California and Oregon Advanced Transportation Systems Phase 3:

Final Report

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EXECUTIVE SUMMARY

This report discusses the various activities that did and did not occur during the course of the COATS Phase 3 project. As Phase 3 evolved, its focus gravitated toward the completion of two activities: technology transfer and leveraging. Technology transfer activities were centered on the establishment, growth and continuation of the annual Western States Forum. Leveraging activities focused on the development of Integrated Corridor Management for rural areas, in line with the emerging U.S. Department of Transportation ICM initiative.

The Western States Forum served as a technology transfer platform where informative, in-depth technical presentations could be given by rural ITS practitioners. Presenters delved into how solutions were developed, focusing on applications that have been deployed in the field and are being used in live traffic situations. Success stories have been shared along with failures and problems so participants could learn what does and doesn't work and why. The Forum eventually expanded to include live demonstrations of rural ITS technologies and "hands-on" question and answer periods. Participants brought actual ITS equipment and performed informal "show and tell" sessions during the breaks. In addition to a live demonstration of ITS communication technologies, short briefings on specific Rural ITS research projects and product development were also conducted.

Integrated Corridor Management examined what may be required to reach the deployment stage for a rural ICM plan, as well as the development of a web-based data clearinghouse to support it. This effort represented a blueprint for what may be required to create a rural ICM. Based on the work completed, it was concluded that the concept of ICM is applicable to rural areas and expected to yield a number of benefits. These included improved traveler safety and mobility, enhanced goods movement, and the availability of information to agencies in a timelier manner. In addition, the work completed under this portion of COATS Phase 3 will ultimately assist other Caltrans efforts, namely the development of One Stop Shop.

During the course of the Phase 3 effort, a number of deliverables were produced, including:

- Quarterly progress reports;
- Meeting minutes (Steering Committee meetings and conference calls);
- Organization and conduct of the Western States Rural Transportation Technology Implementers Forum from 2006 through 2008;
- Annual reports summarizing the Western States Rural Transportation Technology Implementers Forum;
- Development of the Integrated Corridor Management Clearinghouse website (http://www.weathershare.org/ICM/);
- Development, support and final documents associated with Integrated Corridor Management;
- Conference presentations:
    - Applying Integrated Corridor Management to the Rural COATS Region - 2007 National Rural ITS Conference;
    - Rural Integrated Corridor Management in the COATS Region - 2008 Northwest Transportation Conference;
    - Application of Integrated Corridor Management to Rural Areas - 15th World Congress on ITS.

1. INTRODUCTION

The purpose of this document is to summarize the work completed for continued Intelligent Transportation Systems (ITS) demonstration, evaluation and technology transfer in rural northern California and southern Oregon. This work was completed under the third phase (Phase 3) of the California and Oregon Advanced Transportation Systems (COATS) project. The purpose of the overall COATS effort has been and continues to be encouraging regional, public and private sector cooperation between California and Oregon organizations to better facilitate the planning and implementation of ITS in a rural bi-state area extending between Eugene, Oregon and Redding, California.

1.1. COATS Vision

"The COATS Project is a cooperative bi-state, multi-modal project involving public-public and public-private partnerships that will develop, deploy and coordinate cost effective and environmentally agreeable Intelligent Transportation Systems throughout state and local organizations. It is designed to increase safety, improve efficiency for the movement of people and goods, and increase the convenience and accessibility of real-time information and services, to a variety of surface transportation users on primary and secondary roadways within the project limits."

1.2. COATS Mission

The COATS Project will serve to focus member agencies on a seamless, state-of-the art, multi-modal transportation network benefiting travelers, goods movement, economic activity, and transportation systems operators in California and Oregon. Collaboration between the COATS project and its partnership coalition will provide information regarding the development of an effective ITS initiative which best addresses and improves the rural transportation needs of the region. Information gained will serve to promote increased safety, mobility, traveler comfort, environmental quality, and operational efficiency and productivity. Development of a fully functional and compatible ITS program will support long-term public/private partnerships, assist in the transfer of technology between public agencies and increase awareness of ITS technology among state and local officials, transportation professionals and transportation users.

1.3. Phase 3 Goals

The primary goal of COATS Phase 3 was to provide research and support activities to help California and Oregon achieve the COATS vision. These activities included: fostering bi-state cooperation and communication, promoting technology transfer, assisting in ITS planning and architecture development efforts (task order), evaluating ITS projects and systems (task order), and providing assistance to mainstream deployment of field-tested ITS technologies (task order).

1.4. Project Tasks

The work plan for COATS Phase 3 consisted of the following six tasks:

- Task 1: Project Management
- Task 2: Technology Transfer
- Task 3: National Partnerships and Leveraging

- Task 4: Planning and Architecture Support (task order)
- Task 5: Evaluation Support (task order)
- Task 6: Deployment Assistance Support (task order)

These tasks may be viewed cyclically, as shown in Figure 1. Central to the project were the needs and interests of stakeholders within the COATS region. Their input was used to identify what activities would be pursued, as well as provide feedback and information in support of on-going work. WTI managed the project in consultation with the contract administration team, to ensure integrity and unity in the project approach.
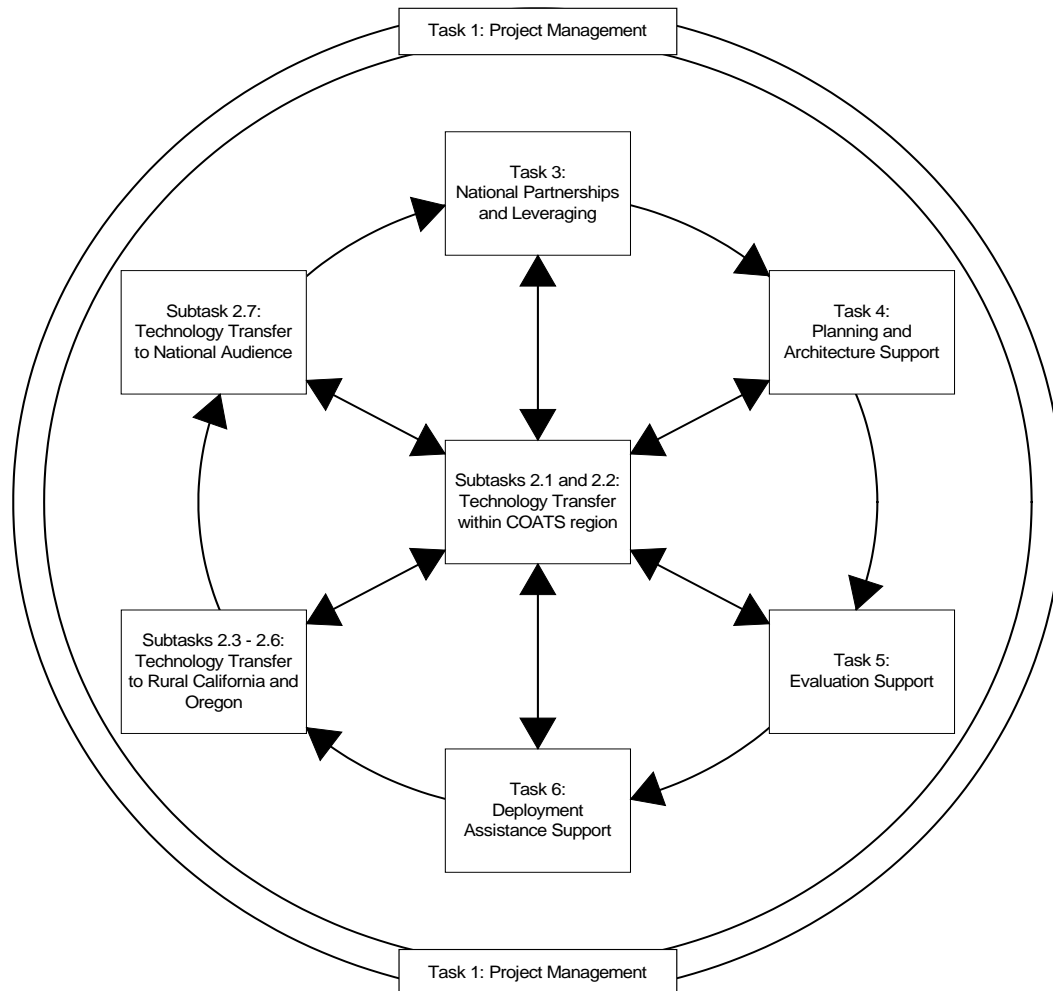
Figure 1: COATS Phase 3 Flow Chart

1.5. Report Organization

This report presents a summary of activities that were and were not completed during Phase 3 of the COATS effort. As Project Management activities encompassed work related to budget maintenance, communications with the project sponsor, scheduling and the like, a discussion of the work completed for that specific task has been excluded. Remaining chapters of this report will discuss Technology Transfer, National Partnerships and Leveraging, Planning and

Architecture Support, Evaluation Support, and Deployment Assistance Support. Note that activities related to some of these tasks were not completed due to shifts in project scope during the duration of the work. Additionally, some activities were proposed as task orders, with budget only being provided should that task be pursued. In no instance during the course of this project was a task order employed.

2. TECHNOLOGY TRANSFER

Technology transfer, or the sharing of information and lessons gained through experience, has been one of the most successful and necessary components of the COATS project. There are three levels of technology transfer that have occurred to date throughout the course of COATS' history:

- Sharing of information within the COATS region;
- Sharing of information to other interested parties in California and Oregon (outside of the COATS region); and
- Sharing of information to audiences outside of California and Oregon.

To continue providing these levels of technology transfer, as well as to expand efforts, Phase 3 of COATS proposed to:

- Conduct Steering Committee meetings;
- Hold ITS technology transfer workshops;
- Hold ITS maintenance workshops;
- Participation in CAATS meeting;
- Participation in local transportation conferences;
- Outreach to local stakeholders; and
- Develop National/International awareness.

The intention of these activities and the extent to which they were or were not completed during the course of the project is discussed in the following sections.

2.1. Steering Committee Meetings

This portion of work focused on the conduct of meetings that served primarily as a forum to guide planning and decision-making related to the COATS project. The original proposal called for seven Steering Committee meetings:

- May/June 2006
- November/December 2006
- May/June 2007
- November/December 2007
- May/June 2008
- November/December 2008
- May/June 2009

In completing this task, only three Steering Committee meetings were held in Yreka, California. These occurred on November 13, 2006, October 30, 2007 and November 3, 2008. The project held only three such meetings due to the increased use of teleconferences when needed, as well as contract delays and stop work orders. This allowed for a travel savings which could then be applied to other aspects of the work, specifically the Western States Forum and development of Integrated Corridor Management discussed later in this document. Aside from the organization and conduct of these meetings, associated deliverables included meeting minutes.

2.2. ITS Technology Workshops

ITS Technology Workshops were proposed to occur once per year in May or June, with the purpose of providing a forum for detailed discussion of ITS deployments. This would allow technology transfer to occur at the design and engineering level. To this end, the task was met by the establishment of the Western States Rural Transportation Technology Implementers Forum (i.e. Western States Forum), conducted annually during June since 2006 in Mt. Shasta, California.

Individual participation at this event indicates its growth and success, rising from 15 in 2006, to 22 in 2007 and 39 in 2008. In line with this increase in attendance came diversification of attendees. The initial Forum was attended primarily by Caltrans personnel. By 2008, engineering professionals from California, Idaho, Montana, Nevada, Oregon, Washington and Wyoming attended the Forum.

Each year, the Forum has been distinguished by informative, in-depth technical presentations given by rural ITS practitioners. Presenters have delved into how solutions were developed, focusing on applications that have been deployed in the field and are being used in live traffic situations. Success stories have been shared along with failures and problems so that participants may learn about what does and doesn't work and why. The extended length of the presentations (60-120 minutes) and the informal atmosphere have allowed frank discussion of equipment functionality, vendor claims, system performance, and other key information that practitioners need to know for successful rural ITS projects.

In 2008, the Forum was expanded to include live demonstrations of rural ITS technologies and "hands-on" question and answer periods. Participants brought actual ITS equipment and performed informal "show and tell" sessions during the breaks. In addition to a live demonstration of ITS communication technologies, short briefings on specific Rural ITS research projects and product development were also conducted on the second morning of the Forum. Some of these presentations were given by student assistants and others who will be the next generation of ITS engineers and integrators.

Aside from the organization and conduct of the Forum itself, specific deliverables completed during this task included the production of reports detailing each year's event (1, 2, 3).

2.3. ITS Maintenance Workshops (Task Order)

This subtask intended to create and support a workshop directed toward DOT maintenance staff to help address any outstanding maintenance issues with ITS. The workshop would provide hands-on training for maintenance staff, based on their input of what they need, in order to provide Department of Transportation staff with ITS maintenance training and a forum to express their concerns with specific equipment and design specifications. This would promote technology transfer activities in relationship to maintenance activities.

To an extent, as the Western States Forum grew, the purpose of this task was met in terms of providing an ITS maintenance training and a discussion forum. Specific assessment of training needs, design of a workshop curriculum, and conduct of workshops did not occur based on the

evolution of the Western States Forum in meeting short-term training needs of stakeholders. As a result, this activity may need to be revisited in future efforts.

2.4.   Participation at CAATS Meetings

Funds were budgeted with the intention of allowing for presentation of results and physical representation at annual meetings of CAATS, the ITS America state chapter for California. This would allow for the sharing of information and experiences gained in the COATS region with other transportation stakeholders in each state.

Attendance and presentation at these meetings were not completed during the course of COATS Phase 3 for two reasons. First, funds were employed to provide presentations at other venues (ex. NRITS, Northwest Transportation Conference) to spread awareness of COATS to an audience outside of California, as well as to maintain interest from stakeholders whose participation in the COATS effort may have been waning. Secondly, COATS project results were not available in time for submission/acceptance for presentation (ex. Integrated Corridor Management) to this audience during the course of COATS Phase 3.

2.5.   Participation in Local Transportation Conferences

Technology transfer outside of the ITS community is also important, and this subtask provided for travel costs and time for one WTI staff member to attend "local" transportation conferences. As discussed in the previous section, attendance at such meetings did occur, with presentations and a presence made at the annual National Rural ITS conference, as well as the Northwest Transportation Conference (4, 5). This attendance was viewed as beneficial in creating renewed interest in COATS outside of California, where such interest remained strong.

2.6.   Outreach to Local Stakeholders (Task Order)

The intention of this task order was to meet with local stakeholders and share information. Because the nature and scope of this outreach was uncertain, funding for this task was to be provided on a task order basis. During the course of this project, local stakeholder outreach was not conducted, and so funding on a task order basis was not employed.

2.7.   Develop National / International Awareness

ITS activities in the COATS region have been on the leading edge of rural ITS deployment for several years. Sharing the information and experience gained through COATS Phase 3 and earlier efforts to other audiences was viewed as being advantageous in advancing the practice of rural ITS nationally and internationally. To this end, presentations and attendance at national and international meetings were completed. These included presentations and presence at the 2008 ITS World Congress, as well as the 2006, 2007 and 2008 National Rural ITS conferences (4, 6).

3. NATIONAL PARTNERSHIPS AND LEVERAGING

Sustainability of the COATS effort was viewed as achieved in part through strategic leveraging of national partnerships and funding opportunities. Accordingly, the COATS region could have benefited from efforts towards responding to requests for proposals, and securing outside funding during the Phase 3 project. To this end, a portion of this task was for WTI to seek to keep apprised about opportunities for funding and partnerships at a national level, and presenting such opportunities to the Steering Committee as needed. To this end, WTI monitored opportunities as they became available; unfortunately, no such funding or partnership opportunities emerged during the course of the COATS Phase 3 effort.

A second portion of this task involved WTI developing "big ideas" that would be consistent with California and Oregon transportation needs while aligning with potential funding opportunities at the federal level. These ideas were detailed in a memorandum deliverable and included:

- Augmenting Rural Chain-Up Area Information;
- Development of a Field-Ready Work Zone Traveler Information System;
- Integrated Corridor Management for Rural Areas;
- Integration of VMS and HAR in the COATS Region;
- NOVIS Phase II;
- Research and Deployment of ITS Technologies for Snowplows;
- Rural Traffic Flow Data Collection;
- Trans-Cascades Traveler Information System; and
- VII for Rural Weather Data Collection (7).

Based on the potential for partnership and leveraging, Integrated Corridor Management for Rural Areas was selected as the "big idea" project to pursue during COATS Phase 3. This project also held the potential to meet the needs of COATS region stakeholders for improved data-sharing, addressing motorist safety, as well as serving to lay the groundwork for future COATS spinoff efforts, specifically in this case, Caltrans' One Stop Shop project (presently on-going).

Based on the technology/programming needs behind the data-sharing platform required for ICM development, a majority of the budget for COATS Phase 3 was expended on this effort (as well as the Western States Forum previously discussed). Several deliverables were produced as the result of this project, including a Work Plan, a Draft Vision document, a Data Collection Plan, a Requirements document, and a Final Report (8,9,10,11,12). In addition, a data-sharing platform to facilitate ICM in a rural area (http://www.weathershare.org/ICM/) was developed. The following section summarizes the overall ICM effort.

3.1. Integrated Corridor Management Summary

Understanding current roadway conditions and performance throughout a rural area – particularly one that covers a bi-state region – presents transportation agencies with a myriad of challenges. In most cases, the sharing of critical information such as changes in roadway status across jurisdictional borders is made via personal communications (ex. telephone, faxes, etc.). While this approach is effective, it often prevents a real-time understanding of current conditions, as the relay of information incurs a time lag. In dynamically changing conditions, such as a winter storm event, this time lag may result in multiple condition changes in rapid

succession. When such a scenario occurs, the picture of what is happening in the field, especially in a neighboring state, can become quickly clouded.

One approach that has emerged which holds promise in addressing the provision and use of data in real time is Integrated Corridor Management (ICM). Integrated Corridor Management seeks to coordinate individual network operations between parallel facilities/routes to create an interconnected system allowing cross network travel management. The work conducted under this task examined what may be required to reach the deployment stage for a rural ICM plan, as well as develop the tools to support it. Given the absence of rural ICM activities to date, this work represented a blueprint for what may be required in creating a rural ICM. The steps, requirements, tools, etc., required for a rural deployment are likely to vary by locale and conditions.

The objectives of this task were straightforward. First, it examined what was required to apply ICM to the COATS region. Second, it developed a data-sharing platform to facilitate ICM in a rural area (http://www.weathershare.org/ICM/). Finally, it developed a Concept of Operations (ConOps) for a specific event that could be addressed by ICM in a rural area; for this work, a winter storm event was chosen.

Based on the work completed, it was concluded that the concept of ICM is applicable to rural areas. To make that application, several conditions must be present. First, the necessary infrastructure must be in place. Namely, alternative corridors must be present along which traffic may be rerouted when necessary. Secondly, these routes should be host to a number of different ITS deployments. Ideally, the majority of these systems have their present status frequently updated in electronic databases that also provide data streams to traveler information websites or web portals. Finally, the mechanism to support data-sharing between agencies and regions must be in place. In this project, that mechanism was developed: a web-based center-to-center data-sharing platform. For other locales, this mechanism may take on a different form or strategy. Regardless, the ability to quickly share data between agencies in a timely manner is crucial to any rural ICM plan.

Implementing ICM in a rural context is expected to yield a number of benefits. Traveler safety and mobility are expected to improve, as the provision of timelier information to motorists at key decision points will allow them to travel via the best available routes or stop in a location where amenities are available. Goods movement will also be facilitated in this manner, keeping drivers and trucks moving toward their destination rather than sitting at a closure. Finally, the availability of information to agencies in a timelier manner will allow them to react to changing conditions more quickly and effectively, improving operations.

4. PLANNING AND ARCHITECTURE SUPPORT

A primary deliverable of the original COATS project was a strategic deployment plan to guide ITS deployment within the COATS region over a fifteen-year time frame. At the time of the development of the COATS Phase 3 proposal, the short-term timeframe of the architecture plan was nearly complete. As a result, it was thought that states might consider updating their plan during the course of Phase 3. WTI believed that it might be necessary to provide a supporting role for California and Oregon in these activities, due to relevant local and national experience in these areas. Consequently, the Planning and Architecture task would cover undetermined support activities, with funding allocated on a task order basis.

When proposed, this task envisioned the potential to consist of the following:

- Conducting workshops to promote ITS awareness;
- Researching transportation needs that may be addressed through ITS;
- Developing new ITS concepts that may address actual transportation needs;
- Working with extending the ITS architecture to meet unique rural challenges; and
- Providing review of consultant-prepared planning and architecture documents.

During the course of the Phase 3 project, activities specific to this task were not completed. The reasons for this were twofold. First, some of the envisioned activities were performed under the umbrella of previous tasks. For example, to a large extent, the Western States Forum served the role of conducting a workshop to promote ITS awareness. In addition, the work performed specific to ICM met the intentions of researching transportation needs that may be addressed through ITS and developing new ITS concepts that may address actual transportation needs. Second, the need for planning and support activities did not arise during the course of Phase 3. As a result, efforts to extend ITS architecture to meet unique rural challenges and review of consultant-prepared planning and architecture documents did not occur.

The deliverables associated with the activities that were related to this task but performed under other tasks have been discussed in other sections of this report. As no work was performed specifically under this task, funding on a task order basis was not employed.

5. EVALUATION SUPPORT

Tasks originally identified for Evaluation Support were thought to include conducting evaluations of existing deployments and providing support for evaluation activities. Once again, this task was to be funded on a task order basis, with each state making a decision on how to allocate its resources should activities be pursued. WTI would also allocate UTC funding to support evaluations and research activities that were deemed beneficial in addressing the transportation needs in the COATS region.

5.1. Conducting Evaluations

Based on the transition of ITS into more of a mainstreamed context, it was proposed that future evaluation plans would reflect an increased emphasis on benefit-cost analysis, along with an assessment of the technology's readiness to be adopted on a broader scale. As stated, the funding for such activities would be allocated on an as needed basis via task orders. As the Phase 3 project progressed, its emphasis shifted from the potential for evaluation efforts towards technology transfer (Western States Forum) and leveraging (Integrated Corridor Management). Consequently, no evaluation activities were identified by the Steering Committee as being essential during the course of Phase 3. As no work was performed specifically under this task, funding on a task order basis was not employed.

5.2. Evaluation Support

An additional task order item specified in the Phase 3 proposal was evaluation support. This activity was envisioned to consist of:

- Working with designers to incorporate, within system design, means to measure effectiveness
- Assisting in data collection and analysis (for example, using the video surveillance trailers purchased through the COATS project) for an evaluation led by others
- Developing an evaluation plan to be conducted by others

Similar to conducting evaluations, as the Phase 3 project progressed, no support activities were identified by the Steering Committee as being required during the course of Phase 3. Rather, work focused on technology transfer and leveraging. As no work was performed specifically under this task, funding on a task order basis was not employed.

6. DEPLOYMENT ASSSISTANCE SUPPORT

The final activity called for in the Phase 3 proposal was Deployment Assistance Support. This activity was envisioned to support evaluation and documentation of research-oriented, innovative applications/deployments to facilitate their mainstreaming. This task would provide deployment assistance support for Caltrans, specifically the transfer of projects from the experimental to everyday realms.

Concurrent with the Phase 3 project, WTI performed work for Caltrans under separate contracts to evaluate ITS projects (ex. Redding Responder Phase 2). Subsequently, such work covered the intention of this task outside the scope of the Phase 3 project. Over the course of COATS Phase 3, the opportunity to pursue deployment assistance support separate from such complimentary projects did not arise. As this was proposed as a task order activity, no project funds were allocated to it.

7. CONCLUSION

This report has discussed the various activities that did and did not occur during the course of the COATS Phase 3 project. As Phase 3 evolved, its focus gravitated toward the completion of two activities: technology transfer and leveraging. Technology transfer activities were centered on the establishment, growth and continuation of the annual Western States Forum. Leveraging activities focused on the development of Integrated Corridor Management for rural areas, in line with the emerging U.S. Department of Transportation ICM initiative.

7.1. Summary of Major Efforts

The Western States Forum served as a technology transfer platform where informative, in-depth technical presentations could be given by rural ITS practitioners. Presenters delved into how solutions were developed, focusing on applications that have been deployed in the field and are being used in live traffic situations. Success stories have been shared along with failures and problems so participants could learn what does and doesn't work and why. The Forum eventually expanded to include live demonstrations of rural ITS technologies and "hands-on" question and answer periods. Participants brought actual ITS equipment and performed informal "show and tell" sessions during the breaks. In addition to a live demonstration of ITS communication technologies, short briefings on specific Rural ITS research projects and product development were also conducted.

Integrated Corridor Management examined what may be required to reach the deployment stage for a rural ICM plan, as well as the development of a web-based data clearinghouse to support it. This effort represented a blueprint for what may be required to create a rural ICM. Based on the work completed, it was concluded that the concept of ICM is applicable to rural areas and expected to yield a number of benefits. These included improved traveler safety and mobility, enhanced goods movement, and the availability of information to agencies in a timelier manner. In addition, the work completed under this portion of COATS Phase 3 will ultimately assist other Caltrans efforts, namely the development of One Stop Shop.

7.2. Summary of Deliverables

During the course of the Phase 3 effort, a number of deliverables were produced. Specific report documents and memoranda are listed in the References section of this report. In terms of deliverables produced over the course of the project, these included:

- Quarterly progress reports;
- Meeting minutes (Steering Committee meetings and conference calls);
- Organization and conduct of the Western States Rural Transportation Technology Implementers Forum from 2006 through 2008;
- Annual reports summarizing the Western States Rural Transportation Technology Implementers Forum;
- Development of the Integrated Corridor Management Clearinghouse website (http://www.weathershare.org/ICM/);
- Development, support and final documents associated with Integrated Corridor Management;
- Conference presentations:

- o Applying Integrated Corridor Management to the Rural COATS Region - 2007 National Rural ITS Conference;
- o Rural Integrated Corridor Management in the COATS Region - 2008 Northwest Transportation Conference;
- o Application of Integrated Corridor Management to Rural Areas - 15th World Congress on ITS.

7.3. Conclusion

The COATS Phase 3 project, running between 2006 and 2009, focused on two primary activities. These were technology transfer, specifically the Western States Forum, and leveraging, which consisted of an investigation into the application of Integrated Corridor Management for rural areas and the development of a web-based data clearinghouse to support such an application.

Since its inception, the Western States Forum has grown both in terms of attendance, as well as the scope of material being presented and discussed. This event has continued under the scope of COATS Phase 4 and is expected to keep providing an intimate forum for the discussion of rural ITS applications, successes, and failures. In providing such a venue for ITS discussion, one of COATS' overriding goals was met: promoting technology transfer.

The preliminary investigation of Integrated Corridor Management indicates that it can be successfully applied in a rural environment. This application is contingent upon a number of factors being in place (deployments, stakeholder buy-in, etc.). The potential benefits in terms of traveler safety, goods movement and interagency data-sharing/coordination make ICM an attractive application in addressing many rural transportation problems. The data-sharing platform developed as a part of this work has provided a means for timelier data acquisition across jurisdictional boundaries, as well as served to lay the foundation for subsequent development efforts, such as One Stop Shop. In allowing for the sharing of data between agencies, through a more streamlined approach, another of COATS' overriding goals was met: fostering bi-state cooperation and communication. In meeting these goals, it is believed that the COATS Phase 3 effort achieved its intended purpose. Subsequent efforts should strive to similarly meet the overall goals of COATS, while also seeking to meet the rural ITS needs of stakeholders and expand the audiences that participate in the effort.

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