Countermeasures Initiative included two treatments, and they were both focused on horizontal curves. We made great strides in implementing high-friction surface treatments during EDC2, but there are still opportunities to expand eschews to reduce the number of curb crashes. Additionally, there is some new research that we are doing on measuring friction; and it shows great promise in helping us make better decision about where enhanced friction or high-friction treatments might be needed. So you'll probably hear more about that in the near future.

So friction addressed the pavement issues, and the other part of that initiative was to address delineation at horizontal curves; and that focused on addressing driver behavior issues. So those two treatments dovetail very nicely with our new initiative, which is improving the roadside at horizontal curves as part of the design process.

There are three aspects to the new countermeasure: increasing clear zone at curves, improving the traversability of the clear zone, and installing barrier to reduce the severity.

It's already recommended to increase the clear zones on the outside of curves. There's even a table in the AASHTO Roadside Design Guide. However, even the RDG says it's seldom used unless there's a crash history there at that particular curve. However, if we think systemically, we know we'll have a crash problem at curve; and therefore, we need to be considering even though we don't have a crash history at a particular curve, if it's a curve that's a high risk maybe we should be using these horizontal curve adjustment factors to increase the size of our clear zone.

It's also got crash reduction factors to back up the proven countermeasure. We do know that there are crash reductions when we increase the clear zone distance. And while the CMFs were not designed specifically at curves, we know that

we'll probably even get better benefits at curves because we have bigger problems at curves than in tangent sections in terms of fixed objects in the clear zone. Trees are particularly a problem. We have about 3,500 people die every year in roadway departures where the most harmful event was hitting a roadside tree or shrub. So that's an annual average, and we add a couple thousand more if we look at other fixed objects.

We know that 45% of the tree fatalities are occurring in curves, so this is a really great way to focus our effort. We can't increase our clear zones everywhere necessarily and we can't remove trees everywhere; but here's an opportunity where if we look at curves, particularly curves that are high-risk, we're going to be able to get some good bang for our buck.

In tangent sections where the research tends to be done, an embankment slope as steep as four to one is considered traversable. And up to three to one slope is considered recoverable, meaning the average driver can ride it out to the bottom. While an embankment on the outside of a curve may have the same slope as in a tangent section, what you find is that the departure angle is greater; and because of the curvature of the roadway away from that slope, there's also the compounding factor that the typical reaction of the driver is to counter steer back up the slope rather than down the slope, which would stabilize the slope. So there's more instability of vehicles in a curve than in a tangent.

We are seeing in some recent research on rollovers that while we are seeing improved crash reductions in tangent sections because of vehicle stability systems like electronic stability control, we're not seeing that reduction in curves. So we are still having an issue with the rollovers and curves.

Wider shoulders and slopes and curves can reduce the likelihood of rollovers. We realize that that's not feasible everywhere. Where that's not feasible, we're recommending that you consider a barrier where you wouldn't necessarily have considered it in the past. Remember, we're just talking about curves now.

If you look at this chart that's shown on the slide, that is developed based on tangent sections of roadway. It basically recommends that embankment slopes that are three to one or steeper, you wouldn't normally consider installing a barrier just because of that slop. However, the vehicles have gotten less stable on slopes since this research was done; and actually, our barrier has gotten quite a bit better. We now use blackouts on our WB, and we have forgiving guard rail, like cable guard rail, with a lot of different options out there. So we perhaps should be considering installing guardrail in places where we haven't in the past, and specifically on curves where we know we have a bigger problem.

I wanted to clarify that this initiative isn't suggesting wider clear zones and flatter slopes or guardrail everywhere. We're just focusing on curves, which is a fairly small percentage of the national roadway mileage. In addition, this clearly isn't appropriate for every curve. In some parts of the country, the typography is such that curves are the norm and tangents may even be considered a rarity. But lower-risk curves may not need any treatment. For instance, if you have sharper curves on either side of a specific curve or if you have low speeds or low traffic volumes, perhaps you don't need anything. For many curves, standard signing and pavement markings is adequate delineation. But as you get to higher risk curves based on your geometrics or your crash data, there's an opportunity to use additional delineation to clarify the alignment to the unfamiliar driver. Or, database again improving the friction to help keep vehicles on the roadway.

So we want to continue pursuing these countermeasures to keep people on the road; but crash data is showing us that the current drivers in vehicles are still running off the road at curves. It's worthwhile to look at those that are the highest risk and consider how we can reduce the likelihood of crashes for those by increasing the clear zone or flattening the slopes or, if we need to, find ways to reduce severity of the crash by adding a barrier on the outside of the curve.

Since roadway departures constitute more than half of all fatalities, implementing these five roadway departure Proven Safety Countermeasure initiatives is an important component of our road to zero.

Now I'll turn it over to Tamara.

Tamara Redmon:

Thank you.

As an overview, over 15% of roadway fatalities involve pedestrians and over 2% of all bikes or bicyclists. Pedestrian

fatalities have been increasing since 2009, and bicyclist fatalities have been trending up as well. Mid-block crossings account for over 70% of these fatalities, so four out of the five countermeasures being promoted in this list are geared towards reducing the frequency and the severity of pedestrian and bicyclist mid-block crossings.

To address pedestrian safety, Federal Highways is promoting the use of medians in pedestrian crossing islands, as well as the pedestrian hybrid beacon, walkways, and now leading pedestrian intervals.

The leading pedestrian interval is a countermeasure we just added to the list, as Jeff mentioned earlier. Even though it's been around for a while and pretty widely used in some cities…like Washington D.C., unlike the other countermeasures we're promoting, LPI is aimed at reducing crashes at intersections rather than at mid-block locations. It's an inexpensive countermeasure that involves simply retiming the signal, and it basically just allows the pedestrian a three- to seven-second head start before the signal turns green for vehicle traffic. Pedestrians are allowed to establish their presence in the crosswalk before the vehicles have the priority to turn left.

Some of the benefits…a 60% reduction in pedestrian/vehicle crashes at intersections. There is increased visibility of the crossing pedestrian. There is reduced conflict between pedestrians and vehicles if the pedestrians have already started their crossing and they're more visible to drivers. And there's an increased likelihood of vehicle drivers yielding to them.

For guidance, we have two sources listed here. Freeway Highway Administration's Handbook for Designing Roadways for the Aging Population recommends using LPI intersections with high-turning vehicle volumes. And the Manual on Uniform Traffic Control Devices, Chapter 4E.06, has a chapter on pedestrian intervals and signal phases that provides direct guidance on this.

Now Rosemarie Anderson is going to start the discussion of cross-cutting strategies

Rosemarie Anderson:

I just have to take it off of mute, right, so you can hear me. Good afternoon, everyone.

These are the three cross-cutting strategies. They are road safety audits, which has been around for the last three iterations of the Proven Safety Countermeasures; Local Road Safety Plan, which is new; and the U.S. Limits 2.

Road safety audits have proven to be an effective tool in many safety programs across the country. Freeway Highway has and continues to provide training, technical assistance, and other resources in terms of road safety audits. For those of you who are not aware of what a road safety audit is, it's a formal safety performance examination of an existing or a future roadway or intersection, and it uses a multidisciplinary team to do that examination. It qualitatively estimates and reports on potential road safety issues and identifies opportunities for improvement and safety for all road users.

I'm sure that many of you have been part of a team for road safety audits. It's been around for a little while. There are number of resources on the Federal Highway Safety website.

Several agencies have established policies in the use of road safety audits in the development of projects and applying for safety funds as well. As a result of its success, we continue to recommend road safety audits as a program as a proven safety countermeasure. The new addition of local road safety plans to the roster of Proven Safety Countermeasures is a natural follow-on on to our extension to the overall Road Safety Audit Program as well.

I won't actually bore you with a lot of data and statistics at this point. But suffice it to say, that local roads experience three times the fatalities of the interstate highway system. As evidenced by several jurisdictions that have developed road safety audits…oh, now I'm mixing up road safety audits with local road safety plans, I'm sorry. As evidenced by several jurisdictions that have developed local road safety plans, it is an effective strategy to improve safety on local roads.

So what is a local road safety plan?

It's a coordinated plan which provides a comprehensive framework for reducing fatalities and serious injuries on a local

roadway system within the jurisdiction. It is coordinated because it involves safety stakeholders from many disciplines. We've heard of the four "E's"…engineering, emergency service, education, and enforcement. And it's comprehensive in terms that it generally addresses all roadway safety issues. It is usually flexible and includes established goals, objectives, and safety emphasis areas.

I showed local safety plan road development in many states like Minnesota, Iowa, Washington, Oregon, and Illinois and others. The benefits have shown that it enhances safety awareness amongst safety stakeholders within the local community. It establishes partnerships representing the different stakeholders…not just those involved in the four "E's" but usually those in the public as well. It enhances collaboration between different levels of government entities…why did that move?

Okay, sorry…it identifies target crash sites, risks, and safety confirmations as well. Including all the partners and stakeholders, you are able to leverage your safety funding in terms of implementation for those plans. It also informs the priority.

What it does also, which is really important, it complements the State's strategic highway safety plan. In states like Alabama, for instance, it actually feeds the strategic highway safety plan development process, which is kind of important…especially when we're trying to implement using HSIP funds.

In general, there are six steps to the local road safety plan development. The first step is establishing leadership. Basically, you want to identify your champions. You can have multiple champions as well. You can have champions at the higher level, and you can have champions at the lowest technician level as well; but you just need someone to take the lead in terms of developing that plan and also in terms of implementing the plan, which is even more so important than actually developing the plan itself.

We also want to look at it in terms of identifying your partners. Who are your partners? Who is going to help you develop the plan? Who is going to help you implement that plan? We want to make sure we are identifying the right partners in terms of road plan development.

Who is actually analyzing the data…collecting and/or gathering that data and analyzing the data? That feeds into Step 3, which in turn is an emphasis area because your emphasis areas are going to be dependent on what the data shows; those are your emphasis areas.

Step 4 is to identify strategies which actually address those emphasis areas. We want to prioritize and emphasize our strategies because we don't have unlimited funding. So we want to make sure that we are getting the biggest bang for our bucks. So we are going to look at it in terms of let's prioritize the strategies that we come up with. How can we get the best benefit/cost in terms of what strategies we're going to be implementing in terms of improving safety on the roadways.

The sixth step…and I won't say the last step because the process is basically cyclical. So once you get to the evaluation process, you may want to go and update the planning and look at it in terms of those six steps again.

The plan is a living document, and you want to update that plan at some time after implementation. You want to evaluate to see how your strategies are working within your jurisdiction.

There are several resources that are available for local road safety plan development, many of which are available on the safety website.

I'll pass it on to Guan to talk about the USLIMITS2.

Guan Xu:

Thank you, Rosemarie.

Hi, everyone.

USLIMITS2 is a web-based tool to help jurisdictions in the setting of safety limits. To help better understand the purposes and benefits of the USLIMITS2, let me start with the question…why do we set safety limits?

The fact that one driver's speed can cause injury or harm to others provides the rationale for speed limits and the regulation speed. The speed limit is to inform drivers of the maximum reasonable and safe operating speed under favorable conditions. There are statutory speed limits and the speed zone speed, and USLIMITS2 is applicable for setting speed limits for speed zones.

The next question would naturally be…why USLIMITS2?

As you know, the responsibility of setting speed limits resides in state and the local agencies that have jurisdictions over the roadways. The only guidance at the national level for setting speed limits is the one provided in the MUTCD. The MUTCD recommends that the speed limit should be within five miles per hour of the 85th percentile speed of free flow traffic.

The MUTCD also lists some other factors that may be considered when setting speed limits, but it does not provide any guidance on how to account for those factors. The lack of a systemic and consistent method for examining those factors often leads to subjectivity and inconsistency when it comes to determining posted speed limits.

Obviously, more guidance on how those factors will be considered is helpful. In the late '90s, the TRB published a special report named Managing Speed: Review of Current Practices for Setting and Enforcing Speed Limits. In the report, it indicated that an expert system's approach may offer a solution and work quite well for this type of a problem. This is because a knowledge-based expert system can improve the decision-making process by mimicking that expert's thoughts and decision-making process, thereby reducing the subjectivity involved in the decision-making. The expert system also helps in the more explicit consideration in making the list of relevant factors.

Following up on that recommendation, AASHTO found that the development of USLIMITS2 through an NCHRP Project. You see the rules used in the tool on the left based on the information from a panel of 140 experts from states, counties, and the city agencies, including traffic engineers and the enforcement officers. It also included engineers from non-government transportation agencies, such as ITE.

USLIMITS2 is very friendly and easy to use. It considers all of the factors included in the MUTCD and more. It has certain consistency limits for similar conditions, and that in turn improves drivers' acceptance of and the compliance with speed limits. Because the process is transparent and consistent, the public and the decision-makers are more likely to accept speed limits recommendations from USLIMITS2, so it makes it easier for transportation agencies to defend speed zoning decsisions when public pressure comes to bear.

The USLIMITS2 takes out all the emotion and the politics, and it provides us with something that we could show to others that is concrete and easy to understand.

Before I end my presentation, I want to mention that we do offer free training webinars upon request for the USLIMITS2.

With that, I'll turn it back to Jeff.

Jeff Shaw:

Thank you, Guan.

Just a couple more things to mention about what our next steps will be with the initiative, in the next couple of months, our office will be working with our division offices and other field offices to get a sense of what the proven status of each of the new Proven Safety Countermeasures is across the country.

As with past iterations of the initiative, we want to track progress. We are going to utilize the scale of implementation that we are currently using for our Every Day Counts innovation program. Many of you may be familiar with that. Our

field offices will be feeding us the information about where they're at. This is a more informal assessment of where we're at. So if you're worried about this rising to the same level as an EDC, you don't have to worry about that; but we are very interested to see progress made.

We'll set the "go" line for January 2018, after we get a sense of what the baseline status is. From that point forward, we will be checking in with our field offices on progress every six months. So in June of 2018 and then again in December of 2018, we'll ask what kind of progress has been made, what kinds of stories can people tell about their implementation. Really, what we want to hear is how is this making a difference in people out there saving lives on our roadways.

We've got a few new resources out on our updated webpage. The main webpage for the Proven Safety Countermeasures is the same as it's always been. If you click on the "Proven Countermeasures" link, it will take you out to an updated webpage where we've got all 20 Proven Safety Countermeasures now reflected on that webpage. Each of those has a one-pager summary, so really kind of a marketing flyer associated with it. We will post the slides from today's webinar and a link to the recorded session also that page. And then as we continue to enhance that Proven Safety Countermeasures website, we will cross-link to other FHWA resources for each of these Proven Safety Countermeasures items.

Here are the contacts once again for each of the technical leads from our office.

Next, I would like to transition over; but between now and when we start to hear from Minnesota, we have a quick poll question for everyone: Of the six new Proven Safety Countermeasures that we just introduced, which one are you most excited about for improving safety in your jurisdiction?

We're just trying to get a sense of where do you think you're going to start first? What's the most appealing treatment from where you sit that you intend to pursue after today.

We're getting some great answers here. Thank you for the quick responses…that's fabulous.

[Pause for responses]

Kayce, if you could go ahead and end that poll. It looks like we've got a lot of people looking at the intersection countermeasures, which I personally am delighted about. But it looks like a pretty good mix across the board here. Feel free to contact any of those technical leads I showed on the past slide.

At this point, I would like to welcome Brad Estochen and Doug Carter from the Minnesota DOT, who will talk about the experience implementing the RCI intersections.

Guys?

Brad Estochen:

Thank you.

Doug and I are going to talk a little bit about our experiences here in Minnesota in terms of implementing reduced conflict intersections. This is typical. Winter is coming soon to Minnesota, but it's not like this now; I can guarantee you. But this is a typical expressway intersection. What usually happens is we have crashes that occur at our far side… so vehicles crossing from up here trying to make a row. These occur on that far side.

So we had some intersections that we monitored, and we actually have video of vehicles at this particular intersection crossing and getting hit on that far side. So that far-side angle crash usually is a good indicator of where our intersections start to decay in terms of safety and performance.

One of the first things we try to do is not install an interchange because that's usually the most expensive option we get approached with. Instead, we try to look at other low-cost things we can do maybe on a much more compressed time

frame.

Some of the things that we've had experience installing in our state are the reduced conflict intersections. This is just an aerial schematic of one of the reduced conflict intersections that have been installed in our state. As you can tell at the intersection here, we had some problems with our vehicles getting hit…had some characteristics that aren't really good about the intersection being on a curve. And a far-side angle crash was a very prevalent problem. So what we did is we actually restricted that crossing movement. Again, the main line can make your left turns, your right turns to get into communities. It's just that left turn out of the community now needs to take a separate movement in order to make their move. So they would basically go down the road here, make the U-turn to make that left turn movement…same thing if you're coming from the right side of your screen and you wanted to make that through movement. You would go down the road here and make the U-turn to come back to get across.

When you introduce this to the public, usually the first they say is, "Oh my god, where did you come up with this idea?"

But the good thing is when we look at our performance at that previous location, we've got eight locations installed in our state. This is just a snapshot from a few years ago, where we looked at six of our sites. And we averaged about a severe crash a year at those locations. After we installed this strategy, we reduced our fatal and serious injury crashes by 100%. Now, it's a small sample size; but one of the things is we're seeing the performance. We don't think it's just happenstance that we're seeing these reductions. We really do think it's associated with our installation of the reduced conflict intersections.

When we look at the specific crash types before, here's why we think we're onto something. Before we did these installations, we had about 30 of those right-angle crashes; and afterwards, we only had 3 of those right-angle crashes. That far-side right angle crash we're really confident we eliminated because you can't really make that move. We still have some near-side angle crashes that occurred; but in this case, we're looking at about a 90% reduction, which is pretty good in terms of performance. So these are just our observations. By no means am I saying there's a 90% crash reduction associated with this, but the results are encouraging.

We now have eight locations installed in Minnesota. We actually just completed a study a couple of months ago where we updated our analysis. We looked at 19 site years prior to installation and 19 site years after, and you can kind of see the difference in performance. So before we had seven severe…so fatal and serious injury K&A crashes at our locations, and afterwards we had just one A-injury crash and that was a sideswipe, same direction type of crash. It really was more a lane departure issue that curd at the intersection and not necessarily and intersection functionality problem.

We did see, again, a reduction in those crashes we were looking at, those right-angle crashes. We were also able to accommodate just as much traffic. Some people say, well, the reason these things work so safe is because nobody drives through them after they're installed. But as you can see from here, our vehicle miles traveled actually increased from the pre to post conditions, in line with what our statewide traffic volumes have done over that time. So people may say they avoid that intersection at all costs, but our observations and measurements tend to indicate something else.

One of the things that we routinely hear about is, oh, it's hard for our semi's, our trucks, our agricultural equipment to execute these locations. I will say it can be intimidating if you drive a truck or you drive a combined, and now we're asking you to go down the road and take a look at some things. So we actually contracted with Iowa State University to go out and install some video detections and record some video of people using traditional expressways, full-access intersections, and actually look at how vehicles functioned at our reduced conflict intersections.

We looked at three main categories: the exposure…how much time were they actually exposed to traffic, then how much time did they spend at the queue, overall travel time and get an idea of the impact and evasive maneuvers that were involved with a vehicle or a large truck.

When we looked at exposure time, the actual time it takes to make the right turn at your intersection, make the U-turn, and then merge back into the lane is about 13 seconds, almost 14 seconds. So it takes 14 seconds to physically execute the turning movements to get through the intersection compared to about 11 seconds that it would take a semi to go from a full stop condition at an intersection to make that left turn…so for them to accelerate up to speed, traverse the intersection, complete their left turn, and actually get in their appropriate lane and proceed down the road. So there is

about a three-second difference in exposure. So that's out there. To us, the crash reduction greatly offsets that three-second delay or three-second increase in exposure.

For the queue and the travel time, the queue at the reduced conflict intersection was nine seconds to actually make the merge into traffic and about nine seconds to execute the U-turn. Again, when we break those movements out, it equals about the 18 seconds it takes to clear the intersection if you were just making that simple left turn.

However, I will tell you that the total travel time…it does take longer to execute a movement at a reduced conflict intersection. You're going down the road 1,000, maybe several thousand feet. So by the time you take that right turn and you add your travel time to go down the road to make your U-turn and travel time to come back, it is longer in terms of time to get that done. Overall, it's about 40-45 seconds difference in terms of executing the reduced conflict intersection for these large trucks and agriculture equipment. But we do think that, again, that's an equal trade, if not a better trade, to reduce that travel time by 40 seconds for these trucks in exchange for the crash reduction that occurs.

Finally, we looked at the evasive maneuvers. An evasive maneuver is when you cause somebody to slow down, stop, change lanes…basically anything that would require somebody to take immediate action due to their interaction with a truck or agriculture equipment. We looked at our reduced conflict intersections. We had about 15 evasive maneuvers per 100 large vehicles for the merging condition, 11 per 100 large vehicles at the U-turn, for about a 25% evasive maneuver interaction with these vehicles. When we looked at our controlled intersections, it was actually more at those locations. So sometimes our vehicles at these controlled intersections would simply pull out and block the oncoming lane until they got a gap in the far lane to make their movement.

In terms of the actions or the controls that the drivers take, we get a little better performance in terms of interaction with other users throughout RCI versus a controlled intersection.

Again, I wanted to highlight just a couple of things here. In the city of Cologne in Minnesota, this is a location where were installed a reduced conflict intersection. We have an elevator located in the small community, and you can see the trucks are typical users…or these single-unit trucks that come in there and drop off their grain and then go back to their farms and then gather more and then bring it to this spot. There's actually a railroad here so this is a distribution point. So this is a primary customer of kind of the trucks that use this intersection and then they're able to actually make the move and make the movements that are there.

Another thing that comes up from other folks is the impact on the vitality of businesses at the intersection. We have a Holiday gas station that's here, and it's still in business. They're still doing well; and so this reduced conflict intersections doesn't, again, inhibit from the mainline to get access to the business. It's when they try to get out of town that they have to maybe take an alternative measure. So the financial or the economic impact to the retail businesses… we haven't seen a lot of negative impacts in that regard.

There also are upper limits to when these things probably break down from an uncontrolled situation at the U-turns or even at the turning movements for the mainline. We're actually in Minnesota embarking on selling our first signalized RCUT or superstreet. It's on Highway 65, which is just north of the Twin Cities/Minneapolis area. We'll be installing this in the near future.

But the good thing is by installing this signalized RCUT here, I'm anxious to go a little north of this intersection. The volumes drop down a little bit, and we're actually able to get five unsignalized reduced conflict intersections incorporated into this corridor type of project. So one of the things that we've realized and we have programmed in our STP going out into the future is that we'll have several RCIs that are on the books to be planned. I think we have a couple dozen in our current STP that are scheduled for construction in the next five years.

This is just an artist's rendition of what the signalized RCUT is going to look like at the location I just previously identified. With that, I'm going to turn it over to Doug Carter.

Oops, sorry, here are some links that you can come back to look at these studies that we did. We did the safety

evaluation, the truck and agricultural study, and then a link to our overall reduced-conflict intersection webpage.

I'll turn it to Doug Carter now, who is going to talk a little bit from a geometric side as to how we incorporate this as an agency.

Doug Carter:

Thanks, Brad.

I'm going to give you a little background of how MnDOT implements strategies like this. We have a General Road Design Manual that has all of our design guidance for state projects. We update that via a couple of different mechanisms. One of them is tech memos. The application works very well for the RCUTs, where we can write a tech memo addressing this new intersection treatment and publish it. Tech memos, by definition, they all supersede the Road Design Manual. So this becomes part of our guidance and is required to be followed by all of our projects.

Now, in developing the guidance and getting stakeholder buy-in, we had to identify who our stakeholders actually are. Brad did a good job of explaining that the driving public, the locals, who are likely going to be in at least initial opposition, the freight haulers locally who are going to have to use this facility. It's also important on these divided multi-lanes to work out the bikes and the peds and the ADAs. How are you going to get them across this new intersection treatment?

As Brad's first slide showed, we're going to have snow this year. We had snow last year, and we will have snow in coming years. Our ploughing is a big component of our maintenance. Our plough drivers aren't big fans of raised channelization, so getting them on board with what was the most efficient design of what was the most efficient design from the standpoint of keeping it clear and safe for the public during the winter months was important.

The goal we were shooting for was statewide consistent. We want to have the RCUTS from one end of the state look like the RCUTS from the other. We want to set driver expectation. So while this may be the first in the local community, when they are traveling statewide, they recognize the treatment and they know how to maneuver through it.

We also wanted to share the best practices. One side of the state may have some ideas about how to best design the RCUTS based on site availability, and we want to make sure that we all learn from each other so we can move the design forward to the optimum design in the most efficient manner.

As Brad mentioned, some of the advantages of the RCUTS…we use it primarily as a low-cost, retrofit option. We're coming back to divided four lanes that likely have crash problems above the average and putting these in to address those. And those intersections are actually likely identified in our road safety audits that take place.

These treatments eliminate crossing and left-turn movements. They also, as was stated by Jeff, they reduce intersection conflict points considerably. And they make the gap acceptance/gap acknowledgment a linear problem instead of a problem where you're managing gaps for traffic to your left, having to move a distance, and then managing it for traffic oncoming at the right…which we generally, as humans, don't do very well.

We are seeing a decreased crash severity with these overall. I know there was a question earlier about the median U-turns and how those play into our safety stats. Per NPH RP-524, there is currently no indication that the U-turns constitute any safety concerns.

We've got an example up here on the screen right now. It's a good example of how we get pedestrians across. You can see where we cross them behind the minor road medians, bring them across, and then cross them on the divided four-lane and get them to the other side. When working with all the stakeholders, the bikes and peds and ADA units…their approach was we want a standard methodology for getting peds across these treatments.

The reality is as treatments, these RCUTS – and this is going to be the primary takeaway I hope we leave with you…is that every one of these is different. It's based on the intersection's skew; it's based on the primary trunk highway alignment; the median spacing between center lines comes into play; and there are other factors. The result is these all

look a little bit different, and they're going to require different pedestrian accommodations from that regard.

Again, this is the Cologne RCUT that Brad was showing you photos of; this is another view. This particular design, with the long legs on the center line median, this was done before we had a statewide guidance. The maintenance personnel in this district weren't very fond of these long, raised medians. And through working with them, we've changed our base design to better meet everyone's needs.

Now, as I mentioned earlier, when we're considering an RCUT for an intersection for a safety treatment, we're looking at the traffic/demand balance. What's the ratio of the trunk highway traffic to the minor road traffic, and does that fit the RCUT model? These don't fit every application. What is the median spacing on the mainline? Is it wide enough that you can get the design vehicles to turn, or are you going to have to add additional mainline pavement at the median U-turn. And what is the spacing for the median U-turn?

Nationwide, there's quite a bit of variability. When we started implementing these, we worked with Will Stein at our local FHWA to get the nationwide perspective. Maryland had quite a few of them. They had median U-turn spacing that was quite far. I believe it was in the neighborhood of 2,000 feet. We wanted to bring those closer to reduce the minor road delay, reduce the exposure, reduce the weave…and to stay out of the center left-turn lane.

Another design factor, as Brad mentioned, was ag and freight. We worked with our partners there to come up with a design that while they may not be great fans of they can still tolerate. I spoke about maintenances and pedestrians. Signage is another big issue with these. We're looking for consistency across the state to set driver expectations. And as part of the tech memo that we developed, within that are links to our traffic signage plan and striping plan for these RCUTS that meets MUTCD requirements.

I want to say, in case I didn't earlier, that both our Road Design Manual and our Tech Manual are available on our website.

Let's go to the next slide.

For demand balance, looking at the traffic on the mainline, looking at the traffic on the minor road…I apologize for the out of focus. But if you're looking up the y axis, this is the major road volume. So for unsignalized, they're applicable from about 15,000 to upwards of 90,000. The minor road volumes are about 5,000. Now, when you get up into this area here, the signalized RCUT that Brad showed you, I believe that has a trunk highway volume of about 38,000 and a minor road volume of about 11,000. That falls into this area right here, which puts it on the course for a signal…which I s why that's what the design shows.

Now, this is a graphic of what I was just explaining. We've got 37,000 on the trunk highway, and we've got 10,000 and 11,000 on the minor road. We've got a heavy left-turn/right-turn movement here, so we've actually got a double right. And that goes directly into a double right left turn lane that then is signalized at the median U-turn. We've got the same on the north side of that intersection.

Now, we also talked about – I said median placing plays a role into it. This is an example of where we have enough median spacing between the two trunk highway center lines for the design vehicle to make that left turn. The median spacing on this trunk highway is approximately 120 feet to 125 feet. Here on this leg you can see that they might have needed a little bit more, so they brought the right-turn lane back and allowed those vehicles to make that median U-turn right into the right-turn lane. And while that's not our preference, there are times when that is appropriate.

As an intersection treatment, one thing that I think is important to note is to not have any preconceived ideas of what you want these to look like because every time you construct one, every installation will be slightly different and have different considerations.

Here's an example of narrow median spacing. This is a trunk highway in Wabasha, Minnesota. The median spacing here between center lines is about 65 feet. Due to that, there's not enough room for the design vehicle to make the turn without needing extra pavement. So we've come up with this design we call a loon. It's additional full-depth pavement that allows the design vehicle to make the left turn and then come back into mainline traffic.

While I'm talking about design vehicles, I want to share that the primary design vehicle for these loons is the WB62. Now, based on our maintenance needs and our understanding that plough trucks will be out there each and every winter, we use an SU40 straight axle for our plough trucks. And what we've found is our plough trucks, because they're straight axle, have a larger turning radius than the WB62. So this lune is often defined by the plough trucks and not by the WB62.

Additionally, based on our work with the maintenance staff, they wanted to be able to turn their plough truck around using the three-quarter intersection and go back down the trunk highway without having the need to go down the minor road and find a place to turn around and come back. So our three-quarter intersections are designed so that the SU40 vehicle can come into the median left and swing around and stay on the trunk highway.

Now, in order to put these vehicles directly into the left-turn lane, we had to get the state statute modified to allow that maneuver…for a vehicle to move and cross directly into the left-turn lane. That was not the easiest thing to do, but don't let that hold you up. It is still very viable.

This is an example of the turning movements that we require when we're reviewing a layout. You see that our plough trucks can make the turning movement and stay on mainlines, and the plough truck actually defines the extent of the turns on the median U-turns.

This is the Cologne example that Brad showed you. What's important here is this little clip from the newspaper. One of our biggest opponents drove through the intersection after it was done and realized that while it was new to him, it actually works well; and he doesn't even think about it anymore. And he's now on our side when we come for the next one.

This is an RCUT that was put in with input from the information in our tech memo. You can see that the median U-turn is much smaller. It's much more compact and cost-effective. The crash data at this particular location has gone from 54 with 2 fatals and 3 serious injuries to zero. This is a street view of a similar RCUT so you get an idea of how little you can do this with.

As a last example of don't have any preconceived ideas of what you want these to look like, here we've got a diverging mainline. I have no idea what that median spacing is on the long side…at least a few hundred. The median spacing over here is probably around one hundred. But you can morph these to fit any example that you happen to have in front of you, and that's something to keep in mind.

With that, I'd like to say thank you and hand it back to Jeff.

Jeff Shaw:

All right, well, thank you, Brad and Doug. That was an excellent experience, and I'm so happy to have you guys share it with everybody today. I encourage those folks who are interested in learning more about the RCI to go visit that webpage because they've got wonderful information out there.

Thanks again to you guys.

Next I'm going to ask James…and I'm going to probably murder your last name again here real quick…James Shahamiri from the city of San Francisco to talk about their experience in implementing the leading pedestrian interval.

James Shahamiri:

Thanks, Jeff.

I'm James Shahamiri. I'm an engineer with the San Francisco Municipal Transportation Agency, which is our local DOT here in San Francisco. I'm going to share our experiences with LPIs.

As Tamara said, an LPI is when we display the walk indication for pedestrians prior to displaying the green for

vehicular traffic. It helps establish the pedestrians in the crosswalk, gets them ahead of turning traffic, and it can help with both left and right turns. It also sends a clear message that we're prioritizing people crossing over people driving.

In terms of timings of LPIs, the METCD is the minimum duration of three seconds…that the goal of the LPI duration is to allow people to cross at least one lane of traffic; and typically in San Francisco, we use a four-second duration. A lot of times people say, oh, you're giving extra time to the pedestrians. That's actually untrue. The LPI retains the existing pedestrian split. It's easier to think of it as a delayed green.

So in terms of signal timing considerations, LPIs can reduce the overall green time at an intersection by a non-trivial percent. Here in San Francisco, for example, we use a lot of 60-second cycles. So when you do the math, four seconds for a two-phase signal; and you're looking at about a 16% reduction in green time.

Some tricks that we use…we'll rebalance splits. If we don't want to remove an intersection from a system, maybe we take a few seconds from the side streets, give it back to the main streets. In some situations, we'll increase the cycle length. When you're working on a coordinated corridor, if you've implemented the LPI along the coordinated phase and you've already created sort of a bottleneck in the green band in terms of the coordination. So it kind of makes it easier to take a corridor-wide approach, so you just kind of maintain the green band along the corridor.

In terms of other signal timing issues that come up with LPIs, is depending on how your offset is referenced, you may have to adjust your offset depending on which phase you're serving the LPIs for. You really want the vehicles to arrive on the green, not the LPI. You don't want vehicles violating the LPI.

In terms of when not to use an LPI, there is only one situation so far we've come across where an LPI didn't work. That was a situation where we had a leading effective permissive turn phase. You do not want to have an LPI for the conflict crosswalk for the left turn because once the protected portion of the left turn has ended and it goes to permissive, the opposing through vehicles are held back due to the LPI; and the left-turning vehicles may continue to go. And you really don't want them going during the LPI.

Turn on red restriction often comes up when discussing LPIs. The turn on red restrictions can help with LPI compliance because the whole purpose of the LPI is to prevent vehicles from turning across the cross while the peds are being served.

In terms of our observations here in San Francisco, we really haven't seen that as an issue. Drivers tend to respect the LPI. They don't tend to violate it. So we don't have a policy of coupling LPIs with turn on red restrictions. We'll use engineering judgment on a case-by-case basis, and I would say the vast majority of our intersections with LPIs do not have turn on red restrictions. Thinking more globally about it, if you couple the two, it makes implementing LPIs more challenging because I think most people are willing to live with a few seconds of lost green time. But when you are coupling it with turn on red restriction, which is full time for the entire red phase, that can make it more challenging. So I really recommend looking at it on a case-by-case basis and evaluating intersections.

Another issue that comes up with LPIs is accessibility. Pedestrians who are sight impaired rely on either the successful pedestrian signal to let them know when the walk phase is active or the sound of parallel vehicles traveling…starting up from green. When you have locations that don't have APS signals, you may want to think about either adding APS signals or timing the pedestrian split so from the start of green, when a sight impaired person will start to cross, they still will have that minimum three-feet-per-second split. So they have all the time available to them.

In terms of how this addressed in San Francisco, we now install APS by default at all new signals and major upgrades. We also time our signals for a slower walking speed of a two-and-a-half-feet-per-second split. So that usually takes care of the issue.

Some of the questions that we ask ourselves when we're implementing LPIs, really the point of the LPI is what's the likelihood of the first vehicle on green making a turn. If you have locations that that's a very low likelihood, the LPI may not be very effective. If there's a turn lane adjacent to the crosswalk, that's a pretty good indication that the first vehicle is going to turn. If you have a turn lane, there's probably high turn volume. Approaches that have multiple turn lanes, for instance multiple right turns that turn permissively across a crosswalk, that's a good location for an LPI.

In terms of safety, obviously if there's a collision history of collisions between turning traffic and pedestrians. Some locations can have limited sightlines. Maybe there's a signal control on the corner or there may be some obstructions that it's helpful to get the pedestrian out ahead of turning traffic to really establish themselves and can be visible…also if the intersection may be near a school or a senior center.

In terms of mitigating factors, things that kind of make the LPI a little more palatable from a signal timing perspective, very often when you have an arterial street with a minor side street, the phased duration for the side street is really governed by the pedestrian crossing time, not by the actual vehicle demand. So it's very easy to cut a few seconds off the green to serve the peds with an LPI.

Actuated crossing is another great location for LPIs. The LPI is only active when a ped is there, and so you're not wasting any green time when somebody isn't crossing. The intersection has trans signal priority; so if you're in San Francisco, transit is very heavy. You have a lot of buses, a lot of streetcars. We sometimes get pushed back saying, hey, you're reducing our green time; you're affecting our on-time performance. So we've equipped almost all of our signalized intersections with transit signal priority. So we say, well, you're losing a few seconds of green at the beginning; but we're giving you an extension at the end, so that balances it out.

And volume of people crossing the street, we don't have a minimum threshold for pedestrians crossing. We typically don't do an evaluation of the number of pedestrians. But the more pedestrians there are, the easier it is to justify an LPI. Just from personal experience in locations with very low ped volumes, motorists are not expecting a pedestrian, and will turn left or turn right, right in front of you when the light turns green. So having that LPI, getting out ahead of turning traffic, is actually very useful even in low-volume pedestrian situations.

We have five typical cases where we – these are sort of typical intersections. So the minor side street to major street… this is one I just talked about where typically where the side street is governed by pedestrian time and not by vehicle demand. There is typically a likelihood of the first vehicle turning from the minor street to get onto the major street, and there typically most pedestrians will take advantage of crossing the major streets. That's just the way the splits are set. The main street has most of the green time, so pedestrians crossing parallel to the main street have more opportunities to cross on "walk." They may not be queued up, but pedestrians will likely be queued to cross the major streets.

T-intersections…vehicles approaching on the stem of the T have to turn. Left turns can be problematic at the intersection due to lack of opposing traffic. Left turners just go.

One way to one-way streets…these are typically arterial to arterial connections. There's a high likelihood of the first vehicle turning. One-way street networks are typically downtown, so you can have moderate to high pedestrian volume. Again, the left turn can be problematic.

Neighborhood commercial…so this is also kind of downtownish, but kind of a smaller intersection, a lot of congestion. People are circling looking for parking; there are a lot of people parking. You may have transit on some or all approaches. These intersections typically have short cycle lanes, so they're very snappy for pedestrians. But these are situations where you may need to balance safety and delay.

The last example is the arterial-to-arterial intersection. Here you do have a high likelihood of the first vehicle turning. You have long crossing distance exposure. This is another situation where you have to balance safety versus delay. Here in San Francisco, our default is to consider an LPI whenever we're retiming an intersection. We really have to justify not installing the LPI as opposed to justifying it.

That's it for my presentation.

Jeff Shaw:

Thank you very much, James. That was excellent stuff. I really like the idea of the approach that San Francisco is taking to make walking a priority. I think that's a really innovative approach. I think clearly other cities are starting to think alike.

Obviously, everybody, I owe you an apology. We've got much longer today than we had originally planned. So we've tried to answer all of the Q&A that was in the Chat pod. We've also put up on your screens the contacts for further information. So please send an e-mail to any of us directly if you have any questions about any of the countermeasures we talked about today.

I'll also be happy to funnel questions to Brad and Doug in Minnesota and James in San Francisco.

We've got a couple of poll pods up just to act you what you'd like to hear more in-depth information about for the new safety countermeasures. We'd appreciate your opinions on that. That will help inform future efforts as we roll these out over the course of the next year.

With that, I would like to thank all of the speakers today…from my office, from Minnesota, from San Francisco. I'd like to thank all the support staff.

With that, we will leave this screen open here for a while; but we will officially conclude the audio and thank everyone for their attendance today. Have a good rest of your day, everyone.