Transit Module 6 – Traveler Information Part 1 of 2

Mac Lister: ITS Standards can facilitate the deployment of interoperable ITS systems, and make it easier to develop and deploy regionally integrated transportation systems. However, these benefits can only be realized if you know how to write them into your specifications and test them. This module is one in a series that covers practical applications for promoting multimodalism and interoperability in acquiring and testing standards-based ITS transit systems for public transportation providers.

I am Mac Lister, Program Manager, Knowledge and Technology Transfer in the ITS Joint Program Office of the USDOT and I want to welcome you to our newly redesigned ITS Transit Standards Training Program of which this module is a part. We have worked closely with the Federal Transit Administration and the American Public Transportation Association to develop this material. We are also pleased to be working with our partner, the Institute of Transportation Engineers, to deliver this new approach to training that combines web-based modules with instructor interaction to bring the latest in ITS learning to busy professionals like you.

This combined approach allows interested professionals to schedule training at your convenience, without the need to travel. After you complete this training, we hope that you will tell colleagues and customers about the latest ITS standards and encourage them to take advantage of the archived version of these webinars.

ITS Transit Standards Training Program is one of the offerings of our updated Professional Capacity Building (PCB) Training Program specific to transit industry domain to promote the use of ITS Transit standards such as TCIP, Automated Fare Collection, and Transit , to name a few. Through the PCB program we prepare professionals to adopt proven and emerging ITS technologies that will make surface public transportation systems safer, smarter, and greener, which improves the livability for us all. This series of online courses based on ITS Transit standards is in addition to a 35-module series available for free on ITS Standards for practitioners in state and local highway agencies and transit agencies. You can find information on additional modules and training programs on the USDOT website at www.pcb.its.dot.gov.

Please help us to continue to make improvements to our training modules through the evaluation process. We look forward to hearing your comments. Thank you again for participating and we hope you find this module helpful.

Jeffrey Spencer: ITS Transit Standards help simplify the complexities, overcome procurement challenges, and reduce costs of acquiring ITS systems. I would like to use a simple example to explain how this approach to ITS Transit Standards is analogous to our day-to-day life. Imagine that when buying a computer—and you want to buy an upgrade, a printer, or anything else—that you must always buy that same brand at an exorbitant price. Of course, this is not the case because standards have been successfully implemented to allow interoperability. Similarly, transit standards have been developed by transit professionals like you at a national level to encourage competition and limit costs within our industry.

I am Jeffrey Spencer, ITS Team Leader in the Office of Research, Demonstration, and Innovation of FTA within the USDOT and I would also like to welcome you to this ITS Transit Standards training. FTA actively supports the development and implementation of transit standards and we hope that you find this series of online courses a useful tool in promoting standardization. We look forward to your participation and input.

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Carol Schweiger: I'd like to welcome everyone today to the ITS Transit Standards Professional Capacity Building Program Module 6, which is Traveler Information Part 1 of 3. And for a couple of housekeeping items at the very beginning of this module, whenever you see this slide that says activity on it. It indicates that there's a pop up quiz for you to take and I will be reading the questions to you so that you know what selection to consider.

And my name is Carol Schweiger. I'm the president of Schweiger Consulting, LLC. Just very brief background, I have 35 years of experience in transit consulting, most of which has been in the area of ITS or intelligent transportation systems for public transport. And I've been doing a variety of training over the years like this particular module related to transit ITS and transit ITS standards.

So without further ado, let's get into the module and begin by talking about who the target audience is for this particular module. And this will lead us into a very, very brief discussion of the curriculum tab so that you understand what other courses are available that might make sense for you to take after this one in particular. So the audience here you can see that there are five bullets and five types of individuals that are targeted with this particular module. One is management staff. So that would be folks like heads of departments or senior management who are involved in decision-making. They may be considering deploying a traveler information system to meet customer needs. Then we have transit agency procurement and grant staff who should have a very basic understanding of what traveler information is and what some of the standards are because they may run into that in the procurement document. Transit information technology staff and third party content providers obviously need to understand what standards will be suggested to be used during the development and deployment of these kinds of systems as well as the vendors and consultants. They also need to have a basic understanding. And in this particular module we're also looking at transportation management center or transportation operation center staff who could really benefit from knowing how to categorize transit traveler information they may be disseminating some of the information that's related to public transportation in the region. So if you look at this particular chart we've focused on three of the positions I've just talked about decision makers, project manager, and project engineer. And you can see that for the decision maker which is suggesting modules 1 through 3, which are introductory modules for the project manager who will be leading the project overall we're recommending modules 1 through 5 as a prerequisite which are introductory modules. And one module that's in a little more depth, which is module 5 and the same for the project engineer as well.

What we're recommending for prior knowledge to this particular module is some information that's provided in the Professional Capacity Building Programs ITS ePrimer module 7, which is exclusively related to public transportation technology. And we're also

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suggesting that if there is an opportunity you might want to take the National Transit Institute Course—it's called an ITS workshop and it gives you an overview of transit technology. So just briefly talking about the curriculum path for, again, the three stated positions. The decision maker you can see in green, the boxes in green are the recommended prerequisite modules and that's 1 through 3, which we mentioned. And then the module that we're on now is highlighted in red and that's obviously an optional module. And two other optional modules that we suggest are electronic fare payment systems which is module 10 and a module related to connected vehicles which is module 11. For the project manager, we're recommending a few more modules as prerequisites as I mentioned in the earlier slides. Those are, again, in green with modules in blue are optional. So optionally we're looking at the project manager taking part 2 of 2 for the extension of this module, as well as the arterial management and transit signal priority module 8 we're recommending as a pre-work requisite. And then taking the extension of that which is module 9. Same for the project engineer. Actually, we're recommending that those two modules 8 and 9 are taken as well as module 7, which is the extension of this one.

So let's jump right into the material, the course material where we're quickly reviewing. We have five learning objectives. And the first is describing how traveler information systems fit into the National ITS Architecture, which sets the stage for understanding the core functions and taxonomy for traveler information which is learning objective 2. Then getting into another level of depth in looking at functionality within those categories of traveler information. And then we begin to explain the standards that can be used to specify different traveler information functions and functional requirements in the procurements. And then we do a very brief review of the role of standards within procurement.

So let's go right into learning objective 1. Learning objective 1 covers very basic information about the National ITS Architecture. And it talks about a specific service package which is called transit traveler information, which sort of highlights most of the categories we are going to discuss in learning objective 1. And then we talk about related service packages, related traveler information service packages. So getting started, traveler information systems cover what we call customer facing technologies that provide the public with information about trip planning, so how do I get from point A to point B and some real time information to go along with that. When is the next vehicle going to arrive at a particular stop? That information is generated by on-board and central systems. We'll talk about that very briefly. Those systems are typically used to monitor and manage operations but they generate the information that makes up traveler information. So we can use a variety of dissemination media to get that information out to the public. It could be electronic signage that's located at stops and stations. It could be information that's available on mobile devices like smartphones. It could be available on

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the Internet. It could be available by phone on 511 systems or interactive voice systems as well. And this information can be provided directly to the public or indirectly by making that underlying data that makes up our traveler information available to developers. And then we also have some other categories you can think about static data, which would be, for example, bus schedules and dynamic data which is real time information about when a vehicle is going to arrive at a stop. And then we can also define the information by where in the trip chain someone will seek that information. Is it before they make their trip? Is it while they're making their trip? And we already talked a little bit about the dissemination media.

The other thing that I want to mention very briefly is where the traveler information fits into the National ITS Architecture. In the architecture there are two technical layers of standards. One is the transportation layer and the other is the communications layer and both of those operate within the context of an institutional layer where everything is institutionally organizations are related to each other. The transportation layer happens to be the most relevant to what we're talking about today and what we're going to review. And the services packages are within that transportation layer as well. And then the role of ITS standards within the National Architecture will be reviewed. We have a slide that speaks to that as well. So briefly reviewing these layers I've already discussed the two technical layers—communications and transportation—and then working within the institutional layer. So the transportation layer is where transportation solutions are defined in terms of the subsystems that you need to have and the interfaces that those subsystems either have with each other or with outside systems. And then it also speaks to this underlying functionality and some of the data definitions that are required for each of these services to operate. So this, we mentioned, is most relevant to traveler information because it provides a nice framework for applying technology in a consistent and effective way. And one of the entities within this particular layer is the traveler, which is really the most important here because we're talking about how to get information to the traveler and what kinds of systems are we going to use to do that. There are a range of dissemination media and equipment that will be used and often involves equipment like personal computers, smartphones, and other kinds of equipment like equipment that will be related at the wayside. So keep in the back of your mind that transportation layer.

So now let's talk a little bit about one of the service packages that relates directly to transit traveler information. And, I guess, I just want to make a side note here that when I use the term traveler that's anyone who is traveling. It's very general. But we also use the term transit traveler or transit users and that's a little more specific and that indicates a traveler who has already made the choice of using transit for their trip. So in this transit traveler information service package we have four elements. We have pre-trip systems that are used for the traveler to decide how they're going to make their trip. Then we have some information that's provided on-board as well as at the wayside. And then we also

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have third party applications and some information provided by social media that will also help the traveler.

So if we want to look at this in kind of a flow chart format you can see in this particular diagram that we have five boxes. The center box for the transit management center is connected to and exchanging data with four other entities that are the four other boxes that are shown here in purple. And so those other entities are personal information access where you might be using some kind of a device to access traveler information. The transit vehicle, which is actually generating some of the information, the information service provider who may be a third party providing some of this information to the public, and then remote traveler or support, which could also be an entity that's providing information remotely outside of the transit agency.

We also have four other entities that are outside of the architecture and they're in the sort of yellow ovals you can see. One is called other ISP, which might be another information service provider outside of the transit authority. We have travelers, again, sort of the general traveler. We have media who will be accessing information. And then other transit management which could be like a traffic management center.

So the other thing I want to mention is there's a larger version of this particular chart in the student supplement material. So you'll be able to look at that. Also the lines with the arrows indicates specific transit traveler information as being exchanged.

The next chart shows that there are architecture flows which are actually those lines with the arrows from box to box that show that there's information being exchanged between one part of the architecture and another. When you see that flow, of what we call an architecture flow and you happen to be on the website that describes the architecture and describes this particular service package you can click on that exchange and it will bring up a list of potential standards. So here, you can see if I look at an information service provider and the fact that it's exchanging information with another ISP I can click on that little blue box that says standards and it will bring up a list of standards for you to consider as you're building your system.

So here we have our first activity, which is a question that states, "Which one of these components is not in the transit traveler information service package?" So that's the package that we just spoke about. And the answer choices to that question are: a) on-board systems, b) wayside systems, c) dynamic ride sharing, and d) pre-trip systems. So which one of these components is not in the transit traveler information service package? Let's now review the answers to this question. So the correct answer is dynamic ride

sharing. Now, while dynamic ride sharing is an actual service package itself within the architecture, it's not within the transit traveler information service package. Answer a is incorrect because on-board systems are actually included in this service package. Wayside systems are actually included in this service package. And pre-trip systems are also included in this particular service package.

Let's now talk about, again, the transit traveler information service package. So another question that we have is when you're looking at that service package within the National Architecture website you can click on the architecture flow and it will show you the standards associated with that data exchange. Is that statement true or false? Now, let's take a look at the correct answer is true. You can use the information flow view and then click on that little box that says standards to determine which standards are associated with those particular service packages. We just reviewed that.

Okay. Let's very briefly talk about the other traveler information related service packages. So we have one that's called broadcast traveler information. And here is a variety of different information about traffic conditions, advisories, some general information about tolling and parking. This information can be provided directly to the traveler or provided to, for example, an information service provider so they can better inform their customers about travel conditions. And then we have interactive traveler information. That provides some tailored information based on a specific request that a traveler might make. There you can push information to people who have maybe registered for a service where they only want to get information about what's happening on Route 135 or something along those lines. Then we have ISP data trip planning and route guidance. And here a variety of devices might be used by the traveler to access this information prior to making a trip like if they're doing a trip planning. It could be a personal computer or a smartphone or something like that. And this particular service package allows value added resellers to collect information that could be aggregated and then made available to travelers. Then we have transportation operation data sharing which is making real time operations information available to other transportation systems operators like traffic management center or something along those lines. This is often done at the regional level, so keep some regional information flowing to operators of these centers.

So the next four are the first one here travel services information reservations. This service package provides the ability for someone to access information while they were en-route and also make reservation coming up. So it's a more broadly traveler-based service package. We have dynamic ridesharing, which allows you to use some ride matching services while you're traveling or before you actually travel. In-vehicle signing gives you within a vehicle, information about regulatory or warning signs that are coming up as you're making your trip. And then short-range communications travel information is

actually a lot of the information that will be provided in the connected vehicle environment where you may be approaching a piece of infrastructure and that will be communicating with the vehicle that you're in as you're making your trip.

Then we have three more, a wide area alert, which alerts the public in emergency situations. An early warning system, which actually monitors and detects potential emergency situations like a disaster, hurricane, an earthquake, something along those lines. And then disaster traveler information, which may give you information about evacuation or recovery after a disaster has taken place. So those are all traveler information packages, service packages, within the architecture.

So here is our very brief discussion about the purpose of standards within an architecture. Standards really facilitate the deployment of interoperable systems at the local level, at the regional level, and potentially at the national level without impeding technology advances. So the standards don't describe the technology. You can use different technologies with the standards as they evolve. So it's not technology prescriptive, and here you can see how the standards work within the local, regional, and the national environment.

So that wraps up learning objective 1. And learning objective one we talked about the transportation layer and how important that is when speaking about traveler information. We've talked about the four elements of the transit traveler information service package. And we talked about the eleven other traveler information related service packages.

So let's move into learning objective 2 which describes the taxonomy that we're going to use from now on in speaking about traveler information and traveler information systems. So we have four major categories of systems, pre-trip, on-board, wayside, and then third party applications and social media. These are all things that I've already mentioned as we've started the module but I'm now going to define each of them and frame them for you so as we go along and we talk about them in even more detail you'll have a clearer understanding of specifically what they are.

So the first is pre-trip traveler information. Generally, there are two types of pre-trip traveler information. One is proactive, that's information that's provided regardless of what the user really needs. It's information that's available to everyone and you haven't asked for a specific type of information. So it's generally broadcast. Interactive information is the other type and that's where you've requested very specific information and it has an interactive element. Pre-trip information can be provided at several different locations which we'll talk about in an upcoming slide. It can also consist of static

information, you know, what is the fare generally if you're going to ride transit. And also dynamic information which is possibly when the next vehicle is going to arrive.

So here's an example of pre-trip traveler information which would be building an itinerary on the Internet. This is an example from the Massachusetts Bay Transportation Authorities website, which allows you to generate an itinerary. You're going from point A, which will start on this diagram to point B, which is the end point. And here we're going from a subway station called the Oak Grove Station, which is on the orange line in the greater Boston area, to a specific location in Boston. And you can see here that the example gives you an itinerary which is in the lower left. It gives you a couple of options for itinerary. And then you can click on that to obtain the detail about that specific itinerary. If gives you a narrative of how to travel. Also, there are some other locations where you can obtain pre-trip information. On a mobile device, like a smartphone, and on fixed devices that might be rotated in an office building, for example. Or you may be near a transit stop and you still haven't decided how to make your trip. This particular sign is one that's located at a major transfer facility in Worcester, Massachusetts. And it shows from that particular location what the services are that are being provided and when are those vehicles on those routes actually going to arrive at that stop.

So types of pre-trip traveler information, I'm not going to read the list here for you, but we have a variety of static information. We can make transfers, all kinds of facilities are available at different stops. And then dynamic information, which will be how long are you going to wait for the next vehicle? What are some weather conditions? Are there some advisories that you need to be concerned about?

One other very important part particularly of pre-trip information is we talk about the impact of providing that information—that has a pretty significant impact. Pre-trip, someone hasn't decided yet if they're going to make their trip and how they're going to make their trip. So the impact on providing that information is whether or not a trip is actually taken. Also, what time that trip is taken. For example, if someone is not commuting and you're flexible on when they can make their trip then there's going to be an impact on maybe when they will take their trip. Also what mode are they going to use? Will they use public transportation? Will they take a private service like Uber? Will they look at dynamic ride sharing, for example? And then what route are they going to take if they do take transit, what route if several are available which routes will they decide to take?

Now, finally, I want to introduce a matrix to you that shows the relationships between different travel characteristics and the different dissemination media. So if you look at the top of those slides we say when and where the information would be provided. Then we

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say what type of information is being provided and how is that information being provided? And then down the left-hand side, the rows indicate the basic dissemination media that could be used to provide the information at those locations for specific type of information and how. So in this matrix, we're specifically looking at information highlighted in yellow is the media and when and where the information is going to be provided in addition to what information and how the information is going to be provided. So this gives you a very rich set of characteristics of that pre-trip information. And there is a version of this that you can look at for a longer period of time in the student supplement information.

So now we have our first activity that specifically addresses pre-trip traveler information. And so our question is "In which location is pre-trip traveler information not provided?" So the answer choices are: a) via a mobile device, b) on devices and dedicated locations, c) on devices at transit stops and stations, and d) on-board vehicles. So at which location is pre-trip traveler information not provided? So now let's review the answers. The correct answer is d. Pre-trip traveler information is not provided on-board vehicles primarily because you've already made your choice to take a transit so you're already on-board and it's no longer pre-trip. So that's primarily why you change the stage of your trip at that point. A is incorrect. Pre-trip traveler information is provided via a mobile device. B is also incorrect because you can use devices at dedicated locations, as I mentioned, on one of those slides. And also pre-trip information can be provided at a stop or a station before you actually commit to taking transit.

So now we're going to move on to on-board traveler information, which is our second category and here, static and real time information can be provided on-board a vehicle. So the types of information here are general annunciation and display of what stops are coming up as you're taking your trip. There might be some information on when your vehicle that you're sitting on is scheduled to arrive at an upcoming stop, maybe a major transfer facility. And then other information of interest like interest to transit users where it might be general information about if you get off at this stop, here are services that are available at that stop could also involve advertising or something along those lines. So you can see here the types of static and dynamic information that are provided for you.

So here we have a similar matrix but, again, this shows a relationship between the travel characteristics and the dissemination media. And the yellow highlights show the on-board traveler information so we get a sense of that. And a version of this matrix is also provided for you in the student supplement.

Let's move on to wayside traveler information. Here, the information that can be provided at the wayside are, again, static and dynamic. And if you think about it prior to the advent

of things like electronic signs there was always static information at the wayside. It might have just been a bus stop sign that said Route 5 stop here. Or it could have actually been a map of the route or the schedule. So we've always had static information but we now have dynamic information so there could be information about whether the escalators or elevators at upcoming stops are working, any kind of emergency information that will be real time, and information that you might provide during a special event that's happening during a very short period of time like a baseball game, or a marathon, or something along those lines. So here, again, is our matrix that we looked at before and you can see it highlighted the wayside information that can be provided both at the wayside and on mobile devices, as well, as you're taking you trip. And there is a copy of this in the student supplement for you.

Finally, let's see, we have an activity coming up, a pop up quiz, so let's look at that first, before we go to our fourth category. So "Which type of dissemination media is not used to provide traveler information at the wayside or en-route as they're making their trip?" So the answer choices are: a) dynamic message sign or what we're calling DMS, b) kiosk, c) television, and d) smartphone. So which of these dissemination media is not used to provide traveler information at the wayside? Okay. So now we're going to review the answers and the correct answer is C television because the television is not typically used at the wayside to provide traveler information. It can be used by, for example, a cable TV provider could provide information that's related to your trip on cable TV but that would not be located at the wayside. So to look at the other answer choices that are incorrect, a dynamic message sign or DMS can be used to provide traveler information at the wayside, as well as a kiosk, which could be used, as well as a smartphone, which could also be used at the wayside to provide information.

So now let's move to the fourth category of our traveler information taxonomy. And here this category really didn't exist about five or six years ago was when it started. And we're talking about third party applications and social media. And this is something that is very prominent now. Transit agencies are actually using third parties to develop applications that can, in some cases, provide real time information on mobile devices. And actually that's overwhelmingly the approach that's being used by transit agencies for a variety of reasons. There is a report that was written as part of the Transit Cooperative Research Program or TCRP, which is part of the Transportation Research Board. It was called Synthesis 91. And it describes in detail why transit agencies are using third party application developers to develop a lot of these applications. And you can see a list here, which I'm not going to read to you, of applications that are out there to provide travelers with up-to-date information for the transit authority. It saves the transit authority a fair amount of money to do it that way as long as the information, the underlying information that they are providing to the application developer is very accurate and correct. Also social media is now being used and there's actually another Synthesis report specifically

about the use of social media. There are a lot of questions that agencies typically have about how to use social media and this is Synthesis 99.

Here in our matrix that you're familiar with we show the use of third party applications and social media particularly on mobile devices and showing you the different types of information that will be provided.

So that wraps up learning objective 2 for us. And we talked about the various taxonomy categories, the four different categories that we have. And just some basic reminders; pre-trip traveler information has the potential to help the traveler determine whether or not they're going to take the trip and if they take it, what mode are they going to use, what route are they going to use? Dynamic message signs, they're one of many different dissemination media that can be used with a couple of examples of those. There are different types of information that can be provided on-board. We talked about giving you an idea of the upcoming stops, different services that are available at upcoming stops, that type of information, using a third party to develop applications and then using social media as well.

Okay. Let's move into learning objective 3 where we're diving one level deeper into the various categories of traveler information that we've already discussed. So here we'll be covering on-board automated voice announcements. It's also abbreviated AVA. Our en-route or wayside traveler information, a variety of publicly available information on 511 systems, and some other Internet based information. And then we'll go back and talk about third party applications and social media.

So our first deep dive is into automated voice announcements. And our automated voice announcements are really we defined already but what they do is they provide audio and visual announcements. So why do we have visual announcements so that if someone cannot hear, if they have a hearing impairment they can see the same information. So that's made to on-board riders and those waiting to board the vehicle. The way it works is each fixed-route vehicle is approaching a stop. As they're approaching a stop a digitally recorded announcement will be automatically made over a PA system, a public address system, and displayed on a sign inside the vehicle to let the passengers know about upcoming stops, major intersections, landmarks. This particular type of system also has the capability to make time based, location based or operator initiated announcement. So a time-based announcement might be "It's the end of the month, it's time for you to purchase your monthly pass for next month" or something like that. You can also have this system make exterior announcements of the current route that that vehicle is operating on and its final destination so that waiting passengers are aware of that. It can also include a relatively new function, which is an external announcement that announces

the people outside the vehicle that the vehicle is turning and that tends to help with incidents that have been happening where pedestrians have been hit by transit vehicles. So this alerts the pedestrian. One of the major reasons for the deployment of these systems is to comply with the applicable provisions of the Americans with Disabilities Act of 1990. So that's one of the major reasons why these systems have come into play.

So there's an example here. There's a photo of the interior of a transit vehicle, a bus that operates in the Worcester Regional Transit Authority. And so an example here is that they equip their fixed route fleet with automated voice announcements, on-board announcements. And as they were deploying them they had some issues that had to be worked out before the system was finally deployed to the public. A couple of these were they had a challenge where the length of the announcements were too long. The announcements were too long and what was happening was you'd pick up a passenger, you'd open the door, passenger would get on, the door would be closed and the announcement would still be being made at that stop. And that's just too long. So they had to shorten the announcements. They had to validate the trip patterns which is very typical. It's actually a requirement that you have to validate the trip patterns. The Worcester Regional Transit Authority used interns at a local university to conduct the validation so that gave the interns experience and it saved them a little bit of money. They also were concerned about the volume with which the announcements were made on board and that had to really address some concerns that were being made by both the drivers of the buses as well as the passengers. And then finally, there was an issue of translating the announcements into Spanish because there are some differences in Spanish dialects and they ended up not translating the announcements into Spanish.

So we have our first activity here in this particular learning objective, which is that we're asking the question "Can an on-board automated voice announcement system or AVA be used to comply, in part, with the Americans with Disabilities Act?" And the answer choices are: a) yes or b) no. So as we review the answers, the correct answer is a, which is an on-board automated voice announcement system can, indeed, be used to comply in part with the Americans with Disabilities Act. We talked a little bit about that two minutes ago. No is the incorrect answer.

Okay. Let's move into our deeper dive of en-route and wayside information. So the key point I want to make here is that the way the function works is we have some underlying systems that are generating information about how well the transit system is operating, specifically individual vehicles, and we'll actually get to look at this in a few slides down the road in a diagram. So that schedule adherence information is combined with other conditions, what's the speed of the vehicle? Is it en-route? Is it off route? And then there's an estimate of time of when that vehicle is going to arrive at the next set of stops that's made. So one thing to keep in mind is in today's world people who are traveling have a

very high expectation of receiving information as they're making their trip. In this kind of en-route or wayside information is really particularly important to people who are what we call "choice riders", where they could actually drive somewhere. They don't have to take transit but it might be easier to take transit or cheaper or more expedient. And so they're going to need information along the wayside to help them figure out how they're going to make their trip and what the travel time is and things like that. So this particular information is dependent on—we need to know the schedule and the route of the vehicle so that we can measure whether it's on schedule and en-route. We need a vehicle location system so that we know where the vehicle is. We need to know the information about how it's traveling. And we need data communication so we can communicate with the public. What's the other key piece of information we need to know? Where is the traveler along their trip? If we're talking about wayside, what are some wayside or en-route locations? What is the origin? You've decided you're going to take the trip on transit. What are some of those origins? It could be your home. It could be your office. It could be another location, a store or a medical facility, or something like that. Then between the origin and the first transit stop, as you're making your way to the first transit stop would be another part of the trip chain. Then you have at a bus stop a platform when you're physically in a station that would make a difference. And then you have on-board a vehicle, we've talked about that, at a park and ride location and between the first stop and your final destination you may be walking to your final destination or you may be taking another form of transportation. All of these are discussed in detail in another TCRP Synthesis report, which is Synthesis 104 that talks about making information at the wayside.

Okay. So we also have discussed already different dissemination media. This slide lists them. And the reason why I want you to look at these is each of these dissemination media has different standards associated with it. So you're going to have different standards identified for a dynamic message sign, versus, for example, an SMS or text message. So there will be different standards for those two types of dissemination media. So I want you to keep that in mind as we begin to talk about the actual standards which we will be doing shortly.

Here's an example of a dynamic message sign that was deployed by what is called Mobility Lab, which is actually now a company—it actually split off into a company that just provides these signs called TransitScreen. Mobility Lab still exists but they spun off that part of their business to TransitScreen. And it's a unique sign. It's a dynamic message sign that was provided back in 2012 in two local establishments. One was a coffee shop and the other was a bar to show patrons the real time information related to all the transit and bike share opportunities available at those locations. So if you are getting ready to leave the coffee shop and you needed to know how to get to your next location you know at one glance when the next vehicle was going to arrive. So we have

some bus services. We have some metro rail services. We have some local buses. And then we also have Capitol Bike Share in the upper right hand corner so that you know if there are any bikes available. And then a couple of other examples I wanted to show you were here are some examples of dynamic message signs. Upper left hand corner is Metrorail in Washington, DC. Next to that, to the right of that is a sign from Kansas City for the Max which is their bus rapid transit sign which says when is the next bus rapid transit vehicle arriving, as well as the schedule for those services. To the right of that, is a sign from TriMet, which is in Portland, Oregon, which shows an electronic dynamic message sign. Below that, in the lower right hand corner of the slide is another type of dynamic message sign, which is on the outside of a bus shelter in Chicago, which shows the route, the final destination, and when the vehicle is going to arrive. And then to the left of that or the lower left hand part of the slide is a dynamic message sign from Monterey Salinas Transit, which shows when the next bus on that route is going to arrive.

Now, I want to talk about some other services that can provide traveler information. There is a series of N11 systems that were designed by the Federal Communications Commission several years back or the FCC, three of them in particular. Five-one-one (511) provides traveler information around the country for state and local or regional agencies to tell the public what the traffic conditions are, give them transit information. Some of them actually provide both static and dynamic transit information but not all of them do. So that's 511. Three-one-one (311) is used to provide, typically, city/state information and for individuals living within those communities to report things like potholes and maybe street lights that are out or whatever. Then two-one-one (211) systems are local or regional—they're community based information and referral services. So when might you use 211 or 311. Some major cities have actually moved their transit information to 311 like San Francisco. In San Francisco you can access that information by both 311 and 511. Two-one-one (211) is also used in a variety of locations to provide social service or para transit information. These types of systems are dependent on open data so that they're utilizing information that's available to everyone to provide this traveler information. Another generally available system is on Google Transit. And with Google Transit it's providing some static information like about schedules and fares. And we're going to talk a little bit about this in more detail but it provides a point A to point B reference. So it can be used for local or regional trip planning. It provides information about origins and destinations, walking directions. A lot of people are very, very familiar with Google Maps. So at this stage of the game; at the beginning of 2015 there were over 800 cities that are covered by Google Transit, so very powerful. And I give you an example here of Google Transit which is, again, you put in a point A or an address and a point B like a point of interest here, one is going from an address to a point of interest. And Google Transit returns to you a variety of different itineraries with details. There's also something called Google Live Transit Updates, which is giving you Google information but it adds real time information about vehicle arrivals, about advisories, and things like that and so it provides these real time updates. And live

transit updates are available in a variety of cities, not everyone has this service but some cities do.

There's also the capability to use the general transit specification that's called the General Transit Feed Specification, which was originally developed by Google that actually describes static elements of the transit system like stop location, services around stops, fares, things along those lines. It was at one time called the Google Transit Feed Specification but it became generalized and it's called the General Transit Feed Specification or GTFS. And any other third party trip planning services can utilize GTFS as well as Google can. So it's being used by Bing Maps, which provides itineraries, MapQuest and something called HopStop, which provides detailed transit and walking directions particularly pedestrian navigation. So it provides this door to door walking, biking, transit, taxi, and car rental directions to residents and tourists. And it uses GTFS and it does also have real time information. And then there are other services. There's something in the Chicago region called goroo®, which allows you to plan a multimodal trip which may or may not include transit.

And then we are back to our discussion about other third party applications. And we already really covered this well, and, again, I would direct you to those two TCRP Synthesis Reports, Synthesis 91 and Synthesis 99 to obtain a little more detail about the use of this kind of dissemination of the traveler information. Here's an example for you of a smartphone based third party application. On the left is what looks like an iPhone and it's displaying an application that's called OneBusAway. OneBusAway is actually an open traveler information system that is based on open standards and it's part of this whole open standards and open data movement. And it was developed with the use of open data that's provided by agencies. So this gives you in real time this happens to be in the Seattle area. It gives you information about when the next vehicle is arriving at the closest stop to where you're standing. It's got a location based feature. And then the three boxes to the right of that are an example of an application in the Boston area that also uses open data and it says, "Where's my bus?" And it says based on my rotation here are the next times when the bus is going to arrive and it shows you that both in a kind of tabular format as well as a map format.

So I wanted to summarize for you the information dependency based on the kind of information we talked about already. So we've covered the five different systems or deep dive into the technology. One was our voice announcements and those were based on the AVL system and the route vehicle schedule data, which we have wayside information that is based on, again, the same thing, AVL and route to vehicle scheduled data. But we have two additional dependencies, the CAD system or computer aided dispatch and data communication technology. Then the dependency for on-board Internet access, which we really haven't covered because it's not specifically traveler information but that Internet

access if it's available is going to be based on some communication technology which we're going to talk about in the next learning objective. And then we have our 511 systems and Google Transit, and our third party application, all of those are dependent upon open data.

So now we have our next activity. We'll give you a little pop up quiz based on what we just talked about. So "En-route or wayside information is not dependent on which of these systems?" So our answer choices are: a) data communications technologies, b) open data, c) route and vehicle schedule data, and d) AVL data. So wayside information is not dependent on which of these? So now let's review the answer. The correct answer is b. En-route wayside is not typically dependent on open data, although it could be. We saw it in our example of that—what is now provided by transit screen. That information actually is based on open data, not typically considered in our taxonomy but could be. The other answer choices are incorrect because en-route and wayside information actually is absolutely dependent upon a) data communications, c) the route vehicle schedule of data, and d) the AVL data.

So to summarize our learning objective 3 we've covered quite a bit of information here with our deep dive into the various technologies and how they operate. And so we remember that standards are going to be different depending upon the types of traveler information. We talked about a functionality of the different kinds of technologies that are within the taxonomy. We talked about a little bit we started to touch on standards with the General Transit Feed Specification or GTFS and GTFS Real Time. And then we talked about the use of open data for third party smartphone applications for social media which may also use open data.

Okay. Let's move into learning objective 4. This is really where we start talking about some actual standards. And we'll give you a picture to keep in your mind about specifying standards at various points along the traveler information data exchange spectrum. So these are the topics that we're going to be covering linking our standards to the actual traveler information technology that we have. A little bit about communication network standards and considerations because you really need to understand that. Some discussion about where to locate the technology and the dissemination media and then just some examples about how you might specify the standard.

So let's talk about linking the resources. So we've already talked about the fact that these underlying systems, which we call transit management systems, or we talked about in some other modules two and five, they provide the raw data. Information is collected and then processed to provide real time. You have a server that you're using and you're going to be monitoring feedback. And then you're pushing some information to customers and

they're pulling some information. And all of this is based on user need. So let's look at it from a sort of schematic or flow chart basis. So on the left, we got our CAD/AVL systems. And what I put in this chart was various modes that an agency might operate. They only might operate one of these or for a very large agency they might operate all of these modes. All of those are generating information and collecting information about how the system is operating. All of that information gets reconciled with the way the system is supposed to operate. So that would be scheduling data, planning data, some information about the customers. All of that's reconciled and fed to another database or server that contains real time information. And then that is going to be monitored consistently so that we know people are using it and they have feedback. Is the information accurate? Are you providing me with the information I need? And then all of that information goes to our dissemination media on the right hand side. So that would be obtained by personal devices, or information service provider, or third party applications, or the transit agency application itself like an interactive voice response system where you can call and find out when the next vehicle is going to arrive at a particular stop. So that's what it looks like in a flow chart.

Let's talk just very briefly about communication network requirements because we need to be concerned about that when we're using a variety of dissemination media. So how do we connect the information with the dissemination media? We need some technology. We either need wired technology or wireless technology and that comes about with our communication network. You might have a situation where an agency will use a phone line to connect the information with a sign, for example, an electronic stop. Or they might use wireless means like a radio or a Wi-Fi or something like that to send the information from a central location to a sign. So there's different ways of doing it. And there are different ways depending on the specific type of dissemination media. So a communications network is divided into three basic components. One is the backbone and the backbone is capable of carrying any type of traffic or information to a particular location and so it can be wired or it can wireless. Then we have the distribution portion of the network, which provides the connection between the backbone, a series of nodes, and the devices in the field. So it could be something like fiber optic cable. And the distribution portion of that has some strands that take the information in the backbone and provide it to the dissemination media. And then we have the local portion which drops the information into the media itself. So those are the three components of communication. And within that we have some other technologies that you're going to be considering and I'm not going to read these all off to you but we have some technology options that are wired and wireless. We have some backbone technology options. We have some physical configurations that can be made. And then we have some distribution technologies that are also used. So you can see all of those on the chart.

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And now we have a little pop up quiz to talk about that a little bit. So "Which one of these is not a basic element of a typical communication network?" We've got four potential answers. Answer choice one is the backbone, B is local, C is regional, and D is distribution. So remember the components that we just talked about. So let's review the answers. The correct answer is regional. Regional is not a basic component of a communication network. However, the other three are. We talked about the backbone, which is A, that's a basic element. B is a basic element, local. And C, distribution is a basic element.

Now, we have a slide that speaks to how you determine where you place your dissemination media in the field and this comes directly from a Synthesis report. It's Synthesis 104 which I mentioned before. It talked about where to locate dissemination media to provide traveler information. And you can see that the most prevalent criteria for locating your dissemination would be based on the number of boardings at a particular stop or station and the availability of power at that station where you might place an electronic sign. And then the third most prevalent is the number of routes or lines that go buy that particular stop or station.

So we have another pop up quiz that specifically deals with that aspect of your criteria for dissemination media. So the question is "Which location criterion for dynamic message signs is the most prevalent among transit agencies?" So think back to that chart that I just showed you. You've got four potential answers. Answer A is safety considerations. Answer B is the availability of communications. Answer C is the number of transfers at stops or stations. And answer D is the boarding counts at stops or stations. So let's review the answers. The correct answer is boarding counts at stops and stations. That's the most prevalent. That's at the very top of the matrix I showed you. Answer A is incorrect. It happens to be the ninth most prevalent. B is also incorrect. It's the fourth most prevalent in the chart that I showed you. And C, the number of transfers is the fifth most prevalent location criteria. So I'm actually not going to really spend any time on this particular chart. I wanted to remind you the different dissemination media that we've talked about throughout the module so far. There is a person you can speak to which would be a customer service agent. We've got our electronic signs. And we've got all of the other media that we've spoken about for use.

I did want to show you an excerpt but it's an excerpt from a procurement specification that begins to give you the idea about how a standard or a de facto standard would be used in a specification. And here it talks about utilizing exporting data for use with Google Transit, the trip planner in Google Transit. And it states that there has to be an interface to Google Transit that uses what we talked about before GTFS. And there is a complete listing of this in the student supplement that gives you the whole listing of exactly how you would specify this. And also module seven speaks to that as well.

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Okay. So to summarize learning objective 4 what if we talk about different standards and formats can be used for traveler information systems and the data exchanges? We are talking about data exchanges among various transit system management elements, like I showed you in that traveler information chart that showed you were the information was generated and how it was processed until it got to the dissemination media moving from left to right. Between some of the databases and traveler information we got standards we are going to use and between the databases and the dissemination media. We talked a little bit about determining the network architecture and some of the options you have there for technology, the specific criteria. We talked about that as well as the dissemination media.

So this leads us to our last learning objective, which talks briefly about the role that standards play in travel information systems procurement and it kind of leads us back to some material that was covered in modules 1 and 2. And so some of it is going to be a little bit of a review, but I think it's going to be very worthwhile to kind of wrap up our discussion about traveler information.

So I wanted to give you a general list of traveler information standards. We will be presenting several of these in a lot of detail in module seven. But I wanted to give you an introduction to some of these. The ones that have asterisks next to them are typically European standards that you may or may not see here in the States. And I wanted you to be aware of them because some of them are used in the States but you may not hear about them as much. So DATEX II is the European standard to communicate and exchange traffic information among what the Europeans call traffic centers, which also include transit, actually. And to communicate between the services that are provided and some of the operators of traffic services and transit services and the media. So that's DATEX II. GTFS I mentioned already that was originally developed by Google but has become generalized and it contains static schedule information about stop locations, route geometries, stop times that are on the schedule. Then we have GTFS that's real time, which has the real time information about vehicle positions in real time, service advisories, and alerts any kinds of delays, things like that. The identification of fixed objects in public transport. You can see it's a European standard. It's primarily used to talk about fixed objects kind of like GTFS that are related to public transport. So it might be about stop locations, what kind of services are around the stop, where can you transfer? Where are station entrances and things like that. You don't see this used in the U.S. very much. Then moving to the next column, ITIS or the International Traveler Information System Standard that is actually a Society of Automotive Engineers Standard called J-2540. And that is a way of providing other types of traveler information that are in depth. It has lookup tables and it's sort of effectively transmits some information that the traveler would want to know about. And then we have NTCIP or National Transportation Communications for ITS Protocol, which includes TCIP, which is a Transit

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Communications Interface Profile which is—there are two modules describing that in detail that are often used for transit management and used in some ways for traveler information. There were two modules that are modules 3 and 4 of this particular course material about TCIP. But the more general NTCIP that's a family of standards that define a functional control and communication profiles for electronic control equipment that's exchanging traveler information. Next, we have a few more and, again, the Radio Data Systems has an asterisk, typically a European standard although it has been found here in the U.S. It's a communications protocol standard for embedding some bits of digital information on a conventional FM radio broadcast. Service Interface for Real Time Information is called SIRI. It's the not the Siri on your iPhone. It's completely different. It's a standard that was developed by a standards development organization in Europe. It's used for real time transit information. And it's the predominant standard for transit information in Europe but it's making significant inroads in the United States. And, in fact, one of our case studies in module seven is a transit authority here in the States that uses SIRI but actually suggested that SIRI be modified and the standards development organization actually modified it to make it more useful. TCIP I already mentioned. You can learn a lot about that. That is not used a lot for traveler information but it can be. TransXChange is a United Kingdom nationwide standard for exchanging bus schedules and related information. And then XML is actually a format, not a standard per se, but it's used by a lot of the de facto standards like GTFS. It has an ability to represent large amounts of data in a very easy to understand way. So that will come up a lot in module 7.

So now we have a pop quiz for you. So "Which one of these is a Society of Automotive Engineers or SAE Standard? Answer A is National Transportation Communications for ITS Protocol or NTCIP. B is Service Interface for Real Time Information or SIRI which was one of our European standards. C, eXtensible Markup Language or XML. Or D, International Traveler Information Systems or ITIS. So let's review the answers. The correct answer is D, ITIS. That is an SAE standard. We pointed that out specifically to you. And then the other answers; NTCIP is incorrect. It's actually an AASHTO or American Association of State Highway and Transportation Officials. ITE or the Institute of Transportation Engineers and National Electrical Manufacturer's Association Joint Standard. But it is not an SAE standard. B is not an SAE standard either. It's a European Committee for Standardization or abbreviated CEN product. And then eXtensible Markup Language is not an SAE standard. It's a format that was developed by the World Wide Web consortium which was initiated back in 1996.

So to wrap up learning objective 5 let's go back a little bit to our discussion about systems engineering because it all goes back to systems engineering. Why? Because systems engineering is based on developing a system specifically based on user needs not just to develop a system with certain functionality. Every piece of functionality has to be related back to a user need which is identified early in the systems engineering

process. So you have to keep that in mind. The whole systems engineering process gives you a very efficient and effective way of developing a system that is based on user needs. There's a variety of processes. If you recall the Vee diagram that's where we talked about that. And one thing that we didn't explicitly say is in that project development process that you can see being used in our Vee diagram that you've seen before the actual process is going to be strongly influenced by the procurement strategy that you use. What do I mean by procurement strategy? I mean are you going to use a request for proposal? Are you going to actually use a low bid process? Are you going to have a two-step bid process where you prequalify vendors and then you use a low bid? So that's going to really affect your project development process. One tool that you can use to specifically come up with the right procurement approach is an NCHRP or National Cooperative Highway Research Program product that's called the "Guide to Contracting on ITS Projects." There's a report and there's also a tool online that's web based that will help you decide what the appropriate approach is and I strongly suggest that you utilize that.

So I think we're down to one of our last, if not our last pop quiz. So the systems engineering process does not include considering user needs. And the answer choices are A, that's a true statement. And B, that's a false statement. The correct answer is it's a false statement. We just got finished saying the systems engineering process does include considering user needs. And of course A is incorrect.

Alright, so summarizing we've talked about those traveler information standards and some that aren't specifically standards but they're actually formats that can be used in traveler information. And then we talked about the importance of using systems engineering process.

To encapsulate the whole module, which is a little difficult to do, we picked out some key points of interest and we're going to fill in the blank here very quickly. And so we say alright, so what overall have we learned? We've learned a lot here but here's five different pieces of information that are important to remember. There are eleven traveler information related service packages, we reviewed them, in addition to the one that's called what? What was our key information service package that we focused on? It was called the Transit Traveler Information Service Package. Secondly, the core function which define a taxonomy of traveler information systems are—remember, there were four of them, pre-trip, en-route or wayside, blank, and mobile. It was on-board that was the third one. There were three basic components to a typical communication network. What were those three? A was the backbone, B was the distribution which took the information from the backbone and provided it to the media, and C local, which dropped the information to the media, the dissemination media. Four, the most prevalent criteria for locating the dynamic message sign is boarding counts at stops and stations. And then

five, standards for traveler information systems consider user needs which is part of the systems engineering process. So that wraps up module six.

Here is a list of resources and it only scratches the surface. There are many more resources in the student supplement that you can use to go back and gain additional information about the module and the information presented in the module.

The next module is module 7, which dives into the standards at a greater level of detail, and beyond that is module 11, which speaks to the connected vehicles, information about connected vehicles, and also there's a module on electronic payments which you may want to consider. So I want to mention two things: I want to thank you very, very much for taking module 6. I also want to mention that we're very interested in you evaluating the module. This is going to help us if we need to make any modifications to it. So if you could please take the evaluation after you've completed the slides here that would be greatly appreciated. Thank you very much for your attention.

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