Data & Analysis Technical Assistance Program Technical Webinar: Systemic Safety Approaches

June 3, 2014, 2:00 to 3:30 EST
Participants: 73

FINAL TRANSCRIPT:

Welcome to the Systemic Safety Analysis Approaches conference call. At this time, all participants are in a listen-only mode. Later we will conduct a question and answer session. If you require assistance or if you want to ask a question, press star and then zero. I would like to turn the call over to your host at this time, Ms. Sharon Chan Edmiston.

Thank you. On behalf of the Federal Highway Administration Office of Safety, I would like to welcome everyone to this Data and Analysis Technical Assistance program quarterly webinar. If you haven't already done so, please take a moment to check out the questions on the screen. I am Sharon Chan Edmiston with the USDOT Volpe Center in Cambridge, Massachusetts. Joining us as presenters today are Bob Pollack, Peter Eun and Becky Crowe from the FHWA Office of Safety, Reg Souleyrette from the University of Kentucky, and Dough Harwood from MRI Global.

Before we begin, I would like to point out a couple of key features of our webinar room. On the top-left side of your screen, you will find the audio call-in information and the list of attendees. On the bottom-left of the screen is a chat pod. If you are having any technical difficulties, please use the chat pod to send us a message. You can also use the chat pod to submit questions to our presenters throughout the webinar. We will queue up all questions to answer during the Q&A section. At the end of this webinar, you will also have an opportunity to use the chat pod to suggest ideas and topics for future webinars. Today's webinar will run until 3:30 PM today. There are folks who are unable to take part in today's Webinar; we are recording the session so that they can listen to the presentations and the Q&A session at a later date.

With that, I would like turn the webinar over to Bob who will introduce us to the Data and Analysis Technical Assistance Program and today's presenters. Bob Pollack is a transportation specialist in the FHWA Office of Safety and a member of the data analysis team. He is currently the Program Manager for the Roadway Data Improvement Program, the Model Inventory of Roadway Elements (MIRE) Reassessment, and the Data & Analysis Technical Assistance Program. Bob.

Thank you and good afternoon. It is a pleasure to have you on board for the first technical webinar. Before we begin, I would like to give you information about the Roadway Safety Data Program. The RSDP is really an umbrella for a host of programs and activities that are presented under the FHWA Office of Safety. The activities include providing safety data guidance, training, conducting studies or identifying good practices for data collection, data management,

data analysis, and providing technical assistance on data and analysis. This effort is being undertaken to help states make more effective data-driven decisions for their safety data programs. Today's presentation is being presented under the technical assistance portion of the Roadway Safety Data Program. We refer to this particular program as Data and Analysis Technical Assistance Program. This program is broad-based and far-reaching. What we intend to do with the Data and Analysis Technical Assistance Program is to present a customized approach to any state or local entity having difficulty with either data collection, data analysis, data management, in order to address their particular needs. We do offer other technical assistance programs, most notably the Roadway Data Improvement Program (RDIP) that provides an overview of a state's roadway data program. That program is more broadly based but is focused on a single state at a time. So if you are having a particular issue with data, data collection and analysis, I would invite you to submit a request for assistance through this program and I believe we have a slide at the end on how to access and submit a request.

Also as part of the Data and Analysis Technical Assistance Program, we will be conducting quarterly webinars and today is the first such occurrence of the technical webinar. You see the agenda and I would like to make a couple of quick remarks about today's program. Our topic is Systemic Approaches to Safety and this webinar will examine--not in depth but at least present an overview--three different approaches to conducting safety and analysis. The three approaches are Road Safety Audits, the FHWA Systemic Safety tool, and the usRAP tools software. In addition to looking at these tools, Kentucky performed a comparative study on the three approaches to safety on rural roads within the state and we are going to hear about the findings from their study. Part of our purpose in presenting information on these programs is to identify and present information on different approaches and conducting safety analysis. While two of the programs are FHWA programs, we also acknowledge and recognize other good approaches to conducting safety analysis. And it is with this in mind that we commend Kentucky for undertaking this comparative effort. Now each approach has its own benefits and limitations. No one approach is likely to work through every circumstance and depending upon available resources the agency may have, they should identify the process and practice that works best with their particular needs, circumstances and resources. So with that in mind, we will go ahead and begin the program.

Before we begin, I would like to take a brief moment to introduce our presenters and we have a very good group with us this afternoon. We have Doug Harwood, the program director for the Transportation Resources Center with MRI Global in Kansas City Missouri. He has over 40 years of experience in research related to traffic safety, traffic operations, and highway geometric design. He had a lead role in developing many of the innovative highway safety tools in current use including the Highway Safety Manual, SafetyAnalyst, the Interactive Highway Safety Design Model, and the U.S. Road Assessment Program (usRAP) Tools. Mr. Harwood is a member of the TRB Committee on Highway Safety Performance and the TRB Committee on Operational Effects of Geometrics.

Also presenting for us this afternoon will be Peter Eun. Peter is a transportation safety engineer with the FHWA Resource Center Safety & Design Technical Service Team. He is the lead for the team in pedestrian and ITS safety. He has been a Division Safety Engineer, a NHTSA liaison, as well as a Division Area Engineer for FHWA.

Next, we will have Becky Crowe presenting on the Road Safety Audits. She is a transportation specialist in the FHWA Office of Safety. She manages and provides guidance on matters related to Road Safety Audits (RSAs), Older Drivers and Pedestrians, Motorcycles and Road Diets. She also works closely with Federal, State, local, tribal and not-for-profit agencies to advance highway safety initiatives. Before joining FHWA, Becky worked for a regional planning agency and the Virginia Department of Transportation.

And then, finally we have Reg Souleyrette, a Professor of Transportation Engineering at the University of Kentucky, where he also serves as a program manager for Planning and Education at the Kentucky Transportation Center. Reg is a former Chair of TRB's Data and Information Systems Section, and GIS Committee. He has worked with the usRAP program since its inception in 2004.

These four individuals will be the presenters this afternoon and I will turn it over to Doug to begin his portion of the program.

Thank you very much, Bob. I appreciate it. This is Doug Harwood from MRI Global and I will do the first portion of the presentation and really introduce you to the subject matter that we are going to be talking about today. As you can see in the slide on the screen, our presentation today deals with comparing systemic safety analysis approaches. And we are going to focus on three approaches and tell you about each one of them and also show you a comparison where we applied each of those approaches to the same set of roads.

As you can see we are going to compare those methods and we are focusing in this presentation on methods that can be applied first of all without extensive data. You need some data to apply any scientific approach to safety management. But, we are focusing on methods that don't require as much data as, for example, applying Highway Safety Manual Part C, which is intended for design analysis. We are focusing more on measures that can be used initially to identify what safety improvements or countermeasures might be appropriate for a particular location. We are also emphasizing methods that are based as much as possible on the analysis of roadway characteristics data. Crash data is the traditional method for identifying countermeasures. That certainly is a very appropriate approach to use but there are some other approaches that can be used when crash data are not available or when the crash records of the road network of interest are pretty sparse and by themselves don't provide enough information to look at the ways to improve safety. So we're going to look at those methods and we are going to compare their results.

In this presentation we are focusing on local roads and in particular, the application of these countermeasure selection methods to local roads. Why the emphasis on local roads? First of all, up to half of fatal crashes occur on local roads rather than on the state highway systems. We need approaches that are applicable to local roads. Unless we have such approaches, we would not be addressing half of the safety problem, so local roads are clearly important in safety management. Generally, the agencies that administer local roads have less sophisticated roadway characteristics and crash databases than state highway agencies do. Given that more limited data, some of the approaches that states might apply to the safety management process may not work

for local agencies and local roads, so we're going to talk about some things that will work. Furthermore the current Federal Highway legislation, MAP-21, in the Highway Safety Improvement Program requires attention to all public roads as part of the safety improvement programs. Just focusing on the state highway system, as may have been done in some places in the past, is not enough to satisfy the intentions of MAP-21, and that is certainly why we are focusing on local roads.

Now, the Federal Highway safety improvement program requires projects to be based on a data-driven process. Data are needed to justify why a particular location, rather than other locations, are candidates for improvement. But if on a local road system the available crash data are either sparse, poorly located, have inaccurate or unavailable locations or crash data are not available, how can safety projects be data-driven? We're going to show you ways in which they can be data-driven and will work for these situations so that lack of data can't be a reason for not looking at potential safety improvements on a roadway system where half of the fatal crashes occur.

Some of the key challenges that highway agencies face in administering safety programs is identifying countermeasures and appropriate implementation of countermeasures – both what locations to improve and what types of countermeasures to use at those locations. Chapter 6 of the Highway Safety Manual discusses the principles involved in countermeasure selection. Now there are other tools that can be used in countermeasure selection that we are not talking about in this presentation. For example SafetyAnalyst, a software program available from AASHTO, has been deployed in 14 states and can do a good job of selecting countermeasures. But SafetyAnalyst requires very good crash data and roadway data. What we are addressing this presentation is what agencies can do if they don't have the kind of crash data and roadway data necessary to drive SafetyAnalyst. Many agencies do have poor crash and roadway data. Also as I mentioned before, many roads have crashes that are too sparse to identify a high crash location. Crashes may appear randomly but good tools can help identify locations that are good candidates for safety improvement despite the lack of crash data or sparseness of the crash data.

Now, we have said this webinar is about systemic approaches, so why use a systemic approach? Historically, most identification of countermeasures has come from the analysis of crash history data but short-term crash histories are simply random observations of a long-term process. With just a short-term snapshot of the process and without knowing the long-term average, we may not be making good decisions about where to implement safety improvements. A systemic approach is intended to help you see through the short-term random variations to the long-term process and identify where improvements are appropriate. The crash data for a short period doesn't necessarily represent a site’s true long-term crash risk. High crash frequencies in a short time may be unrealistically high; maybe just randomly high. Low crash frequencies in a short period may be unrealistically low or just randomly low. So the Highway Safety Manual and SafetyAnalyst use some sophisticated statistical approaches in what is called the Empirical Bayes method to estimate long-term crash risk. A simple review of crash histories can't do that. Geometric features that experience consistent crashes are likely to have similar inherent crash risks to other locations. From the study of locations that have crashes, we can identify other similar locations that have inherent crash risks. That is the basis of systematic approaches. Systemic analysis is risk-based and proactive and allows us to identify potential improvement

locations even if we haven't allowed many years of crashes to occur to find out if those improvement locations. We can identify the improvement locations, and be proactive and implement improvements before waiting for crashes to happen.

Local roads involve half of all serious crashes. We said that these systemic methods are useful when good crash data are not available but they are equally applicable to situations that do have good crash data. Just because they're the only methods that can be used when there is not good crash data doesn't mean that these systemic methods aren't useful even with good crash data; they can help identify locations where crashes may be randomly low at particular places but still have significant crash risk.

We are going to talk in this webinar about three different analysis methods that are applicable where crash data are sparse, poorly located, or not available, and can be used to identify or candidate safety improvements or candidate countermeasures for crashes. The three methods are the usRAP tool software, the FHWA Systemic Safety tool and Road Safety Audits. You see on this slide the logos of these various approaches. I'm going to begin the discussion by telling you about the usRAP tool software. Other members of our team will take you through the two other approaches. Following the introduction of all three approaches, Reg Souleyrette will talk about the comparison that was done in Kentucky. That is our plan. I will talk for a couple of minutes about the usRAP tools and we will look at the other approaches.

The US Road Assessment Program or usRAP has a software package called usRAP Tools that has a couple of purposes. First, it assigns star ratings for roads based on the presence or absence of features related to safety, or are known to be related to safety. Second, it can recommend a safer roads investment plan for any road network for which we have roadway characteristics data. The star ratings are developed for reducing crashes involving automobiles, bicycles, pedestrians and motorcycles. The input data for usRAP includes approximately 40 safety-related roadway and intersection features. It can identify an improvement program looking just at those roadway and intersection characteristics. Detailed site-specific crash data are not required to use the software so this is an approach that can be applied without crash data. Now if you have good crash data as well, that is a very useful supplement that can be used in taking the results of usRAP, refining them, making sure we get the right countermeasures for the right locations. Some network wide crash data is useful for calibration of the tool but is not necessary for its application to have detailed site-specific crash data. The data that is required for the tool can be coded in about 20 minutes per mile; so it only takes about a 20 minute investment to get the data for a mile of road and data can be coded from sources such as Google Street view. We have software that helps assistant doing that. usRAP will be coming out with a new version of the software that has additional variables in it. This might increase the coding time to 25 or 30 minutes a mile but it is a very doable thing. In the long run, mobile mapping efforts that combine video and lidar could provide much of the data needed and there is a lot of mobile mapping activity going on. We may see coming along on the future ways to automate it and reduce that 20 minutes per mile. Software and training are available, you can see the www.usRAP.us website for more information. There is no charge to highway agencies to use the software. The only costs involved are whatever it takes to assemble the data that is input to the software.

This gives you a look at some of the software. This was the application of the software to some county roads in Illinois. The map you see displayed are the star ratings for the particular road network in a county west of Chicago. The table below shows star ratings of the road. The software gives a good overview of the geometrics, traffic control, and roadway features of the road system, and also gives a detailed safer roads investment plan. That safer road investment plan has specific improvements at specific locations, but it just is a starting point for thinking about improvements that is followed by detailed engineering studies that the highway agency would conduct to decide on the final countermeasures to be implemented. This is an example of the safer roads investment program. Each line is a type of improvement summarizing this. As you see the results are based on a benefit-cost analysis and the user gets to specify a minimum benefit-cost ratio that would be considered. Altogether, 70 different countermeasures are looked at for every site in the network. A benefit-cost ratio is determined for each countermeasure and they are assembled into a program that the user can review and decide how to apply. With that I am going to turn the presentation over to Peter who is going to talk to about the FHWA systemic safety tool.

Thanks, Doug. This is the first I've heard about the software and I'm glad to learn a little more about it. I'm looking forward to seeing the example from Kentucky.

I'm going to talk about the Federal Highway approach and to start out with a question - what is a systemic safety improvement? It is defined as an improvement that is widely implemented based on the high risk roadway features that are correlated with particular severe crash types. Now the key term here is high risk. We identify those high risk roadway features based on a correlation with particular severe crash types. There's a lot of information and resources out there now to help agencies identify and prioritize safety improvements for high crash locations. That same level of detail was not previously available for the systemic approach, so several years ago Federal Highway initiated an effort to develop the Systemic Safety Project Selection tool. It is called a tool but it is really not a tool, it is more of a guide that defines the process. It has three main components. The first is the systemic planning process, which is shown in the blue, and that provides the step to step instructions and has illustrated examples to identify and prioritize a systemic safety improvement project. The second element of the tool represents the mechanism for agencies to determine the appropriate balance with regard to the funding and site analysis and systemic projects and that is shown in the green. Now with the second step, it is really not a formula, it is more of a series of considerations for agencies to determine how they might distribute their limited highway safety investments. And in red, the final, is the tool that describes procedures to evaluate a systemic safety improvement in terms of output and outcome measures and also the countermeasure performance. The process is pretty simple – just four primary steps that are logical. First you identify your target crash types and potential risk factors and then you screen and prioritize your candidate locations. Then you select your countermeasures and end by prioritizing your projects for implementation, very similar to other types of planning processes for crashes. It is very simple and logical.

As Doug stated, there are different factors that influence the approach. The process is designed to be flexible. It can be scaled based on an individual agency's need. Just like a site analysis in which the specific conditions can vary widely, in the same way the systemic approach can vary between individual agencies that use it. With regards to the data availability that really dictates

the level of detail and analysis. While the systemic analysis can be completed with nearly any amount of data, and that is the beauty of it, the more data that you have, as Doug mentioned, the better as far as the refining of the potential risk factors that you can evaluate; the more data the better. Once again, you don't have to have the robust data that a lot of other systems need. As far as the resources go, the more resources you have determine the extent of the improvements you can be making. But also the resources can impact the level of analysis and how much data you're going to collect. And then as far as the priorities, depending on what the agency's priorities are, it will help determine which direction you go with the analysis as well. Finally, the state and local agency relationship - a lot of states have local programs and are giving the funding. They can influence and dictate whether those funds are spent on state routes and the limitations. Depending on the relationship, it can be an influencing factor as well.

Both in the site analysis and systemic approach, the required data can be a challenge for a lot of local agencies. The most common types of data required are the crash data, and then you have your roadway data and exposure data. We all know safety starts with crash data and most agencies do have it. So this is one of the basic requirements for the safety management process. If you don't have access to the data, there are a lot of different ways you can get it. You can go to law enforcement agencies, state databases, as well as FARS. The systemic approach relies more heavily on the roadway data and if you don't have this, you might be able to obtain it video logs. Google Earth has really made it easier. In Minnesota they did inventory of all of the horizontal curves and they were able to measure the radius of the curve by using the aerial images from Google Earth. So if you don't have it, we have the tools now that make it easier to get that data fairly easily.

This is a chart about distribution of safety investments. On the left side you have the site analysis and on the right, systemic. With regards to the high crash locations and the high numbers, you go with more site analysis; the traditional type of analysis is done. As was stated earlier, the systemic is more proactive while the site analysis is more reactive. Depending on what type of data you have and which direction you want to go, more reactive is site analysis or more proactive is systemic.

The last element of the tool describes the techniques to conduct the systemic program evaluation. As you know evaluation is the key to success of any program. Even though not everyone does it, they really should. It tells you what is working, what is not, and what changes can be made. The tool describes different approaches to the systemic program evaluation. It includes both the output and outcome oriented types of evaluation.

The Federal Highway systemic approach is still kind of young. We want to advance this effort and not a lot of agencies want to be the first try something new. We're fortunate that we had some early pioneers in Minnesota and Missouri. Then we had the early adopters and more states jumped on with a pilot program in Kentucky and New York and Thurston County (Washington). Although we have state DOTs listed here, many have worked with the local agencies. Thurston County, specifically as was stated, the emphasis was with local roads and counties. Both Washington state and Ohio use it as part of their Highway Safety Improvement Programs (HSIP) process with local agencies. The local agencies have to do a systemic approach type of evaluation. There are 38 states that report regarding Highway Safety Improvement funds and

how they're being used with regard to systemic improvement. On average 30% of HSIP funds were being used for systemic. Then we have the Grow America Act, which is a critical development and investment in the program and safety is a priority in this Act as well. This is a good approach and funds to available to use for the next authorization.

Finally, this is just a brief overview to give you information. You can find a lot more information with regards to the process. You can download the tool from the website and also details about the different pilots and pioneers, different background information and how that process went. I encourage you to go to the website and download the information and find out more.

Finally, one of the other ways that we want to advance the systemic approach is to do a peer exchange. In September of this year in the Washington DC area, there is going to be a peer exchange. There are going to be up to four representatives from six different states. One representative from the state and one from a local agency are required. It is to advance the approach, talk about reducing the fatal and serious injuries on the local and rural roadways and exchange ideas. In a file share pod on the left, there is an application that you can download and fill out. You need to get in by this Friday and that would go to Rosemary Anderson.

And with that I will go ahead and have Becky Crowe talk about Roadway Safety Audits.

Thanks, Peter. Looking at the poll earlier, looks like almost everyone has some knowledge of Road Safety Audits. I see a lot of familiar names in the attendee list, which is great.

I'm going to give a brief overview of RSAs. Federal Highway defines an RSA as a formal safety performance evaluation of an existing or future road or intersection by an independent multidisciplinary team. An RSA answers two primary questions: What elements of the road may present a safety concern, to what extent, to which road users and under what circumstances? And a second question, what opportunities exist to eliminate or mitigate identified safety concerns?

Why do we need RSAs? A good road design is one that can anticipate and accommodate common driver errors. The Road Safety Audit simply applies this concept. It identifies safety issues and corrects them. It considers all highway users. We are looking at motorists. We're looking at pedestrians, bicyclist, looking at the aging population. It produces designs that reduce the number and severity of crashes.

How are the RSA conducted? It is an eight step process. You can see in this slide the eight steps. It goes from identifying a project all the way to incorporating findings from the RSA into the project or design. I'm going to spend a little bit of time on steps three, four, five and six. You have the RSA team together. This is where in step three you're going to start looking at the data. Looking at what is available out there. What drawings do I have? Future plans, crash data, traffic volume - that type of information.

One of the key steps in the Road Safety Audit is to get out in the field. If it is a road that has been constructed, observe the road user characteristics. Observe the surrounding land issues. Look at

the adjacent transportation network. Are there interchanges close to the section of roadway or highway rail grade crossings? That field review is so important in a Road Safety Audit. After you have your data and you've gone to the field you, there is step five. You take your data and perform your analysis. It is more like a workshop setting, you have the RSA team members sitting around the table, and you're identifying issues, prioritizing them and mitigating the safety issues.

And finally, this is where as a team, you're going to be sitting down with that road owner and discussing what the team saw on the roadway and using the data. Discussing preliminary findings and possible solutions and you will be using those results to write the RSA report. In that report, this is your opportunity to identify and prioritize safety issues and include suggestions for the road owner and some improvements that can be made on the roadway.

We have a lot of information on Road Safety Audits at Federal Highway. We have done number of cases studies. The guidelines are available online as well. We just recently developed a guide publication on using 3-D design visualization for performing the RSA. I encourage you to check out the website. Also look at the information that we have on Road Safety Audits. If you want more information on any of these items, please give me a call or shoot an e-mail. I will be happy to provide you with information. We have a peer to peer program. If you have never performed a Road Safety Audit and want someone to walk you through the process, we can hook you up with a peer to help you perform a Road Safety Audit. So thanks for the opportunity to provide a general overview on RSA and I will pass the baton to Reg.

Thank you, Becky. This is Reg Souleyrette from the University of Kentucky. I'm going to talk about the comparison study that we did. I probably use the term, examination along the way because of the type of comparison that we did was really looking at the way that we in Kentucky applied these three different tools. Before I tell you about the road network that we applied the study on, I'll just say why we did this comparison in the first place. It was partly due to my familiarity and the state of Kentucky with all three of the methods. We were a usRAP pilot state and, as Peter mentioned, a pilot for the FHWA systemic process. We have had a long-standing safety circuit rider program that writes about six counties-worth a year of road safety audits. So it seems logical that Kentucky would be a place that you could do some type of assessment of different systemic approaches.

Initially, we intended just to compare the usRAP tools with the FHWA systemic and use the Road Safety Audit as more of a boots on the ground inspection. We felt having people in the field was probably the best way to get the actual information of what is out there and what can be applied. That said any of these methods and, in particular FHWA systemic and the Road Safety Audit methods, require good knowledge of the way that these tools and products need to be applied.

Just as a disclaimer, I knew much more about usRAP than I did about the other two approaches, having worked in the program for about 10 years. That said we had safety audit folks who have been doing this for quite a while. We did the assessment at the end of the pilot phase of the FHWA systemic tool and the final guidance has not come out at the time. We were using draft

guidance. Essentially it is the guidance that Peter was talking about. But I just wanted to say that before we begin.

Our comparison was done in five different counties. We had six initially but ended up working primarily in five counties. We used about 220 miles of county local roads in rolling terrain, primarily. The average section was 2.3 miles. In five years period of crash analysis, we had 12 fatalities, 17 major injury, and 56 minor injury crashes on the system of 219 miles, for an average of 14.6 ARD injury crashes per year. Our ADT range was fairly broad from 30-2,800 per day. Most of them were low-volume road, where the systemic process is most helpful at less than 400 vehicles per day. They were all rural two-lane highways.

This is a map of Central Kentucky. The city in the middle is Lexington and the university is located there. These counties that were selected were conveniently located so that we could get the field. Although these were the counties that were selected as a priority by the safety circuit rider for a Road Safety Audit program that year; so that is why we chose those counties. We knew the Road Safety Audits were coming in. The usRAP and FHWA extent of systems is essentially the same. There is a little bit more mileage on the systemic tool but for apples-to-apples comparison between the two we used the 212 miles that we did usRAP analysis on. We had a couple of sites that were within those 212 miles where the safety audits were conducted Again, we continue to use this as a field validation.

The data we used to apply to the usRAP application came about half from Google Street view and half of that from GPS enabled photographs that we took ourselves along the road. They were extracted for 40 different elements of roadside features and roadway features for about 20 minutes a mile. We used values for fatalities of 6,825,000 per serious injury and a discount rate of 4%. Our countermeasures service lives and costs were reviewed by the Kentucky transportation cabinet, the HSIP program. I would like to thank them for sponsoring this comparison. There was a minimum benefit-cost ratio of 5 to 1. We let that range from 5 to 1 to 10 to 1 to see what kind of a countermeasure program the usRAP tools would come up with.

This is results of the usRAP tool for a minimum benefit-cost ratio of five. For each line you will see a different countermeasure that is recommended for portions of the 212 mile system. You can see that shoulder paving is recommended on about 100 of the 200 miles. It has a program benefit-cost ratio of 10.5 to 1. The benefit-cost ratio in the right-hand column shows countermeasures ranged from everywhere from slightly above 5 to as much as 170 for benefit-cost ratio. We have a present value benefit of 20 years life span of approximately hundred million dollars providing a benefit-cost ratio of 11.6 to 1. We can let the benefit-cost ratio range from 5 to 10. As you can see as you increase the minimum benefit-cost ratio you have a smaller program with a higher benefit-cost ratio. So by doing this you can select a program that fits your financial budget; the budget with the programs range from $2.6 million to $9.2 million. If you have less than $2.6 you can simply continue to increase the minimum benefit-cost ratio to get that down to your budget.

The FHWA systemic tool application, this was applied by the Kentucky Transportation Center staff with the direction of the Kentucky Transportation Cabinet. Run-off-the-road crashes were the most prevalent type of crash, as you could expect. Over 67% of them were occurring on

horizontal curves. Kentucky has a lot of curves. 61% of run-off-road crashes were on curves and 39% severe run-off-road crashes were on curves. Obviously a target crash type is run-off-road with particular emphasis on horizontal curves. The risk factors that were selected included horizontal curves between 500 and 1200 feet radius, lane width less than 10.5 feet, should type not paved, shoulder width less than 6 feet, speed limit greater than 30 miles an hour. Equal weight was given to all risk factors in our application. This is not necessary in the systemic tool. You can weight however you want to weight, but there is no specific guidance in terms of how you should weight with each factor. Priorities were based on the number of risk factors identified. So the worst that a section could score would be for the five different risk factors – having all five risk factors that you see on this page. The results of that risk rating for the FHWA systemic tool where a higher number score is a riskier road, ranging from 2 to 5. You can see the sum of miles, the VMT and the count of the segments that were included in the countermeasure program.

To apply the Road Safety Audit we had 22 road segments of 74 miles. The RSA team included a multidisciplinary team, as Becky mentioned, including our safety circuit rider who was an engineer, a county judge executive – an elected decision or administrator people that can make things happen in the counties of Kentucky, a county road supervisor or foreman, traffic coordinator, HSIP coordinator, local law enforcement and we had fire and rescue present at some of the RSAs. 15 countermeasures were selected by the RSA teams across the 22 roadway segments. Five of the 15 countermeasures were also among those that were recommended by the usRAP study as indicated with the stars.

Comparing the results, as we applied it in Kentucky, the usRAP tool and the FHWA systemic tool both highlighted the need for curve improvements. There was no statistically significant correlation between the usRAP countermeasure program and the FHWA systemic program, however. And that, we believe, is primarily due to the fact that we did not choose ADT to be a factor in application of the Federal Highway systemic tool; and so you can see, the results of the systemic tool presented in the table.

This is the last of the slide that I have to show. This is just a general comparison between the usRAP star ratings in the FHWA systemic tool. The matrix shows on the left the usRAP star rating system operating with the highest risk on top and lowest on the bottom and the same kind of thing across the columns for the systemic tool. What you see in green are the rows of the matrix, where you have the most commonality between recommendations. We have about 31 segments where the tools say about the same thing. The further you get away from that diagonal, the more the two methods disagree in terms of the way that we applied it in Kentucky. With that I would like to turn it back over to Doug for some comments on the examination.

Thank you very much. Examination means more assessment. It does not mean a test. So I will assure you that these are just some of the conclusions of the comparison of the overall thoughts about the tools.

In terms of the key features of the usRAP tools, the software provides more comprehensive results of the other countermeasure selection options. We were pleased with the results. I will say this is the first time we had ever applied the tools to a road network with traffic volumes as low

as we had, many of them under 400 vehicles per day. We were pleased with the results and had some safety improvement recommendations even for roads and relatively sparse data. This software is quantitative and based on cost-benefit analysis. They consider the risk for all crash types. You heard the FHWA systemic tool focusing on particular crash types, the predominant crash types. That is good because those types are probably where the most need is. The usRAP tool has the advantage of looking at all crash types; detailed site-specific is not required and the software explicitly considers the risk to motorcycles, pedestrians, and bicyclists, as well as vehicle occupants.

Key limitations are, the usRAP tool requires the most data of any of the three methods considered. You do have to assemble a database of these 40 input attributes. It does not require as much data as part C of the Highway Safety Manual, but it requires a coding of the database that will take you 20 or 30 minutes per mile. The coded data require a trained coding team or a good existing database as a source of those data in order to have accurate data. We have gained a fair amount of experience in how to train coding teams to do this. Basically the coding teams have usually been students, typically undergraduate or graduate students at a university. We know they can be trained and so there is a need for some training in order to get the right data to use the usRAP tools.

With the FHWA systemic tool examination, in terms of the key features, the data requirements are less than for the other measure selections, which is certainly an advantage. It can be done with less data and does not involve the coding of roadway data the way the usRAP does. Although in some applications of the systemic tool, for example in Minnesota, they coded up data on all of curves for all County roads in the state, which is certainly a data intensive effort. The FHWA systemic tool is very flexible. You can make it as data intensive as you want or less data intensive if you want. The target crash types and risk factors that are used in the systemic tool are flexible and data-driven. They are based on a network level crash data review. The FHWA systemic tool is more focused. If you identify horizontal curves is an issue, you can just apply the tool to horizontal curve type of crashes and will get results for just that. Detailed site-specific crash data is not required; having it can be valuable but it is not required.

Some limitations of the FHWA tool: First of all, it does require the user to identify potential risk factors. If this is done well, you can get very, very good results from this. If it is not done well, you will get some poor results. Kentucky learned this from their experience with this. For example, they had not identified ADT as an important risk factor. Doing it without that risk factor included meant that some of the highest priority sites they got were on the lowest volume. Some experience with this approach is important to getting the right risk factors and applying the method properly. If you apply the method properly, you can get very good results. Generally, the systemic tool focuses on specific selected crash types. That can be an advantage if those crash types selected are usually the highest priorities. But there may be opportunities for other crash types that don't get examined. Some of the key elements of the method are optional rather than required. FHWA has gone out of their way to make it flexible and not have a whole lot of requirements. For the usRAP tool says there are all these data you have to code these to get the answers. The FHWA tool is more flexible in trying to use the data that is available. There are potential risks that are important to recognize. It is important to consider traffic volume as a risk factor or you may get some perverse results where you have lowest benefit projects come out on

top. The weighting of the risk factors of some data requires thought and experience. Kentucky weighted each risk factor equally. That may work perfectly well as long as you are sure you have the right risk factors. Another thing that could be included in the FHWA systemic approach tool, and it is in the guidelines, is some kind of cost-benefit analysis approach. If you carry the examination that far, it could produce results similar to what usRAP produces. usRAP does that that automatically. It is an option in the FHWA approach and it is an option that Kentucky chose not to pursue, but it might have strengthened the results.

In terms of Road Safety Audit key features and a great advantage is they are conducted by expert staff. You assemble an interdisciplinary team and that team goes to the field. The other methods we have been talking about are typically based on photo and data reviews. Since RSAs involve a field data element that is a great strength. Also the full crash history is reviewed for each site, so anything that can be derived from that crash history can be taken advantage of.

In terms of limitations, the RSA required the most effort of any of the methods that we looked at. Since multiple team members review each site both in the field and in the office, you get what you pay for. Bringing these experts together to look at this involves the highest effort of the three methods that we looked at. They clearly require staff familiar with the RSA process. You can have a team that has some newbies on it but you also need some people who have done it before to guide people through the process. Detailed site-specific crash data are generally used in the review and the RSA. Other methods could be used without detailed site-specific crash data, but that is generally part of a RSA. The process is generally qualitative rather than quantitative and there is a risk of it becoming standards based rather than risk-based. Risk-based methods can be used in an RSA, but we found in the Kentucky experience was that the RSAs were best at identifying features that were either in poor conditions or missing. But since they did not involve a benefit-cost or cost effectiveness analysis, they really did not probe into what improvements could be cost effective that are not part of the current roadway. Again, the FHWA guidelines suggest that is a valuable thing to do as part of a RSA. It did not get applied to the Kentucky study. There are some overall lessons about the flexibility of these processes. Ultimately some kind of formal benefit-cost analysis is useful in the end to make sure you're getting the most out of any of these methods.

So overall, the limitations of what we did in this examination. First of all, it was limited to rural County roads in Kentucky. That is just one particular type of road and we were looking at low-volume roads. The list of sites used for the usRAP tool and the FHWA systemic tools were nearly identical - 88 sites in common out of 92. But the RSAs only addressed a subset of those sites because that is where RSAs were done. The analysis with the FHWA systemic safety tool focused just on horizontal curves and horizontal curve crashes, while the usRAP and RSA approaches were broader in scope. This comparison as we've described it was focused on each tool as it was applied in Kentucky. Some limitations of the FHWA systemic tool and the RSAs were noted. They could be addressed by broadening the study scope in ways that are suggested in the published documentation for these methods but were not implemented in Kentucky. For example, in hindsight, the FHWA systemic tool could have included ADT as a risk factor and looked at broader issues other than just horizontal curves. Both the FHWA systemic tool and RSAs could have included a benefit-cost analysis component. Those may be lessons learned in

hindsight, but each of the approaches gained valuable insight about the selection of countermeasures for these locations.

To recap, the usRAP tools using predictive models based on road and traffic data and can give you a benefit-cost based improvement program without the need for site-specific crash database. The FHWA systemic tool uses crash data to identify overall problems or target crash types and then uses roadway data to score the roadway to identify locations that are candidates for improvement to address those crash sites. The RSAs review site-specific crash patterns but do not formally assess risk. They include a review of the crash sites by experts in a range of discipline that brings valuable expertise to the review of specific sites.

In conclusion, we found that the usRAP tools were the most quantitative and comprehensive method. Several countermeasures with benefit-cost ratios above 10 were identified. The recommended countermeasures that were identified with the usRAP tool software could reduce network-wide crashes up to 30%, which would be an important benefit. The FHWA systemic safety tool was the most flexible tool. It can perform well if users have the expertise to exercise it properly and to select the right risk factors for consideration in a given study. There may be some more specific guidance needed for novice users to determine that there are not problems like choosing not to consider ADT as a risk factor. The Road Safety Audit put expert boots on the ground and are very valuable. They certainly can be expensive if applied systemically but the fact that they involve a field review is an important strength. We found they are good at identifying safety-related features of things that are missing or poor condition at the site. They may miss the potential for cost effective improvements unless there is a risk-based approach and a cost effective analysis is incorporated.

With that, I will like to turn it back over to the moderator for the question and answer session.

Certainly, if you would like to ask a question, please press star and then zero on a touchtone phone. An operator will take your name and further instruct you. If you're using a speakerphone, pick up the handset. If you have a question, press star zero at this time.

We have gone through quite a bit in a short time so we will take a few minutes to answer any questions that you have. Please feel free to type any questions that you have or call in.

At the same time, we have a final poll question at the bottom of the screen. Here is your opportunity to help us gauge what topics or subjects you would be interested in for future technical assistance webinars.

No further questions on the phone at this time.

Hi, this is Peter Eun. There was a slide with regard to Karen Scurry. She is the program manager for the FHWA systemic safety approach. She had to be in Washington this week and was unable to present the approach but she is the program manager so I just wanted to say that there is a slide with her contact information.

And the file share pod, we have uploaded a version of today's slides and the contact information for the presenters and program managers are available.

I see a couple of questions coming in. We'll wait for those to show.

A question from James Pol: I understand that the data to run usRAP can be coded in 20 minutes per mile. Are there techniques being developed to pull information more quickly? Reg or Doug, do either one of you want to tackle that?

This is Doug. I would be happy to tackle that. Yes. The manual approach takes about 20 minutes per mile. We have certainly been looking for ways to automate that. One of the ways we have found effective is if highway agency has an existing database, we can pull as much data as possible out of the database so it doesn't have to be coded. That can reduce the coding effort. So it may be necessary to only code the data that is not available in a highway agency existing database. In the long run as I alluded to in the presentation, there are strides being made right now on mobile mapping using lidar techniques and also recording other video data in the field. In the long run it may be possible to automate the data collection of much, if not all, of the data needed. That is at the development stage but in five or 10 years that technology will have advanced so there is much more efficient ways to get the data for usRAP.

I hope that answered your question. We have another question that came in. What type of file can be transferred to usRAP?

The data are uploaded to usRAP in the form of an Excel spreadsheet. You assemble your input data in an excel spreadsheet where basically the columns are the road attributes and the rows are section of road that are 100 m or 300 feet long. And then you just save the file as a CSV file, which Microsoft can save any file to a CSV file and you upload that. It is a simple data transfer from Microsoft Excel. Data from any kind of highway agency database can be managed; reduced and put it to a format for uploading so data from a formal database of some sort can be formatted for use with usRAP.

The is Reg. Also if you have information in GIS format, it is particularly conducive to this, and fast. We use it to segment the road network for the initial processing and we have some spreadsheet tools that automatically interact with Google street view and state DOT video logs to pull the information in.

While we are waiting for more questions, I wanted to point out for this last question, we are getting your votes on future subjects, please feel free to put in your suggestions for other topics as well for those who picked "other."

Another question: What is the approximate learning curve to use usRAP?

This is Doug. We have conducted training in the past to train users. In late 2012, a little over a year ago, we had a training session that 18 people attended. That was a day and a half training session. They went away understanding how to do it and it was essentially train the trainer session. At least some of those people are now carrying on usRAP projects and getting data

coded by their staffs. I would say a day and a half for the formal training then certainly the first project anyone undertakes is a learning process. The usRAP team is happy to coach people through that process and help them take advantage of the tool.

We have another question from James Pol: What potential impact could detailed asset management programs pursued in states to help in RSAs?

This is Becky. Maybe James, if you could give me little bit more detail. I'm thinking the more information you have on your roadway system, the better informed decisions you're going to be able to make in selecting which sites you want to pursue for a RSA.

We will give one or two more minutes for questions. What can you say about the history of usRAP is of a proprietary product and where is this use most?

This is Doug. I would be glad to answer that. The usRAP began in 2004; and was patterned after the program in Europe, called EuroRAP, European road assessment program and the Australian road assessment program. Those programs together founded a current organization called the International Road Assessment Program (iRAP) that has been working all over the world; particularly applying this same kind of tool in developing countries. The current usRAP software was developed by an international team under the auspices of iRAP. It is a proprietary product but we are more than willing to have it used and used for free without charge by any highway agency, any public agency or the consultants working for any public agency. So while it is a proprietary product, it is also made available for free. No one has ever been charged to use this product.

Currently it is being used in a number of areas. There is a major study underway in Illinois where it is being applied to county roads in addition to what you heard about the Kentucky project. In Alabama a demonstration is underway for all of the data for all of one county's roads including facilities, everything from the collector level up. After they complete that one County, they're looking at taking it statewide. The Utah Department of Transportation is interested in using the usRAP concept as part of their safety management system statewide on state highways and potentially local facilities as well. So there is a lot of application underway around the country.

A couple of other questions came in: A question of how to get the software: can I get a contact name? And the other one is: can usRAP be applied to intersections?

The first question on usRAP: if you want to use usRAP, either Reg or I would be good contacts for getting in touch with. Both e-mail addresses are on the final slide and I assume before we get done, that the host will put that slide up to make sure that everyone has those e-mail addresses. Please feel free to contact us and we could talk more off-line.

In terms of usRAP be applied to intersections, the answer is yes. The data is coded by 100 meter or 300 foot sections of roads. If there is an intersection within a given section, the attributes of that intersection are coded and the safety improvement program considers countermeasures for that intersection. So, very definitely intersections are considered.

I see one more question. Should I just go ahead? From Arizona DOT- Is there any technical support on usRAP if any agency starts a demonstration project? The answer is basically yes. There has been in past years and while there is a little bit of a hiatus at the moment in the funding, we are still providing technical support as volunteers. We hope to have a funded technical support program under way very soon. So, the answer is, if you are interested in using usRAP, please get in touch with us and we will try to work out the details of how to get you the support that you need.

In the meantime, James, have you been able to dial in? If no further questions I will hand this over to Bob for some closing remarks.

Thank you, Sharon. And I want to thank our presenters today. Becky, Peter, Doug and Reg, I think you did an excellent job and I would like to thank our audience for time and attention. We hope you were able to get a benefit out of today's presentation.

Just a few quick reminders, this webinar was presented as part of a Data and Analysis Technical Assistance Program. If you need specialized customized assistance for any type of data or analysis problem, please contact us at the website-the web address on the screen right now. We also have a listing of where this webinar will be posted. Not sure how quickly it be up but it will fairly soon.

A reminder, a save the date for you, the next technical webinar that we present will be state and local agency data integration experiences. That particular webinar will likely take place September 18th this year. It will be approximately the same starting time and about the same duration so if you want to mark your calendars, that will be the next technical webinar and again. Just to wrap up my thanks to the presenters and to especially the audience for your great participation this afternoon. I think we can wrap it up.

This is Doug. Before you wrap up, could you put up the slide that has the e-mail addresses of the presenters? Thank you very much.

Thanks to all of those who submitted questions and feel free to e-mail any of us. In the file share pod, you can access a PDF version of today's slides as well as an application for the systemic peer exchange. Thank you.

Thanks everybody.

That concludes the conference for today. Thank you for your participation and for using AT&T executive teleconference service. You may disconnect.

[Event concluded]

Q&A Questions:

James Pol: I understand that the data to run usRAP can be coded in 20 minutes per mile. Are there techniques being developed to pull information more quickly?

Norah Ocel - FHWA EFLHD: What type of file can be transferred to usRAP?

Norah Ocel - FHWA EFLHD: What is the approximate learning curve to use usRAP?

James Pol: What potential impact could detail asset management programs pursued in states to help in RSAs?

D Egal: What can you say about the history of usRAP? Is it a proprietary product and where (agencies) is this used most?

Norah Ocel - FHWA EFLHD: How do I get the software? And can I get a contact name?

MassDOT: Can usRAP be applied to intersections?

AZDOT - K Kar: Is there any technical support on usRAP if any agency starts a demonstration project?