

1. Report No. FHWA/TX-06/5-1439-01-2		2. Government Accession No.		3. Recipient's Catalog No.	
4. Title and Subtitle DEVELOPMENT AND DELIVERY OF RESEARCH IMPLEMENTATION WORKSHOPS IN TRANSPORTATION OPERATIONS AND MANAGEMENT				5. Report Date September 2005	
				6. Performing Organization Code	
7. Author(s) Gary B. Thomas, P.E., Ph.D.				8. Performing Organization Report No. Report 5-1439-01-2	
9. Performing Organization Name and Address Texas Transportation Institute The Texas A&M University System College Station, Texas 77843-3135				10. Work Unit No. (TRAIS)	
				11. Contract or Grant No. Project 5-1439	
12. Sponsoring Agency Name and Address Texas Department of Transportation Research and Technology Implementation Office P.O. Box 5080 Austin, Texas 78763-5080				13. Type of Report and Period Covered Implementation Report: September 2001 - August 2005	
				14. Sponsoring Agency Code	
15. Supplementary Notes Project performed in cooperation with the Texas Department of Transportation and the Federal Highway Administration. Project Title: Transportation Research Implementation Consortium for Operations and Management (TRICOM) URL: http://tti.tamu.edu/documents/5-1439-01-2.pdf					
16. Abstract Bridging the gap between state-of-the-art and state-of-the-practice is vital to improving the safety and efficiency of our streets and highways. The goal of this project was to present practitioners with the latest tools and innovations in transportation engineering through interactive adult-learner-oriented workshops. The topics of the workshops focused on traffic operations research projects recently completed at the Texas Transportation Institute. In all, nine workshops were developed and taught 39 times to approximately 700 participants.					
17. Key Words Professional Development, Technology Transfer, Training, Workshops, Continuing Education, Operations			18. Distribution Statement No restrictions. This document is available to the public through NTIS: National Technical Information Service Springfield, Virginia 22161 http://www.ntis.gov		
19. Security Classif.(of this report) Unclassified		20. Security Classif.(of this page) Unclassified		21. No. of Pages 20	22. Price

**DEVELOPMENT AND DELIVERY OF RESEARCH IMPLEMENTATION
WORKSHOPS IN TRANSPORTATION OPERATIONS AND
MANAGEMENT**

by

Gary B. Thomas, P.E., Ph.D.
Center Director
Texas Transportation Institute

Report 5-1439-01-2
Project Number 5-1439
Project Title: Transportation Research Implementation Consortium for
Operations and Management (TRICOM)

Performed in cooperation with the
Texas Department of Transportation
and the
Federal Highway Administration

September 2005

TEXAS TRANSPORTATION INSTITUTE
The Texas A&M University System
College Station, Texas 77843-3135

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 the FHWA or TxDOT. This report does not constitute a standard, specification, or regulation. The engineer in charge was Gary B. Thomas (Texas P.E. #88914).

The United States Government and the State of Texas do not endorse products or manufacturers. Trade or manufacturers' names appear herein solely because they are considered essential to the object of this report.

ACKNOWLEDGMENTS

This project was conducted in cooperation with TxDOT and FHWA. The author gratefully acknowledges the contributions of numerous persons who made the successful completion of this project possible. Among the many people who helped with the development of course materials and/or served as instructors are: Steven P. Venglar, Srinivasa R. Sunkari, Scott A. Cooner, Kay Fitzpatrick, Montasir M. Abbas, Marc Jacobson, Garry Ford, and Roelof Engelbrecht.

Special thanks are extended to TxDOT for support of this implementation project. The author also acknowledges the following members of the project monitoring committee, both past and present, for their leadership, time, efforts, and contributions:

Implementation Director

- Al Kosik, P.E., Traffic Operations Division, TxDOT;

Technical Panel

- Henry Wickes, P.E., Traffic Operations Division, TxDOT;
- Kit Bennett, Human Resources Division, TxDOT;

RTI Engineer

- Wade Odell, P.E., Research and Technology Implementation Office, TxDOT;

Previous Technical Panel Member

- Dan Maupin, P.E., former TxDOT employee; and
- Brian Van De Walle, P.E., former TxDOT employee.

TABLE OF CONTENTS

	Page
List of Figures	viii
List of Tables	ix
Introduction	1
Course Development and Deliveries	3
Instructor-Led Workshops	3
Traffic Signal Operations near Highway-Rail Intersections.....	3
Diamond Interchange Signal Operations	4
Arterial Optimization	4
Beginning CORSIM.....	5
Advanced CORSIM	5
Designing and Operating Video Image Vehicle Detection Systems	5
Setup and Operation of Traffic Responsive Plan Selection Control.....	6
Advance Coordination Features in Traffic Signal Controllers	6
Urban Intersection Design	7
On-Line Workshops.....	8
Course Deliveries.....	9
Course Updates	9

LIST OF FIGURES

	Page
Figure 1. TTI Researchers Served as Instructors.....	1
Figure 2. Screen Shot of On-Line Course Page.....	8
Figure 3. Courses Were Held at TxDOT Training Facilities.....	9

LIST OF TABLES

Page

Table 1. TRICOM Course Deliveries 10

INTRODUCTION

Rapidly evolving technology and new research findings constantly keep changing how traffic and transportation engineers should manage their systems for optimal efficiency and safety. Bridging that gap between state-of-the-art and state-of-the-practice is the primary objective of this project. After all, what would be the purpose of research if the results are not implemented in the field?

In collaboration with Texas Transportation Institute (TTI) researchers in the transportation operations field, the Center for Professional Development at TTI completed a project to bring research results to the Texas Department of Transportation. This project, Transportation Research Implementation Consortium for Operations and Management (TRICOM), developed nine new courses and delivered them 39 times to approximately 700 participants over the span of four years.

All of the courses were designed using adult-learning principles with emphasis on student interaction, in-class hands-on exercises, and extensive classroom discussions. The courses were taught by TTI researchers (Figure 1) at TxDOT training facilities throughout the state including Abilene, El Paso, Fort Worth, Austin, Atlanta, and others. Additionally, many of the courses were featured at TxDOT's



Figure 1. TTI Researchers Served as Instructors.

annual Traffic Signal Technical Workshops in Corpus Christi in 2003, 2004, and 2005.

Two of the instructor-led courses have been converted to on-line versions. These courses are integrated into TxDOT's learning management system and can be taken for credit by any TxDOT employee from a personal computer with access to the system.

COURSE DEVELOPMENT AND DELIVERIES

INSTRUCTOR-LED WORKSHOPS

During the course of the TRICOM project, TTI researchers developed a total of nine new instructor-led workshops:

- Traffic Signal Operations near Highway-Rail Intersections,
- Diamond Interchange Signal Operations,
- Arterial Optimization,
- Beginning CORSIM,
- Advanced CORSIM,
- Designing and Operating Video Image Vehicle Detection Systems (VIVDS),
- Setup and Operation of Traffic Responsive Plan Selection (TRPS) Control,
- Advance Coordination Features in Traffic Signal Controllers, and
- Urban Intersection Design.

Descriptions of each course are presented below.

Traffic Signal Operations near Highway-Rail Intersections

This course provides the practicing transportation engineer with the concepts, methodology, and issues involved in the design of signal timings for traffic signals near active railroad crossings. The one-day course reviews the history of rail preemption at traffic signals. Ongoing efforts to improve the practice are also highlighted. The course presents the results of recent studies conducted and findings made in this area. Topics covered include: terminology, rail and signal aspects of rail-preemption, typical preemption design process, simultaneous and advance preemption, and warning time variability. The course reviews the TxDOT worksheet and describes the terms and assumptions to effectively use the worksheet. Some of the shortcomings and pitfalls of rail preemption in signal operations are identified and solutions suggested. Example signal timings for an intersection near a rail crossing are demonstrated. Participants evaluate a number of scenarios at this crossing. The workshop provides hands-on simulation of the signal priority settings using the Rail Preemption Exerciser program. The Rail Preemption Exerciser program is a training tool developed by TTI to test various scenarios of rail preemption.

- Target audience: traffic operations engineers and signal technicians
- Course duration: 1 day
- TxDOT Course: TRF-331

Diamond Interchange Signal Operations

This one-day course reviews the evolution of various stages of diamond interchange signal operations and the advantages and disadvantages of each stage. The goal of the course is to revisit the conventional methods and strategies of signal control and their applicability for various traffic and geometric conditions. Advanced controller features such as dynamic maximum green, dynamic split, conditional service, and others are explained and demonstrated. The course also provides the experienced signal operations engineer with recent research findings on new ways to help improve diamond interchange operations. To demonstrate the use of PASSER III-98[®], an example problem is worked out in the course.

- Target audience: traffic operations engineers and signal technicians
- Course duration: 1 day
- TxDOT Course: TRF-326

Arterial Optimization

This course provides practicing traffic engineers and signal technicians with the background information and skills necessary to use the PASSER II-02[®] and Synchro[®] traffic signal optimization software packages. The one-day workshop reviews basic traffic engineering theory and safety considerations for arterial traffic signal control. Course participants then use the PASSER II-02 and Synchro software through instructor-guided examples to develop optimal signal solutions for individual intersections and signals along an arterial roadway. As each signal or network is analyzed, emphasis is placed on using the features of the software to provide optimal timing solutions. A final aspect of the course is general guidance on taking timing solutions as output from the software analysis package and using them in the field.

- Target audience: traffic signal engineers/signal system managers and signal technicians
- Course duration: 1 day
- TxDOT Course: TRF-316

Beginning CORSIM

The Beginning CORSIM workshop covers the basics of traffic modeling. The course emphasizes the microscopic, detailed modeling found in CORSIM. Instructors review all aspects of data entry including: geometric, traffic volume (counts or origin-destination data), and signal controller information. Each type of input is covered using TRAFED, the native network editor contained within CORSIM. Discussion on the supplemental details of network coding prepares participants to use the text editor within CORSIM for fine-tuning the data set. Surface street networks, freeway networks, and combined surface street and freeway networks are covered both in the coding examples worked through in the class and in the detailed discussion of network and CORSIM features. Supporting issues, such as model calibration and model validation, are also discussed.

- Target audience: traffic operations engineers, transportation planners, and engineering technicians
- Course duration: 1 ½ days
- TxDOT Course: TRF-708

Advanced CORSIM

The Advanced CORSIM course reviews material from the basic course and presents the more advanced functions of CORSIM including: vehicle calibration, actuated signal parameters, traffic assignment methods, incident modeling, and carpooling.

- Target audience: traffic operations engineers, transportation planners, and engineering technicians
- Course duration: 1 ½ days
- TxDOT Course: TRF-707

Designing and Operating Video Image Vehicle Detection Systems

This one-day course provides practicing traffic engineers and signal technicians with the background information and skills necessary to plan, design, and operate a video image vehicle detection system. Key design and operation considerations and issues associated with VIVDS are discussed. The difference in detection design procedure/concept between VIVDS and traditional loop detectors is described. The workshop also shows participants how to design or

redesign a VIVDS by identifying the best camera location and field-of-view and how to operate a VIVDS by identifying the best layout and settings for both low-speed and high-speed intersections. Evaluation of the adequacy and diagnosing problems of an existing VIVDS is also presented. Participants also learn how to develop a schedule of maintenance checks to ensure ongoing performance of the VIVDS.

- Target audience: Traffic signal engineers/signal system managers and signal technicians
- Course duration: 1 day
- TxDOT Course: TRF-317

Setup and Operation of Traffic Responsive Plan Selection Control

This workshop demonstrates the setup and use of the Traffic Responsive Plan Selection control mechanism currently available in traffic signal controllers that meet TxDOT specifications. Since its development in the 1970s, TRPS mode remained as an underused resource due to the complexity of its configuration. Numerous parameters (i.e., detector weights, thresholds, timing plan look-up tables, TRPS timing plans, etc.) had to be set up correctly for the system to work as intended. Due to the complexity of TRPS mode, traffic engineers have typically preferred to use the time-of-day mode of operation for its ease of setup. This workshop transfers technology obtained during a TxDOT research project that developed guidelines for the configuration of the TRPS control mechanism in traffic signal controllers.

- Target audience: traffic operations engineers and signal technicians
- Course duration: 1 ½ days
- TxDOT Course: TRF-321

Advance Coordination Features in Traffic Signal Controllers

This workshop demonstrates the use of the advance coordination features currently available in traffic signal controllers that meet TxDOT specifications. Traffic signal controllers have a combination of basic and advance coordination features. Typically engineers and technicians only use the basic coordination features to operate signals. This kind of operation meets the minimum requirements of operating arterial signals. However, documentation about the use of advance coordination features is not available. There are no guidelines about which

coordination features to use, where to use them and how to use them. This workshop transfers technology obtained during a TxDOT research project that developed guidelines for the use of advance coordination features in traffic signal controllers.

- Target audience: traffic operations engineers and signal technicians
- Course duration: 1 day
- TxDOT Course: TRF-322

Urban Intersection Design

This two-day course provides the practicing transportation engineer with the concepts, methodology, and issues involved in the design of urban intersections. Intersections are an important part of a highway facility because the efficiency, safety, speed, cost of operation, and capacity of the facility are dependent on their design to a great extent. Each intersection involves through- or cross-traffic movements on one or more of the highways and may involve turning movements between these highways. Such movements may be facilitated by various geometric designs and traffic controls, depending on the type of intersection. The main objective of intersection design is to facilitate the convenience, comfort, and safety of people traversing the intersection while enhancing the efficient movement of motor vehicles, buses, trucks, bicycles, and pedestrians. In order to design intersections that are both functional and effective, designers need current information regarding intersection design that is easily accessible and in a user-friendly format. The Texas Department of Transportation Project 0-4365 produced a reference document, the Urban Intersection Design Guide, to provide this information. The document is presented in two volumes: Volume 1 – Guidelines and Volume 2 – Applications. The project provides TxDOT and other interested parties with useful and practical information on operations and design for intersections.

- Target audience: design and traffic engineers
- Course duration: 2 days
- TxDOT Course: not assigned yet

ON-LINE WORKSHOPS

Two of the instructor-led workshops were adapted into on-line courses: “Traffic Signal Operations near Highway-Rail Intersections” and “Diamond Interchange Signal Operations.” These courses are located on the Texas Department of Transportation’s learning management system. Course developers used the software program ReadyGo Web Course Builder® to structure the material in a format that was compatible with TxDOT’s MeridianKSI® learning management system. Significant use of Macromedia Flash® was also employed to illustrate some of the more complex topics presented in the courses. Figure 2 illustrates a sample screen shot of an on-line course page.

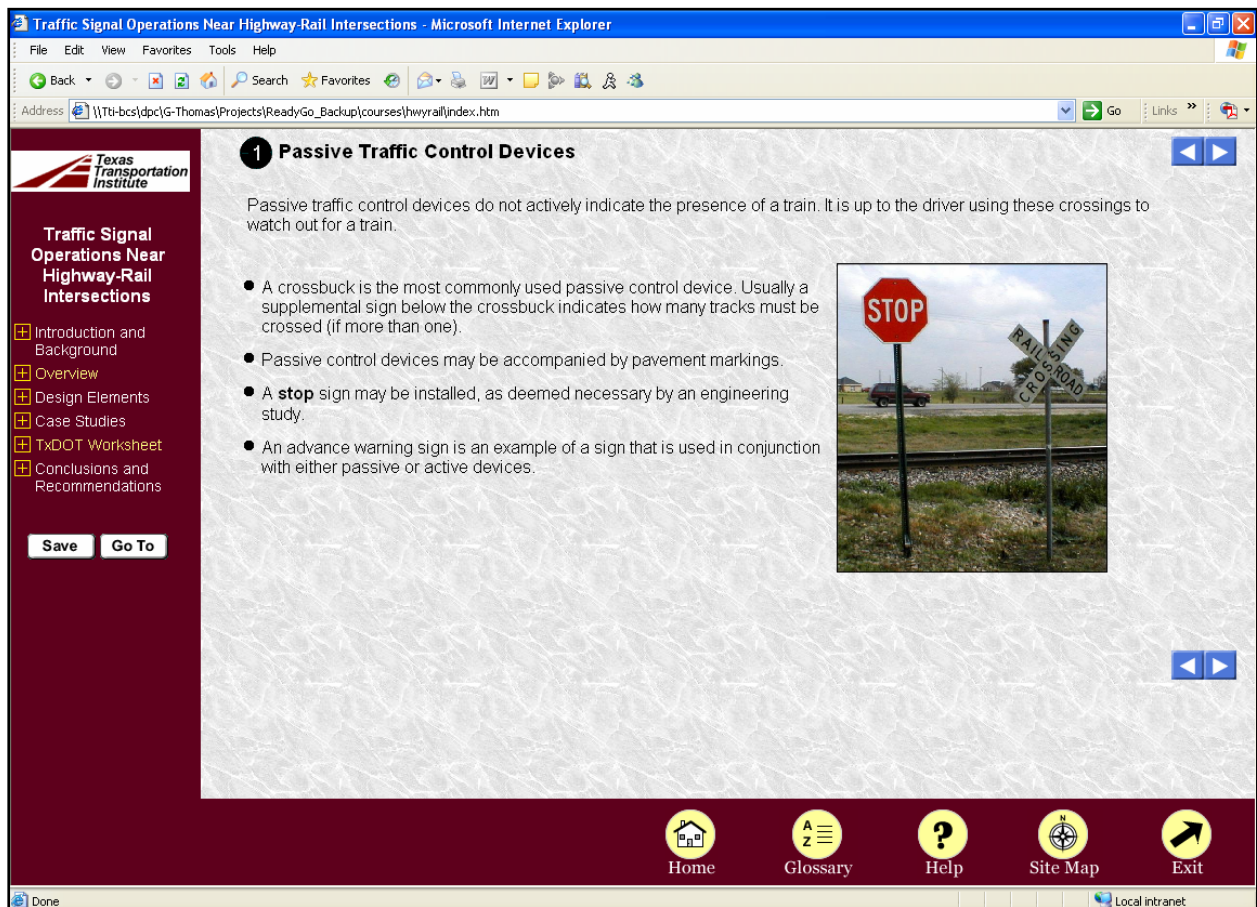


Figure 2. Screen Shot of On-Line Course Page.

COURSE DELIVERIES

TTI instructors conducted 39 workshops during the length of the project. In order to minimize travel for participants, all of the workshops were held at TxDOT's state-of-the-art training facilities at district offices throughout the state (Figure 3). Table 1 lists all of the deliveries, their locations, and the number of attendees for each workshop. In total, approximately 700 participants attended the TRICOM workshops. While the vast majority of the participants were TxDOT employees, it should be noted that numerous attendees came from local governments, metropolitan planning organizations, and private consulting firms.



Figure 3. Courses Were Held at TxDOT Training Facilities.

COURSE UPDATES

Workshops were updated based on comments received from course participants. In the case of the CORSIM classes, both the beginning and advanced courses were updated due to a newer software version that was released during the duration of the project. For the “Traffic Signal Operations near Highway-Rail Intersections” course, the examples shown in class were modified to more clearly present the outcomes from each change in the signal or railroad warning timing. This change was made in specific response to participant comments on the course wherein attendees had trouble discerning the full intent of each example.

Table 1. TRICOM Course Deliveries.

Date	Location	Workshop Title	Attendees
Oct. 10, 2001	Abilene	Traffic Signal Operations near Highway-Rail Intersections	20
Nov. 18, 2002	Austin	Diamond Interchange Signal Operations	15
Nov. 19, 2002	Austin	Traffic Signal Operations near Highway-Rail Intersections	14
Nov. 21, 2002	Austin	Beginning CORSIM	8
Jan. 28, 2003	Abilene	Beginning CORSIM	12
Apr. 9, 2003	Corpus Christi	Beginning CORSIM	18
Apr. 9, 2003	Corpus Christi	Diamond Interchange Signal Operations	38
May 20, 2003	Atlanta	Diamond Interchange Signal Operations	18
May 21, 2003	Atlanta	Traffic Signal Operations near Highway-Rail Intersections	16
Jun. 4-6, 2003	El Paso	Freeway Traffic Operations and Management*	7
Jun. 21, 2003	Atlanta	Beginning CORSIM	15
Jul. 23, 2003	Ft. Worth	Diamond Interchange Signal Operations	23
Jul. 24, 2003	Ft. Worth	Traffic Signal Operations near Highway-Rail Intersections	27
Jul. 24-25, 2003	Ft. Worth	Arterial Optimization	15
Feb. 4, 2004	Pharr	Diamond Interchange Signal Operations	16
Feb. 5, 2004	Pharr	Arterial Optimization	16
Feb. 6, 2004	Pharr	Traffic Signal Operations near Highway-Rail Intersections	19
Feb. 24, 2004	El Paso	Diamond Interchange Signal Operations	19
Feb. 25, 2004	El Paso	Arterial Optimization	20
Feb. 26, 2004	El Paso	Traffic Signal Operations near Highway-Rail Intersections	21
Apr. 7, 2004	Corpus Christi	Traffic Signal Operations near Highway-Rail Intersections	14
Apr. 8, 2004	Corpus Christi	Designing and Operating VIVDS	25
Apr. 8, 2004	Corpus Christi	Arterial Optimization	20
May 11, 2004	Atlanta	Arterial Optimization	12
May 12-13, 2004	Atlanta	Advanced CORSIM	12
July 6, 2004	Ft. Worth	Designing and Operating VIVDS	23
July 7-8, 2004	Ft. Worth	Beginning CORSIM	13
Aug. 19, 2004	College Station	Designing and Operating VIVDS	14
Aug. 19-20, 2004	Austin	Beginning CORSIM	10
Feb. 1, 2005	Atlanta	Designing and Operating VIVDS	19
Feb. 8, 2005	Dallas	Designing and Operating VIVDS	19
March, 29, 2005	San Antonio	Designing and Operating VIVDS	20
Apr. 19, 2005	El Paso	Designing and Operating VIVDS	22
Apr. 20-21, 2005	El Paso	Beginning CORSIM	19
May 2, 2005	Corpus Christi	Advance Coordination Features in Traffic Signal Controllers	21
May 3, 2005	Corpus Christi	Designing and Operating VIVDS	22
May 3, 2005	Corpus Christi	Advance Coordination Features in Traffic Signal Controllers	11
May 4-5, 2005	Corpus Christi	Setup and Operation of TRSP Control	34
May 4-5, 2005	Corpus Christi	PASSER V*	13

* Course developed under separate contract but delivered through TRICOM project.