

**Transit Tracker ITS Project Evaluation
Technical and Institutional Issues - Lessons Learned
Tri-Met Interview Summary**

Responses to Questions by:

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Question 1: Does integrating emergency notification and response apply to this application?

Response: We use text messaging. So, if, for example, we have a problem, we use it for service related problem a disruption we would put that out. If there were information of an emergency nature that needed to go out, the signs would also be useful distributing that information, because it is text messaging and you just type and send it out there. There is a good potential in use from an earthquake to other pertinent information.

Homeland security, also has an application assuming that there is still power to the shelter. If an earthquake has disrupted the power then of course messages can't get out because there is no power to the system. These are not battery operated, but never the less there is the potential that you could reach a lot of sites, if something was going on. Particularly if it is part of the Region, but not the whole Region.

Question 2: Have you talked to other jurisdictions? Have you been coordinating with them about this potential?

Response: No, I think it is something that we would work through our own dispatch center. We are still bringing up the system, and the more that we have an agency-wide system the more potential there is for that, right now we are still bring it up. It is one of our long term goals that this would be one of the ways we would get information out to our riders at least, about what do they do during this major service disruption. Any security, even if you are blocking, say there is an explosion somewhere it would disrupt some of our lines, it might disrupt the rail, where we would have to give people instruction on what do they do now, how do they get home, they got there by bus, they are depending on you so how do you give them instructions if they go to the rail platform. Right now there is a message showing on the rail platforms that you have to take a bus from PGE Park to the Downtown Station because the rail line is disrupted currently. I don't know if this is a planned disruption, or an accident that has the tracks blocked. That is vital information that our customers, so they know that if I want to go out to Beaverton on the train there is some sort of bus that will have to be caught, then of course the bus will be waiting at the platform. This is happening today, so we use it in that way. It can be anything from a terrorist blast along the rail line to in this case something more minor.

Question 3: Does this involve central system software, station controllers, rail and bus shelter signs, online Internet?

Response: Yes, and wireless internet, we recently brought up capabilities, so that if you have a wireless enabled phone or PDA you hit a separate web site that is particularly formatted for that.

The newest element is simply a formatting thing where the LED signs, the old signs are LED and we continue with those, but we are now testing flat screen monitors. The reason we are using those is because it allows us more territory to show, we would use this at locations were you have multiple lines and you can't show it with LED technology. Say

you have eight lines that are served by a stop then you need lots of territory on the screen. It is a derivative or a variation of the other signs, but it opens up more platforms or more stops. The most we have done before is a four line display, which we use at Salmon and Fifth and that works okay, but if you get more lines than that, say up at Portland State where we have fifteen bus lines going past Portland State you can't display those without a TV screen or a flat screen monitor. That's an example of where we would use it.

Question 4: C-Tran, did you coordinate with them on this project?

Response: C-Tran does not have AVL capability yet. However, we will certainly have some discussions as we proceed so that we someday can perhaps exchange information and integrate systems if they were compatible systems. C-Tran is out for bid right now for getting AVL. If we are able to exchange information there isn't any reason why we couldn't show their buses and they could show ours, it just a matter of figuring out the interfaces.

Question 5: Was Orbital involved in the software development? Was that the only contractor? What existing infrastructure or infrastructure funded under a separate project was used for Transit Tracker project? Bus already equipped with transmitters to allow satellite tracking of bus location. How did you integrate these systems? Any difficulties integrating the existing systems?

Response: Actually the name of the company is Orbital TMS (Transportation Management Systems). Orbital TMS is the contractor. That is for the on the street signs only. The Internet and wireless Internet applications are old Tri-Met systems, that were an in-house development by our own IT people.

Yes, and the whole system sits upon, or uses data from the Orbital TMS Vehicle Tracking System, the computer-aided dispatching system. That was a base system that was already in place, and then we layered the transit traffic system on top. We were already getting information back from the buses that told us how early or late they were. That was used by dispatch, so then we built the transit tracking system and layered upon the already tested and operating system.

The most critical thing was the bus dispatch system, and there is a parallel rail control system too which collects information about the locations of trains. The two are completely different, but we integrated the information so that it looks the same.

No there were no problems making it work, we did make some minor changes to the underlying system, because it was designed for different requirements, and now we had new requirements, so the requirement was to increase the frequency of messaging that we got. Dispatchers did not need to know every 90 seconds how early or late a bus was, and also dispatchers aren't interested in a bus that is only 3 minutes late, a customer is very interested in bus that is 3 minutes late. So we changed the threshold of what was interesting information, we brought back more information.

Question 6: Did you have any issues with the contractor and vendors of the equipment, etc.?

Response: We certainly had our share of issues. When we began prototyping we weren't sure what vendor signs to use on the platforms, that point at least there was no TCP/IP compliant interface that we could specify, they were all proprietary. So you either use one vendors proprietary interface or another, because we are using a processor that has to talk to the sign, and one of the vendors that we used we found it very difficult to talk to their signs. In fact we phased out their signs and we are not using them. We bought a couple of signs in the first prototype and we have since taken them out of service, because it was too difficult to integrate to those signs.

That is one lesson learned, and if you get to the point where you can use a TCP/IP compliant so it would not matter what vendor signs then you get past that, but at the point where we were doing it, there was an TCP/IP Specification that we could refer to say thou shalt use this specification, and we will just send you this information. So we had to work with proprietary standards, and some proprietary standards are easier to work with than others. We do have two vendor signs that we do support, and a number of their products so we can talk to any of the AMS signs or any of the Daktronics signs they use protocols that Orbital understands, I think that there are two other vendors that Orbital supports. There are actually four vendor signs that we can choose from if we were going to choose signs. It's not like we are stuck with one, in fact we use different vendor signs depending on how big a sign we are looking for and what the application is, so there is flexibility. We use smaller signs from AMS that are less expensive at some places where we don't have long distance rail sights. Then we use the Daktronics signs were we need multiple line long sight distances, they are more expensive, but they are worth it.

Question 7: Did you have any specific issues during installation/construction?

Response: Yes there are a couple of issues. It is orbitally expensive to get power to a sign. That is a huge cost. Initially we were going to piggy back this project on an Add Shelter Program, so that we would share cost with the Add Shelter Program. Unfortunately, the Add Shelter Program has not been very successful and it has not grown as rapidly as we expected, it has been suspended right now. So the cost for supplying power has been much greater than we expected.

The other that has come up as a big barrier, which we are still trying to deal with is right now is communication costs. For the prototype, or first phase of the system we used CDPD communication. Currently we have about 80 CDPD modems in service. When you use CDPD communication you have to pay AT&T a monthly charge for your monthly bandwidth, that works out well when you don't have a lot of signs, the monthly charges are that great. Compared to bringing up your own infrastructure. As the system grows to more and more signs you reach a point where it is not cost effective any more to pay AT&T, if you have bandwidth of your own, which we do. So we are reaching that threshold where we want to move the system over to our own bandwidth, that is proving to be a little bit of a challenge, its costing a bit more than expected but never the less that is what we are currently trying to work on.

The other challenge that we ran into is that there is a lot of instability in the CDPD world, AT&T is phasing out CDPD and going to the next generation which is GPRS. When they do that you have to buy all new modems, and new infrastructure, and you have to make your current software work with the communications. AT&T plan to move to the EDGE

technology, I think in three years or so, and we will face this all over again. That is another driving factor for us to want to get off of purchased communication and on to our own infrastructure.

Question 8 If you had to do it again, would you have just started with you own?

Response: No, because it doesn't scale well. The capital cost to bringing up your own data channel and the protocol and everything is too great for a few signs it really doesn't make sense. TCP/IP actually which CDPD is a very standard kind of communication is still desirable in some locations. For example what we will be doing on the rail platforms now is using 80211 life line communication, which I have running in the lab, and again it is a TCP/IP base communication, the application doesn't know the difference. The TCP/IP base communication is based on a communication standard and I can use 80211, Y5, or CDPD, or I can directly connect it to my wide area network and the sign or server doesn't care, so this is still very powerful. We want to use that in some places, but when I've got a sign too far away from my 80211 infrastructure, or fiber anywhere, and then I'm stuck with either the CDPD solution which doesn't scale to large numbers very well, or I have to take it to my own infrastructure, which we are attempting to do right now.

Question 9: Any difficulties applying the applicable standard and protocols, did you have any problems doing that?

Well, we certainly used TCP/IP and those communication standards the difficulty would be how do I apply that to my own radio channel. For instance, I don't think there are any standards that we can use, and yet there is a real cost benefit of moving this to our own radio channel. There was an advantage of using TCP/IP and standard kinds of protocols there it allowed us to use different communication methods and still have the application be the same. There don't seem to be standards for some other areas that we move in. I don't think there is a well-developed NTCIP standard yet for communication with the signs. So maybe we were a little bit ahead of the standards as we implemented this.

Question 10: Did you have any issues with incompatible hardware/software?

Yes, it is always difficult to test an application that has to run over several types of communication, and now on several different kinds of processors, because when you begin a project you buy one processor, by the time you do the next batch that processor has been discontinued, and now you are working with a new processor, and they have their own differences, so yes. We currently are working with the processor we put on the signs are Ampro designed units, but the one we used initially that was very robust in use, but has been discontinued and we have had issues with the new one.

Question 11: There really isn't anything you can do about that?

Response: No, except that you want to try to keep things as consistent as you can. It gets more complicated as you keep changing the processor. There are subtle differences that do make a difference, particularly when you are putting an application out in the field and it is running unattended; it has to be very robust and very solid. You can't have anything hiccup because you have to go out and visit it then and that's no fun.

Question 12: Did you have any other technical issues that you wanted to mention, or things that went wrong, and what did you think you did correctly that helped minimize those technical problems?

Response: I think it was good to start with the prototype system to get some things out on the street, because we learned a lot from that first system. By the time we deployed a larger system we were doing it based on a lot of experience. I think it is real difficult to be so smart that you would anticipate everything you needed before you put your first system out. We put signs out in several different environments, because you might find that this sign works fine for a bus shelter, but doesn't work very well on a rail platform, and you have to do something different there.

We also did some accuracy testing before we put very much out, and I think that is very important because even though the bus dispatch system worked really well, we found there issues that affected the accuracy on the signs, that we needed to correct. An example would be a sign that is affected by a layover. A layover is where a driver takes a break, he may be late coming into the layover, but that doesn't mean he is going to leave late, in other words he is probably going to leave on time, so the sign needs to be smart enough, or the system needs to be smart enough to not considering late if the sign is downstream from the layover you need to make the assumption that the driver is going to take a break, but it will be a shorter break and leave on time. Those kinds of things you need to build into the system. It can some times be a little tricky.

Question 13: How did the project come about?

Response: In the case of Transit Tracker when we had the bus dispatch system in 1997 up and running and we completed that, we were looking for what kinds of systems we would layer on top of it then once it was reliable. About that time I visited London and saw the countdown system there. I was impressed with the information they shared with me about customer value and how much customers really valued that information and how much it changed customer's perception of their service. I looked at that and thought it was a good match for where we were since we already had AVL to layer on top made a lot of sense. So this was really the system was inspired by the London Countdown System.

Question 14: Did you ever talk to them?

Response: Yes, I was there and given a presentation by them. They showed it to me and shared evaluation information that they had done with their customers. What they found was it improved their customer perception of the service. We are still trying to verify the same results here, but they actually did some tests that showed that their customer's perception of the service was improved, and the information was highly valuable to the customer. The customers valued it very much, so we realized this is one of things that we can do that ITS technology that can be implement that the customers would actually see, most of the stuff is background stuff that they don't even know is going on. In this case this would be one that they would actually see and interact with so we saw the value of implementation.

Question 15: What funding sources were used for this project and how were the funds obtained?

Response: There is some FHWA money, but actually it is FTA money. We have done parts with 100% Tri-Met funding and then other parts are funded. We have a transit enhancement

grant, which every transit district needs spend 1% of their capital on transit enhancement projects. Transit enhancement projects can be things like buy shelters; we spend our on buying transit tracker and putting transit tracker in shelters. It is a grant source that we get that has to go for certain things, there are certain categories, and we choose to use it for transit tracker. Then there are some other ITS, very small amounts of money from ITS. Most of our grant funds are that type of money that could be spent on shelters or other things, but we feel it's a good source of funds to use for Transit Tracker.

Question 16: Were there any funding issues? Not enough money provided for evaluation, and all the little minor things that you had to do to satisfy FHWA.

Response: There are always funding issues. We are struggling to get what we can done with what we have.

Question 17: What was done on this project to help minimize project costs (i.e., ODOT provided used cameras for project)?

Response: We tried to combine it with other projects, so that they shared costs. We also layered it upon a mature system, so that we already had the bus dispatch system in place providing the information.

Question 18: Were there any contracting issues? Did it take longer with ODOT, or signing issues, etc.?

Response: Not really, not that I can think of. I would say it has taken longer to do software development than we had hoped, but that is always the case, because it did require some development from Orbital TMS, that software development has gone a bit more slowly than we had hoped, but that seems to be often is the case, it is often easy to under estimate.

Question 19: Were there any software development issues like the rights for the software coding?

Response: Not that type thing, its just maintaining schedule and getting it coded.

Question 20: Who has the rights?

Response: We own the rights to the Internet product, but on the street product is Orbital code. We have the right to put as many signs up we don't pay Orbital any fee to put more signs up. We paid them to develop the software, they still own the software we can't sell it or give to somebody else. We can put as many copies out as we want. There are no additional licensing fees; so as we put more and more out I don't have to pay Orbital a fee for using the software we have already paid them to development it.

Question 21: Did you talk to any other agencies about their systems when you were developing?

Response: Yes, there weren't too many that we could talk to in the United States. I did talk to New York because some of the software that we began with that we modified was first tested in New York. They had a project called its about time or something like that, which really didn't get off the ground but it used some of the same software.

Question 22: Was it beneficial, did it help?

Response: Yes, some in this case because it was related. There also was South Hampton, England another place where I looked at similar software. A couple of other people on project also saw software running and had some discussion with people in Gothenburg, Sweden, they have a similar system up and running. We tried to learn from all of those projects as much as we could. I didn't go there, but Jeff one of the other project people visited there and talked to them about their system. This is more common overseas than it is here in the United States, or at least was when we began it is becoming more common here. We certainly looked at those systems where we could. I also talked to people in Paris, France. They were doing a demonstration project on it; their line 47 and they had signs out telling when buses would arrive, so we learned as much as we could about that one. There were several European countries, I happened to be there on a tour that included a lot of things and was able to gather information on real time customer information.

Question 23: So what in general did you think you did right on this project to make the project run smoothly? What would you do differently if you had to do the project over again?

Response: That's kind of tough. The process we went through of layering on top of another system that was already mature that was very important. We did not try to do a bus dispatch system at the same time we were doing this project. Dispatching was done and working, then we layered this on top. Layering on top of a mature system was the right thing to do.

I also think that prototyping, doing a few sites and gradually expanding the system after we had done extensive testing was the right thing to do, and not trying to develop it too quickly. Taking the time to get what had out there working before we started expanding.

What we would have done differently, I'm not sure how we could have gotten around a lot of the things that we have seen as problems, simply because of the types of things that come up during a project when you are prototyping.

Question 24: Are there any other problems that you can remember that you have not mentioned yet?

Response: No, I think there are plenty of problems. I think one of the things that the project has been more expensive than we expected. It has taken more contractor effort on the programming side and we have spent more on equipment than we originally envisioned.