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16. Abstract
This report summarizes the Year 1 activities under implementation project 5-4969-01, Wireline ITS Communications Training. The overall objective of the project is to modify the workshop offerings developed in a previous project to an 8-hour format, and teach the workshop materials at 10 locations across the state, including a pilot workshop. Year 1 activities included workshop modification, pilot course offering, and scheduling of workshops.

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WIRELINE ITS COMMUNICATIONS TRAINING: YEAR 1 REPORT OF ACTIVITIES

by

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DISCLAIMER

This research was performed in cooperation with the Texas Department of Transportation (TxDOT) and the Federal Highway Administration (FHWA). The contents of this report reflect the views of the author, who is responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official view or policies of FHWA or TxDOT. This report does not constitute a standard, specification, or regulation.   The researcher in charge of the project was Robert E. Brydia.

ACKNOWLEDGMENTS

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INTRODUCTION AND HISTORY OF PROJECT

INTRODUCTION

The telephone was the beginning of a worldwide revolution in communications. From a single connection demonstrated in 1876 to the first telephone exchange in 1877 to the first inter-city connections in 1883, the growth of the telephone highlights the historical birth of wide area communications.

Within 15 years of its invention, the number of telephones in use in the United States exploded to more than five million. A growing system of telephone lines—primarily bare copper wire—made possible these long-distance connections. The greatest limitation to the telephone's usefulness was that a wire could carry only one conversation at a time. Telephone exchanges were constructed to handle the switching of calls and manually connect one wire to another to complete the voice circuit. In 1927, the first demonstration of video transmission along the telephone network took place between Washington D.C. and New York City.

In 1941, the first segment of the national telephone network using coaxial cable went into service. Coaxial cable was a vast improvement over the existing copper cable and was able to carry more calls at a lower cost. Trans-Atlantic telephone service via telephone cable was initiated in 1956 and could carry 36 simultaneous calls.

In 1983, AT&T laid the first fiber optic cable on the national long-distance network. Today, the domestic long-distance network is nearly 98 percent fiber optic. A single strand of fiber carries thousands of simultaneous calls at a fraction of the cost of copper cabling.

From these modest beginnings, the era of communications grew to encompass all aspects of our lives. From telephone calls to cable television to Internet connectivity, achieving stable and reliable communications is a critical component of providing high-quality services.

COMMUNICATIONS FOR ITS

In much the same way, intelligent transportation systems (ITS) rely on these same communication services to collect information and provide services. From roadway sensors to remote video cameras to dynamic message signs (DMS) and Internet traffic sites, communications are a critical component of the solutions deployed by the Texas Department of Transportation (TxDOT).

Today, TxDOT engineers are responsible for the design, evaluation, and implementation of ITS solutions across the entire state. These installations occur with vast differences in requirements, expectations, and constraints. Over time, as the available communication options have expanded, it has become more difficult to have a comprehensive overview of the basics as well as a thorough understanding of the pros and cons of the different technologies.

TxDOT RESEARCH PROJECT 0-4969

TxDOT Project 0-4969, performed during fiscal year 2005, answered the challenge of providing a comprehensive overview of communications for ITS applications. Specifically, the project established the objectives of:

- determining the fundamental concepts of communication knowledge necessary for all employees utilizing these technologies as part of their ITS solutions;

- designing an evaluation process for typical communication technologies used in ITS deployments to ensure TxDOT can design and implement practical, cost-effective, reliable, and consistent communication systems; and

- preparing workshop materials enabling TxDOT to train its employees in both the fundamental requirements and the stepwise evaluation process for communications systems.

The design/evaluation process and workshop materials were pilot tested near the end of the project. The 14 participants in the pilot workshop evaluated workshop materials on a scale of "Very Good" to "Very Poor." Table 1 shows the results of these evaluations. The scores highlight the success of the project materials.

Table 1. Project 0-4969 Pilot Workshop Materials – Evaluation Results.

Module	Percent					Percent Good or Better
	Very Good	Good	Average	Poor	Very Poor	
1 – Introduction	Module not Evaluated.					
2 - Basics of Wireline Communication	82	18	0	0	0	100
3 - Understanding Telecommunications Protocols and Topologies	36	64	0	0	0	100
4 - Technology Choices	55	46	0	0	0	100
5 - System Design and Evaluation	27	73	0	0	0	100
6 - Case Studies	46	46	9	0	0	91

In addition to the evaluation of the workshop materials, participants were asked to provide feedback and evaluation on the course itself. Table 2 shows the results of this overall evaluation and showcases the success of the pilot workshop in achieving the stated objectives. The target audience of the workshop was broad-based to any TxDOT employee who works with ITS systems or components. Based on analysis of the provided written comments, the participants who answered "Somewhat" for meeting expectations and objectives were expecting more in-depth coverage of wireless communications and/or video transfer. While both of these topics were addressed in the materials, a detailed treatment was outside the scope of Project 0-4969.

Table 2. Project 0-4969 Pilot Workshop Evaluation Results.

	Percent		
Workshop Content	**Yes**	**Somewhat**	**No**
1. Did the workshop meet your expectations?	75	25	0
2. Did the workshop description match the subject matter presented?	100	0	0
3. Were the workshop objectives met?	75	25	0
4. Was the workshop presented at the correct level of difficulty?	83	17	0
5. Was the information presented in an informative manner?	100	0	0
6. Was the overall quality and usefulness of the materials (e.g., written materials, videos, etc) appropriately geared to providing that information?	100	0	0
7. Do you feel that the time spent on this course was beneficial?	100	0	0

The result of particular note from the evaluation was the unanimous comment that the material should be presented in a full-day, 8-hour workshop as opposed to the half-day (4-hour) format used for the pilot. Participants felt that the material was both important enough and extensive enough to devote an entire day to learning the background, application, and case studies used in the workshop.

TxDOT IMPLEMENTATION PROJECT 5-4969-01

Given the strong results from the pilot workshop, TxDOT decided to proceed with an implementation project to provide a wider opportunity for disseminating the information across the state. The implementation project originated in March 2006 and ends August 2007. The work tasks across the project timeframe include:

- Task 1 – Modify workshop materials
- Task 2 – Conduct pilot workshop
- Task 3 – Update workshop materials as appropriate

- Task 4 – Plan and schedule formal workshops

- Task 5 – Document FY06 activities

- Task 6 – Conduct formal workshops

- Task 7 – Document FY07 activities

- Task 8 – Provide TxDOT with workshop materials

Tasks 1-5 were scheduled for FY06 and are covered in this report. Tasks 6-8 are scheduled for FY07.

STATUS OF YEAR 1 TASKS

TASK 1 – MODIFY WORKSHOP MATERIALS

Feedback from the pilot workshop participants and the experience of the workshop instructors indicated that the existing workshop materials developed in Project 0-4969 encompassed approximately 6 hours of instruction. Therefore, the objective of Task 1 of the implementation project was to include additional material that was, at most, 2 hours in length. The total length of the instructional material would then equal 8 hours, which was the recommendation from the pilot workshop.

The workshop materials have been expanded in several areas to enhance the background information provided to course participants. While the objective was not to provide a single point of reference for all topics related to communication, a number of areas were enhanced to provide a more robust offering of material. Expanded topics included:

- history of communications,
- common fiber optic connectors,
- additional fiber optic topics (e.g., attenuation, loss),
- common cable connectors,
- discussion of electromagnetic spectrum,
- interface between wireline and wireless systems,
- additional discussion on standards for video encoding,
- additional networking topics (e.g., unicasting, multicasting), and
- discussion of future trends.

In addition to the text topics, a large number of additional pictures and tables have been included in the text to help illustrate the above bullet points. While many of the charts, tables, and figures presented in the participant's notebook will be seen during the workshop presentation via slide, the notebook also contains some information that will not be presented during the workshop. This concept of additional information allows the workshop materials to be used as a desk reference following the workshop.

In addition to revision of the participant's notebook, revisions were made to the instructor's notebook. As per the format established in Project 0-4969, information from the text of the instructor's notebook was abstracted into slides for classroom presentation and discussion.

The instructor's manual utilizes a full-color, half-page picture of each slide with speaker comments below. Printed dual-sided, the instructor's manual is both an effective study tool for course preparation, as well as providing a forum for recording specialized notes or comments during the course of the workshop. Overall, more than 40 slides have been added into the instructor materials for workshop presentation.

TASK 2 – CONDUCT PILOT WORKSHOP

The pilot workshop is scheduled for September 28, 2006. The timeframe for accomplishing this task slipped from the first year of the project due to scheduling conflicts. It is not anticipated that this will have any effect on the overall timeframe of the project.

As with the pilot workshop on the initial project, participants will be asked to provide feedback on the course content, teaching, and course examples. These comments and feedback will be instrumental in preparing the final set of workshop materials for statewide dissemination.

TASK 3 – UPDATE WORKSHOP MATERIALS AS APPROPRIATE

As a result of the adjusted timeframe for accomplishing Task 2, Task 3 was not started during Year 1. Task 3 will be accomplished after the completion of Task 2, with no additional cost or timeframe implications on the overall project schedule.

TASK 4 – PLAN AND SCHEDULE FORMAL WORKSHOPS

The initial step in scheduling formal workshops was to obtain approval from TxDOT's Human Resources Division to present this workshop as an official offering. The request was submitted to the TxDOT Standing Committee on Training (SCOT) on August 8, 2006. Conditional approval was obtained, with final approval pending the results of the pilot workshop.

While formal scheduling has not taken place, pending SCOT approval as a course offering, strong interest has been received in support of the workshop from multiple districts within the state. Interest has been recorded and will be matched with available space, attendees, and teaching timeframes in the near future. Statewide interest in this workshop offering is being obtained using the resources of the Human Resources Division and the training section within the division.

It is likely that several workshops will be scheduled initially, with additional workshops taking more time to coordinate and schedule. A full accounting of workshop locations and associated information will be recorded for each workshop. In accordance with the implementation contract, TxDOT is responsible for securing facilities, promoting the workshop, and inviting participants to all workshops.

TASK 5 – DOCUMENT FY06 ACTIVITIES

This report serves as the documentation of FY06 activities.