

**OR0206 - TRANSIT TRACKER (REGIONAL
INTERMODAL TRANSIT TRAVELER
INFORMATION AND SECURITY SYSTEM)**

LESSONS LEARNED REPORT

Prepared for:

Oregon Department of Transportation
and
Tri-Met

Prepared by:

David Evans and Associates, Inc.

April 2004

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INTRODUCTION

This report documents lessons learned through implementation of the Transit Tracker (a.k.a. Regional Intermodal Transit Traveler Information and Security System) project. Included in this report is a discussion on the technical and institutional issues encountered in integrating Intelligent Transportation (ITS) components and the challenges experienced in applying applicable ITS standards and architecture. The goal of this lessons learned report is to allow others to learn from the experiences gained through the project so they can complete future projects with even greater success.

PROJECT DESCRIPTION

The overall objective of the Transit Tracker project is to provide a seamless and complete regional multi-modal traveler information system that will result in more complete information service and enhanced public transportation security.

Tri-Met's computer-aided bus dispatch system (BDS) and the rail central control system (CCS) currently display the location and schedule status of all fixed-route vehicles to dispatchers and rail controllers, respectively. This information can also have considerable value to transit customers, both before they begin a trip and while they are waiting for a bus or rail vehicle to arrive.

The Transit Tracker project builds upon the existing BDS and CCS systems, disseminating real-time transit information collected through the BDS and rail CCS systems to transit customers. The real-time information is disseminated to transit customers via variable message signs (VMS) installed at bus shelters, rail platforms, transit centers, and other fixed sites and via the Internet and other personal access services.

The Transit Tracker project was deployed in three phases. Phase 1 involved deploying a prototype of the system, implementing VMS signs at three locations that represented different types of transit facilities: a rail station (Gateway), a major bus facility (Salmon/5th Avenue), and a selected bus stop with two standard shelters at the intersection of Northeast Martin Luther King, Jr. Boulevard. The Phase 1 prototype also involved implementing an audio component to the system, enhancing the system's ability to serve customers with disabilities. Phase 2 consisted of evaluating the prototype installed during Phase 1 and also continued a limited deployment of additional displays along the Phase I prototype bus and rail routes. Phase 3 completes the deployment of the Transit Tracker system, installing the remaining VMSs, expanding the content and presentation of the information displayed, and implementing the recommended modifications as determined during Phase 2 of the project.

PROJECT ISSUES

Ken Turner of Tri-Met, the project manager for the project, was interviewed in order to determine the issues that were encountered during project implementation. This report section summarizes the technical and institutional issues Mr. Turner noted during his interview as well as the challenges involved in complying with ITS standards and architecture. Details on the interview with Ken Turner are provided in the attached appendix.

Institutional Issues

Institutional issues are non-technical impediments and challenges that may occur during a project. Institutional issues that occurred during the project are noted below.

Financial Issues

The Transit Tracker project was funded through Tri-Met itself and grants from the Federal Transit Authority and the ITS Earmark grant. The primary funding source for the project was a general transit enhancement grant, which requires every transit district to spend 1 percent of their capital on transit enhancement projects. Although the transit enhancement grants can be used for many types of projects (e.g. bus shelters), Tri-Met chooses to use the enhancement funds for the transit tracker project.

Tri-Met noted that funding is always an issue on projects and the Transit Tracker project was not an exception. One funding issue is that a huge cost associated with the electronic displays (VMS) is to provide a power connection for them. Initially, Tri-Met was going to share the costs for power connection between the Transit Tracker Project and the Add Shelter Program. Unfortunately, the Add Shelter Program had not been very successful and had been suspended at least temporarily. Because of this, the cost for supplying power had been much greater than anticipated.

Interagency Coordination and Cooperation

The Transit Tracker project was an in-house project fully developed by Tri-Met. Because of this, coordination and cooperation with other agencies was not an issue. However, Tri-Met is a member of TransPort, a regional ITS committee, and this project was submitted through TransPort to ensure compatibility with the Regional ITS goals and infrastructure development. Tri-Met has also had some discussions with C-Tran, the local transit agency in Vancouver, Washington, concerning Transit Tracker. C-Tran does not yet have the base infrastructure, such as automated vehicle location (AVL) capability, but are currently out for bid for getting an AVL system. Once they do develop the base infrastructure, Tri-Met and C-Tran could potentially discuss integrating their systems so that C-Tran bus information is displayed on Tri-Met's Transit Tracker system as well.

Software Rights

Tri-Met did not note any proprietary issues concerning the software developed for the project. The Internet product was developed in-house by Tri-Met staff and they own all rights to it. Based on their agreement with Orbital (the company that Tri-Met hired to develop the software for the VMS system), Tri-Met has the right to install as many signs as they wish without paying Orbital additional fees. However, because Orbital owns the software, Tri-Met cannot give the software to any other agencies or companies.

Schedule

Schedule delay was a minor issue during project implementation. When asked whether the project was completed on schedule, Tri-Met noted that there were some delays, though nothing substantial. Tri-Met noted that it had taken longer to complete the software development than originally hoped, but delays are often an issue with software development.

Technical Issues

There are often many technical issues encountered while integrating ITS components. Technical issues identified during the project are discussed below.

ITS Standards and Protocols

Compliance to standards and protocols can help to ensure that ITS components being integrated are compatible with each other and can function together.

One standards compliance issue was that when Tri-Met had begun their project, some standards required for the project had not yet been developed. When Tri-Met first began the Phase 1 prototype, they were not sure which vendor signs to use on their rail platforms, as there was not a specific Transmission Control Protocol/Internet Protocol (TCP/IP) standard for VMS sign interfaces. As a result, Tri-Met could only choose between signs with proprietary interfaces. Interfaces act like language translators, making it possible for different equipment to communicate with one another. Tri-Met had originally purchased a couple of different types of signs for their prototype but had to take them out of service as they were very difficult to integrate due to the proprietary sign interfaces, which did not provide adequate communications between the VMS signs and the central control processor.

Today, Tri-Met uses signs with protocols that support Orbital software. Tri-Met uses two vendor signs, AMS and Daktronic Signs, and a number of their products for adequate communication. Tri-Met uses smaller signs from AMS that are less expensive at some places where there are not long distance rail sights. The more expensive Daktronics signs are used where multiple line and long sight distances are required. There are actually four signs sold by different vendors that support Orbital software so Tri-Met does have some flexibility in regards to which signs they use.

The same lack of well-developed standards issue also applies with Tri-Met's radio channel and some of the other communication methods Tri-Met is moving towards. Tri-Met believes that there is an advantage to using TCP/IP and standard kinds of protocols that would allow them to use different communication methods yet retain the same application. However, these standards are not yet available.

Communication Infrastructure Issues

A number of issues were encountered while providing communications to the on-street electronic displays. For the prototype, or first phase of the system, Tri-Met used Cellular Digital Packet Data (CDPD) communication to provide a communications connection for their electronic displays. With CDPD communication, AT&T charges a monthly fee for the bandwidth they provide. That type of communication is cost efficient when the system is small and does not have many signs that require communication connections. As the system grows and more signs are installed, more bandwidth is required and AT&T fees increase. The Transit Tracker project has grown to a point where it may be more cost efficient to move over to Tri-Met's own bandwidth as opposed to using CDPD communications through AT&T. Tri-Met has begun this process of switching communications but have noted that the transition is proving to be challenging and is costing more than originally anticipated.

Another challenge encountered was continually upgrading existing systems in order to coordinate with technology advances. AT&T is currently phasing out CDPD communications and is going to the next generation, General Packet Radio Service (GPRS) communications. When they install all new modems and new infrastructure will be required, some effort will need to be made to make the software work with the communications. AT&T currently has plans to move to EDGE (*Enhanced Data rates for GSM [Global System for Mobile Communications] Evolution*) technology after GPRS, potentially in about three years, and this issues would occur all over again. That is another driving factor to get off of purchased communication and on to Tri-Met owned infrastructure.

Integration with Legacy Systems

Oftentimes, one of the biggest hurdles when developing ITS systems is to make them compatible with existing systems already in place. The Transit Tracker project builds upon the existing BDS and CCS systems, disseminating real-time transit information collected through the BDS and rail CCS systems to transit customers.

Tri-Met noted they did not encounter many problems integrating the Transit Tracker system with the existing legacy system. They did, however, need to make some minor changes to the underlying system because it was designed for different requirements. One of the requirement differences is needing information at a faster rate than before. The BDS and CCS had to provide information to transit dispatchers, not directly to the transit customers. Dispatchers do not need to know every 90 seconds how early or late a bus is, nor are they interested in a bus that is only three minutes late. However, a customer is very interested if their bus is three minutes late. For the real-time Transit Tracker system, Tri-Met had to change the rate at which information is provided and expand the type of information provided by the system.

Incompatible Hardware/Software

Tri-Met noted that it is always difficult to test an application that has to run over several types of communication and on several different kinds of processors. For example, one processor is purchased at the beginning of a project. When it is time to do the next batch, that processor has been replaced by a new processor, and there are differences that may make the new processor less compatible with the legacy system. This is an issue that Tri-Met does not think can be easily addressed. However, Tri-Met believes the best approach to keeping hardware/software compatibility issues at a minimum is to be consistent as possible and comply with standards as much as possible.

General Comments

Overall, Tri-Met considered the project a success. When asked what worked well and what would they have done differently they had many comments, as detailed below.

One comment was that it was beneficial to start with a small, prototype system. Getting the initial prototype out on the street was beneficial because Tri-Met learned a lot from that first system. By the time they deployed an expanded system, they were doing it based on experience. Tri-Met had put signs out in several different environments.

Tri-Met felt that performing accuracy testing on a small prototype before deploying a larger system was extremely beneficial. This method assisted in identifying issues and fixing them before full project deployment. Identifying and fixing problems early on allowed the production of a more effective system and minimized costs.

Tri-Met felt that looking at similar systems already in operation in other cities, can be a great benefit. Tri-Met had come up with the idea of the Transit Tracker project by seeing a similar system in London. While visiting Gothenburg, Sweden, some Tri-Met staff members saw software running on a similar system and had some discussion with the operators. Staff members also saw other systems in place in other parts of Europe such as South Hampton, England and Paris, France. The United States did not have as many of these types of systems as Europe, but Tri-Met did contact New York about their traveler information system. Looking at and discussing lessons learned from other similar systems helped Tri-Met to develop ideas for their system as well as avoid some similar mistakes that occurred in past projects.

CONCLUSIONS

The primary goal of this lessons learned report is to allow others to learn from the experiences gained through the project so that they can complete future projects with even greater success. In summary, the interview results suggested that the following may help contribute to a successful project:

- **Comply with ITS standards and protocol when possible.** Complying with ITS standards and protocols helps to ensure a more modular and compatible infrastructure. Unfortunately, some standards were not fully developed by the time the Transit Tracker project was initiated thus creating some of the issues that were discussed earlier.
- **Review other similar existing systems and their lessons learned.** Reviewing other similar systems that have already been installed can help in terms of avoiding similar mistakes and also may provide ideas on what would work well with the new system.
- **Start with a small prototype, evaluate the prototype, and then expand your system.** Starting with a small prototype and evaluate it prior to deploying a larger, expanded system can allow you to determine problems early on and fix those problems before deploying the full system, thus minimizing project costs and producing a better system overall.

▪ **APPENDIX**

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