TTI-1-18-76-525-1F

A Training Course

SAFETY IMPROVEMENT PROGRAMMING FOR ROADSIDE OBSTACLES

VOL. III (PROJECT REPORT)

Prepared for

FEDERAL HIGHWAY ADMINISTRATION
U.S. Department of Transportation
Washington, D.C. 20590

(Contract DOT-FH-11-9185)
(FCIP Study No. 1-18-76-525)

Through the

TEXAS STATE DEPARTMENT OF HIGHWAYS
AND PUBLIC TRANSPORTATION
Austin, Texas

by

TEXAS TRANSPORTATION INSTITUTE

Texas A&M University
College Station, Texas

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16. Abstract

The report documents the development and implementation of a one-week training course on a cost-effectiveness analyses procedure for developing a roadside safety improvement program.

The project entailed two distinct efforts: (1) development of the course text, instructor's manual, and associated materials, and (2) refinement of the existing computer analysis model to provide output in a form amenable to manager interpretation and priority ranking of roadside safety improvements. The former was accomplished by the Texas Transportation Institute; the latter by the Texas State Department of Highways and Public Transportation. The training course included the updated version of the existing analysis model currently being used in Texas by the SDHPT and the data management computer software.

The refinements to the existing computer analysis model and the development of the data management computer programs are documented in a final report prepared by the Texas SDHPT, a complementary document to this report. The preparation of course materials and discussion of the course conduct are presented here.

The resultant course included a combination of lecture presentations with numerous visual aids, demonstration of procedural techniques using detailed case examples, and five workshop sessions in which participants demonstrated their ability to apply the principles taught in the lecture session.

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Graeme D. Weaver, Anton Huber and Donald R. Hatcher

TEXAS TRANSPORTATION INSTITUTE
Texas A&M University

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September 1977

STUDY DOCUMENTS

This report represents one of four documents prepared under Contract DOT-FH-11-9185 as listed below:

1. Safety Improvement Programming for Roadside Obstacles -- Course Text
2. Safety Improvement Programming for Roadside Obstacles -- Instructor's Manual
3. Safety Improvement Programming for Roadside Obstacles -- Project Report
4. Safety Improvement Programming for Roadside Obstacles -- Computer Documentation

The first three documents were prepared by the Texas Transportation Institute. The Texas State Department of Highways and Public Transportation prepared the computer documentation report.

NOTICE

ACKNOWLEDGMENTS

This document was prepared by the Texas Transportation Institute (TTI) under subcontract to the Texas Department of Highways and Public Transportation (SDHPT) for the Federal Highway Administration (Contract DOT-FH-11-9185). The course text, instructor's manual and visual aids were produced as training materials used at a one-week training course conducted in Atlanta, Georgia cooperatively by staff from TTI and the Texas SDHPT.

TTI staff included Graeme D. Weaver, principal investigator; A. Huber, D. R. Hatcher, and D. L. Woods. Appreciation is expressed to Lorice Bush for typing the manuscript.

Texas SDHPT staff included W. R. Ratcliff, principal investigator, W. L. Crawford, and A. R. Luedecke, Jr. Appreciation is expressed to these individuals for preparing drafts of selected chapters and visual aids, and for assisting in the conduct of the training course.

Special acknowledgment is extended to W. Collins and R. A. Richter (FHWA, Washington) for their invaluable assistance in arranging the necessary facilities and equipment at the Georgia Institute of Technology, and for their cooperation and advice throughout the research project.

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SAFETY IMPROVEMENT PROGRAMMING FOR ROADSIDE OBSTACLES

I. INTRODUCTION

THE PROBLEM

Highway safety administrators today are faced with the problem of attaining goals that are becoming increasingly more difficult to achieve in light of escalating costs of material, labor, and an inflated economy in general. Within these constraints and the more stringent limitations on available safety funds, the choices of safety improvement that can be programmed are by necessity reduced to those which return the largest pay-off for the safety dollar.

BACKGROUND AND DEVELOPMENT

An NCHRP Study, Report No. 148, (1) suggested a basic conceptual probabilistic model as a management tool in establishing priorities for roadside safety improvements. This cost-effectiveness approach provided a basic analysis technique for comparison of safety alternatives on freeways. The conceptual model was somewhat generalized and not readily implementable by operating agencies. The Texas State Department of Highways and Public Transportation and the Texas Transportation Institute cooperatively developed a formalized implementation procedure to program roadside obstacle safety improvements based on the cost-effectiveness analysis concepts presented in NCHRP 148. The procedure is applicable for controlled access roadways and rural non-controlled access highways.

This course was designed to acquaint safety personnel with the Texas implementation procedure and provide a sturctured training course in its actual application.

The application procedure to evaluate safety improvements for roadside hazards and to develop a safety program is composed of six related functions:

(1) Conducting a detailed physical inventory of the highway system to identify and locate each roadside hazard and other geometric factors that may influence the potential hazard of the obstacle

(2) Recommending feasible safety improvement alternatives for each hazard or for groups of hazards

(3) Defining accident history at or in the vicinity of applicable roadside obstacles

(4) Analyzing the recommended safety improvement alternatives using a computerized cost-effectiveness analysis model

(5) Establishing and maintaining a computerized master file of inventory information, accident information, and analysis of the proposed safety improvement recommendations

(6) Conducting a computerized data management process to select, sort, and report the master file information under a variety of allowable options. From this process, projects may be defined for inclusion in a roadside safety improvement program.

PROGRAM BENEFITS

The cost-effectiveness analysis model is capable of evaluating more than 30 improvement alternatives to approximately 50 hazards or hazard groupings containing up to 15 hazards each.

A master data file is developed containing all roadside hazard inventory and recommended improvement data, computed cost-effectiveness values of each improvement, pertinent geometric factors influencing the

potential hazard, accident history of each applicable hazard and related accident indices, and other engineering information. Through use of comprehensive File Management Programs almost unlimited information can be extracted from the master file and printed. This computerized flexibility in data selection and sorting provides the safety administrator with a powerful tool with which to evaluate safety alternatives under a variety of specific options. The product is a comprehensive information source on which to develop an efficient roadside safety program. The procedure is directly responsive to the intent of Federal Highway Standards which call for objective prioritizing techniques for programming roadside safety improvements.

The procedure, developed as a management tool for prioritizing roadside safety improvements, offers additional benefits. Basic to efficient highway design, operations and maintenance is a well documented data base of existing roadway and roadside features. The master file and associated file management capabilities provide a valuable tool for maintenance engineers in identifying needed improvements. The safety attributes of alternative designs may be evaluated prior to construction.

PROJECT OBJECTIVES (Prospectus Statement)

The objective, as set forth in the research prospectus, is summarized below:

> *The objective of this project is to develop a training course on a cost-effective approach for programming roadside safety improvements. This course is to be designed to present the principles of cost-effectiveness analysis to highway personnel who bear responsibilities for forming a program to improve roadside safety on existing facilities. It is intended that the course will provide knowledge on a cost-effectiveness priority approach for programming roadside safety improvements where the application of such knowledge will help highway*

agencies to achieve the highest safety payoff for funds spent for roadside safety.

At the completion of the course each participant should be able to apply the analytical technique on roadside safety improvement programming to highway operations thereby making highway safety improvement programs more effective.

To achieve the objective, the course was developed to provide a training package to instruct participants in the background, development, and application of the Roadside Safety Cost-Effectiveness Priority Program currently in operation in Texas. The program, developed by the Texas Transportation Institute and the Texas State Department of Highways and Public Transportation is a computerized methodology to apply the cost-effectiveness concept documented in NCHRP Report No. 148. Emphasis throughout the course development was placed on providing participants the opportunity, in a workshop environment, to physically apply the techniques taught including conducting an actual roadside inventory and evaluating safety improvement alternatives using the computerized procedures.

SCOPE OF WORK (Prospectus Statement)

The scope of work, as outlined in the research prospectus, is summarized below:

The training course shall be designed as a stand alone training package. The instruction to be included in the course shall be developed so as to include recent innovations by research on a probabilistic hazard index model.

This project will entail the development of a training course relating to roadside safety improvement programming through the use of a probabilistic hazard index model. In addition to the development of the curriculum the project shall entail conducting the training, through a workshop technique using the developed curriculum, for the members of Safety Review Teams (SRT) where the members to be trained will be State personnel. The SRT members to be trained will be from States within one FHWA Region.

The training curriculum will include coverage of the following topics:

1. *The Hazard Model*

    a. *Hazard Index*
    b. *Severity Indices*
    c. *Vehicle Encroachment*

2. *Roadside Safety Improvement and Analysis*

    a. *Improvement Strategies*
    b. *Hazard Parameters*

3. *Cost-Effectiveness Approach*

4. *Inventory Requirements*

One workshop will be required to conduct training. This workshop shall provide for the training needs of SRT members. The workshop will accommodate one team per State, with up to eight States represented at the workshop. It is anticipated that the workshop will have a duration of five to ten days and have class sizes from 35 to 40 students. It shall be part of the Department of Highways effort to make recommendations in this regard. During the workshop it is intended that particular emphasis will be given to hands-on-experience in highway safety improvement programming. If computer applications are required for such hands-on-experience, the contractor will furnish the required computer application programs for use during the workshop.

The Government will provide training facilities for the workshop. The Department of Highways will provide instructors and all instructional materials including classroom texts.

The resultant course included, in a one-week time duration, a combination of lecture presentations with numerous visual aids, demonstration of procedural techniques using detailed case examples, and five workshop sessions in which participants demonstrated their ability to apply the principles taught in the lecture sessions. One workshop included a four-hour field inventory of a nearby roadway. Others provided the opportunity for participants to utilize, with instructor guidance and assistance, the computerized procedures to develop a roadside safety program.

RESEARCH APPROACH

The project entailed two distinct efforts: (1) development of the course text, instructor's manual, and associated materials, and (2) refinement of the existing computer analysis model to provide output in a form amenable to manager interpretation and priority ranking of roadside safety improvements. The former was accomplished by the Texas Transportation Institute; the latter by the Texas State Department of Highways and Public Transportation. The training course, therefore, included the updated version of the existing analysis model currently being used in Texas by the SDHPT and the data management computer software.

The refinements to the existing computer analysis model and the development of the data management computer programs are documented in a final report prepared by the Texas SDHPT, a complementary document to this report. The preparation of course materials and discussion of the course conduct are presented here.

The project tasks necessary to produce the training course materials are outlined below:

1. Review available literature and identify current techniques which contribute to safety improvement programming practices.
2. Develop a preliminary content listing of the topics to be covered in the course including a time schedule for presentation of material.
3. Develop a preliminary course format including definition of training techniques or instructional strategies.
4. Submit items (2) and (3) to the Federal Highway Administration for approval, recommendation and comments.
5. Develop a detailed course content and format including instructional

techniques and strategies for each topical session and training objectives for each training unit.

6. Prepare course text (student notebook) containing sufficient detail to provide the reader with a substantial background in roadside safety improvement analysis techniques, and a working knowledge of the application of the procedures to implement the cost-effectiveness analysis methodology
7. Prepare an Instructor's Manual that summarizes the major points to be made in each training unit and which provides instructional details and information for each topical area to be presented.
8. Develop visual aids for each applicable training unit.
9. Develop course announcement
10. Develop course enrollment procedures
11. Develop course evaluation plan
12. Conduct training course.

The manner in which the tasks were accomplished is described in the subsequent chapters of this report.

II. COURSE DEVELOPMENT

INTRODUCTION

The procedure to conduct the field inventory and analyze alternative safety improvements on Texas highways has been operational for more than two years. The development of the data file management programs to produce a usable managerial tool in establishing a roadside safety improvement program were developed as part of this research project.

The course content, thus, was to be developed to include:

(1) the concept of cost-effectiveness analysis and its application to evaluating roadside safety improvements.

(2) the technical background and rationale of the NCHRP 148 conceptual cost-effectiveness analysis model.

(3) the rationale and assumptions upon which the Texas implementation prodecure is based.

(4) the application of the Texas procedure including detailed explanation of the field inventory process and the computerized evaluation and data management process.

(5) instruction on the development of a roadside safety improvement program using the Texas procedure.

Presented in this section is a description of the method of accomplishment of each of the tasks to develop the training course.

LITERATURE REVIEW

The Request for Proposal (RFP) requirement indicated that the training course be developed to train participants in the analytical cost-effectiveness techniques described in NCHRP 148. Further, implementation procedures and

techniques were to be based on the recently completed and operational TTI/SDHPT process which represents the only computerized operationally application of the cost-effectiveness analysis concepts set forth in NCHRP 148. Since the Texas procedure was developed by TTI, a considerable portion of the literature review requirement was accomplished readily. The development of this procedure is documented in several previous reports (2, 3, 4, 5). In addition to these documents, techniques other than cost-effectiveness were identified. A discourse on various methods and techniques to develop safety programs was developed for inclusion in the course content with discussion of the attributes and deficiencies of each.

PRELIMINARY COURSE CONTENT AND FORMAT

The initial course content, categorized by major subject description, was submitted to the sponsor for review and comments prior to development of a detailed format and time schedule. A one-week training course was selected cooperatively by the contractor and the contract manager. Although this time allocation would impose certain logistical problems for a course of this highly technical curriculum, experience in developing other training courses indicated that a longer course would require participants to be absent from their operational activities or agencies for an unacceptable duration. Also, the course content was of a highly technical nature and it was believed that the more efficient training technique would entail providing each participant a course text containing comprehensive and detailed information on the subject while covering the "highlights" in the one week training course. The participant, therefore,

could study the course text in greater detail after being presented the significant information to understand the total process.

The course format was developed to include a balance between formalized classroom training (information transfer) and workshop activities in which the participants could demonstrate their understanding of the principles by applying the procedures through case examples, field activities and actual computer application to develop a roadside safety improvement program using real-world data.

Teaching sessions were limited in length to one hour. Where more time was needed to adequately cover specific topics, breaks were provided at each hour. Teaching sessions and workshops were scheduled to facilitate conduct of the 3-hour field inventory activity and to accommodate data keypunching and computer turn-around time requirements so that computer data would be available for certain workshops.

The preliminary course content and organizational format were submitted to the Federal Highway Administration contract manager for review, suggestions and approval.

DETAILED COURSE CONTENT AND FORMAT

After sponsor approval was obtained for the preliminary course content format, a detailed course content was developed utilizing three instructional strategies. Formalized classroom training was to be supported by continual visual aids. In each session, the instructor would introduce the topic, indicate the scope of the presentation and define the instructional objective of the session. Each session included a 40 to 50 minute presentation including summarizing the salient points. The remaining 10 minutes were devoted to answering questions.

Extensive use of case example illustration was programmed into the course content because this technique is highly useful in demonstrating methodology. In addition to case example demonstration by the instructors, participants were provided the opportunity to personally apply the procedural principles in workshop sessions, after which the instructors would demonstrate the correct solution to the case examples while the participants checked their solutions. In this type of session, participants were encouraged to discuss their particular state practices and reasons for solving the case examples in a particular manner.

The course content was also to include a three-hour roadside inventory so that participants could gain personal experience in assessing the real-world roadside situation and apply the coding principles. Instructors would provide assistance where needed. It is believed that this workshop activity was vitally important in training participants to apply the procedures.

The course content and format selected for the training course are shown in Exhibit 1.

COURSE TEXT

A course text was prepared and presented to each participant at the course. The text contained detailed information on the subject to provide the reader with a substantial background in roadside safety improvement analysis techniques and a working knowledge of the application of the procedures to implement the cost-effectiveness analysis methodology. Since it was intended to serve as a reference text, the document included detailed narrative of the material presented in the course, a comprehensive listing of reference documents for further study, and solved case examples and

EXHIBIT 1

COURSE AGENDA

(As Conducted in Atlanta, Georgia)

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
AM	1. Registration 2. Welcoming Remarks 3. Introduction and Concept of Cost-Effectiveness (Chapter 1 in Text) 4. NCHRP 148 Conceptual Model (Chapter 2 in Text) 5. Texas Cost-Effectiveness Analysis Procedure Development (Chapter 3 in Text)	1. Roadside Hazard Improvement Form (Chapter 6 in Text) 2. Workshop No. 1 -- Encoding of Case Examples (Chapter 7 in Text) 3. Organization of Field Teams	1. Building and Updating of Inventory Master File (Chapter 8 in Text) 2. Accident Data Incorporation (Chapter 9 in Text) 3. Procedure Adaptation For Individual States (Chapter 10 in Text) (See Note 1)	1. Workshop No. 3 -- Inspection of Computer Output and Correction of Errors 2. Development of Safety Program (Chapter 12 in Text) 3. Experience in Texas (Chapter 13 in Text)	1. Workshop No. 5 -- Team Presentation of Safety Program 2. Course Critique 3. Closing Remarks
PM	1. Application of Procedure (Chapter 4 in Text) 2. Roadside Hazard Inventory Form (Chapter 5 in Text)	1. Field Activity (Roadside Inventory on Selected nearby highways) (See Note 1)	1. Management Programs (Chapter 11 in Text) 2. Workshop No. 2 -- Preparation of Field Data For Computer Analysis	1. Workshop No, 4 -- Development of Safety Program by Participants	

Note (1) Field Activity was conducted in two parts -- half the class traveling to the field on Tuesday afternoon, the other on Wednesday morning. The lectures listed on Wednesday morning were presented on both Tuesday afternoon and Wednesday morning to the half of the class that was not conducting the field inventory.

supplementary problems.

The Course Text provided the nucleus of information around which the training sessions were developed, however, the text contained considerably more detailed information than could be covered in the one-week training course. The table of contents from the Course Text is included here (Exhibit 2) to illustrate the contents.

INSTRUCTOR'S MANUAL

An Intructor's Manual was prepared summarizing all major points to be emphasized in each training session and providing detailed teaching instructions for each topic area. The Instructor's Manual was intended to supplement the Course Text as a guide to the instructor in preparing for and making class presentations. It included instructional details relating to each Course Text chapter, chapter purpose, training objectives, and a print of each visual aid used with the corresponding lesson plan in outline form. Special instructions or training technique comments were also included.

The Course Text contains a very comprehensive presentation of the subject material; therefore, the instructor should be thoroughly familiar with the text content and the computer program and other documents referenced throughout the Course Text. The Instructor's Manual and Course Text were organized similarly; therefore the instructor could review or amplify a presentation by studying the appropriate chapter in the text and citing illustrative examples. Since much of the material is highly technical, it is recommended that an instructor study each chapter carefully to thoroughly understand the various case examples, input data, and format shown on case example slides, and computer formats shown in the visual aids. The Instructor's Manual narrative, lesson plan and visuals are cross-referenced

EXHIBIT 2

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EXHIBIT 2 (Continued)

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- 5.2.4 Width, W (Columns 67-69)
- 5.2.5 Length, L (Columns 70-72)
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- 6.2.2 Hazard/Improvement Costs (Columns 19-40)

EXHIBIT 2 (Continued)

EXHIBIT 2 (Continued)

EXHIBIT 2 (Continued)

EXHIBIT 2 (Continued)

EXHIBIT 2 (Continued)

to the appropriate material contained in the Course Text.

The general format of the Instructor's Manual, shown in Exhibit 3, included:

(1) topic title

(2) presentation time

(3) reference in Course Text

(4) purpose of presentation

(5) training objectives

(6) special instructions and comments

(7) visual aids for complete presentation

(8) lesson plan for each visual aid in outline form.

Also, included in the Instructor's Manual were copies of all handout materials presented to the participants through the course. These included Hazard Inventory and Improvement forms for workshops, copies of all data input forms to be used as reference when the small size lettering was difficult to see on certain visual aids, and other tabular data for use in certain workshops.

VISUAL AIDS

A system of high quality visual aids is considered to be equally important to the success of a training course as is the course content and the style of presentation. Approximately six hundred 35-mm (2x2) color slides were produced for the course considering:

(1) a need to maintain continuity of thought process

(2) a simplistic style for ease of understanding

(3) a diversification to avoid monotony

(4) example situations to reinforce important points.

EXHIBIT 3

EXAMPLES OF INSTRUCTOR'S MANUAL FORMAT

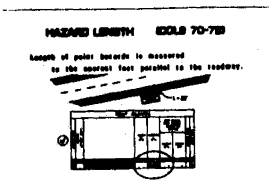
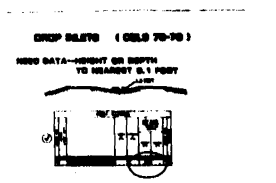
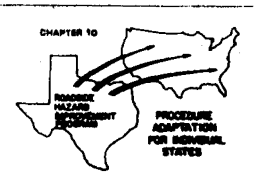
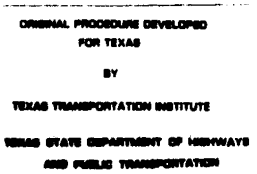
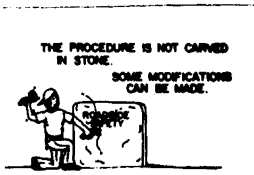
 5-40	Width of Hazard (Columns 67-69) 1. Measured to nearest foot at right angles to pavement edge 2. If hazard is skewed, measure width of "shadow" 3. Example shown: width of 11-ft 4. Width usually estimated
 5-41	Hazard Length (Columns 70-72) 1. Measured (estimated) to nearest foot parallel to roadway 2. Example shown: 32-ft length
 5-42	Drop Inlets, Height, or Depth (Columns 73-78) 1. For all other point hazards, leave blank 2. Recorded to nearest one-tenth of a foot 3. Measured from natural ground adjacent to inlet 4. Data necessary to adjust severity indices for certain types of inlets

EXHIBIT 3 (CONTINUED)

EXAMPLES OF INSTRUCTOR'S MANUAL FORMAT

 10-1	Title Slide: Procedure Adaptation for Individual States Purpose: (1) To define procedural elements that may require modification for application in other states (2) To define potential modificiations
 10-2	Emphasize: (1) NCHRP intent was that each state adapt the concept to its own needs and policy structure. (2) This procedure was developed specifically for Texas; therefore, certain features are unique to Texas and may not fit other states exactly.
 10-3	Procedure is <u>not</u> carved in stone! Emphasize: (1) Certain modifications can be made to existing program easily; others may involve complex internal changes. (2) User must decide what modifications must be made.

A blend of different types of visual aids was developed to maintain effectiveness in the presentation. Artist sketches, color photograph transparencies, graphs, diagrams, keyword outlines, cartoons, and step-by-step illustrative examples were used judiciously to convey ideas. In many sessions, two projectors and screens were used so that points could be made using several slides in succession on one screen while the other screen presented the topical outline or possibly a data input form to which the sub-points referred. All visual aids were numbered and cross-referenced to the appropriate screen in the Instructor's Manual.

COURSE ANNOUNCEMENT AND ENROLLMENT PROCEDURES

A course announcement brochure was developed to announce the course and describe the course content. The brochure (Exhibit 4) contained the course objectives, course agenda, qualifications of participants, and a brief outline of subjects to be covered.

Prior to announcing the course, a plan was prepared cooperatively by the FHWA and State contact in the area in which the course was to be presented for selection of participants. This plan provided a description of the desired qualifications of participants, agency representation, and professional discipline distribution. A class of approximately 40 to 50 participants was planned and achieved.

COURSE EVALUATION PLAN

A mechanism for obtaining feedback from class participants was developed and submitted to the FHWA contract manager for approval. The technique used (Exhibit 5) included a measure of the appropriateness and effectiveness of each topic covered, an evaluation of the time devoted to it, and a measure of the quality of the instruction and the teaching aids (visual aids, sample problems, etc.).

EXHIBIT 4

COURSE ANNOUNCEMENT BROCHURE

COSTS AND ENROLLMENT PROCEDURES

Tuition and material costs are borne by the FHWA. Participants will arrange travel and lodging accommodations. Registration details may be obtained from:

RICHARD A. RICHTER (HDV-21)
Federal Highway Administration
400 Seventh Street, S.W.
Washington, D.C. 20590
Phone: (202)426-9211

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(Back Cover)

UNITED STATES DEPARTMENT OF TRANSPORTATION

FEDERAL HIGHWAY ADMINISTRATION

ANNOUNCES

A TRAINING COURSE ON

HIGHWAY SAFETY

IMPROVEMENT PROGRAMMING

HOST ORGANIZATION:

Federal Highway Administration

WHERE:

Georgia Institute of Technology
Atlanta, Georgia

DATE:

May 23-27, 1977

PRESENTED BY:

Texas State Department of Highways and Public Transportation
Austin, Texas 78701

and

Texas Transportation Institute
Texas A&M University
College Station, Texas 77843

(Front Cover)

EXHIBIT 4 (Continued)

DESCRIPTION OF COURSE AND OBJECTIVES

This course, sponsored by the Federal Highway Administration, is designed to provide a practical approach toward implementation of cost-effectiveness techniques used by the Texas State Department of Highways and Public Transportation in evaluating roadside safety improvement alternatives. The course includes theoretical development and "hands on" experience in applying the computerized process. The objectives of the course are summarized as follows:

1. To present a concept of cost-effectiveness analysis of roadside safety improvements.
2. To provide instruction in the use and application of the Texas cost-effectiveness method of prioritizing roadside safety improvements.
3. To conduct a structured program of participant involvement in the application of the Texas cost-effectiveness methodology of roadside safety improvement programming.

COURSE OUTLINE AND SCHEDULE

First Day

- Introduction and Development of Procedure
- Application of Inventory Process

Second Day

- Application of Inventory Process (continued)
- Field Activity: Conducting Field Inventory Process

Third Day

- Development of Data File
- Application of Management Programs

Fourth Day

- Introduction and Development of Safety Programs
- Workshop Activity: Development of a Sample Safety Program

Fifth Day

- Workshop Activity: Team Discussion of Safety Programs
- Course Critique and Evaluation

QUALIFICATIONS OF PARTICIPANTS

The training course is designed for presentation to members of safety review teams from eight state agencies within the FHWA Region 4 jurisdiction. The course content includes training on a procedure to develop a roadside safety improvement priority program, and includes data collection technology and management decision making techniques. Therefore, participants selected should include personnel whose activities include technical and managerial responsibility. Management level personnel are expected, upon completion of the course, to understand the concepts, application, and benefits of the procedure; and be capable of implementing a statewide safety program within their respective states using this technique.

Specifically, the attendees should have experience in highway geometrics, traffic operations, highway safety, construction and maintenance, and cost estimating of roadside modifications. Teams of people from each state should contain individuals representing as many of these disciplines as possible.

(Contents of Course Announcement)

EXHIBIT 5

EVALUATION FORM

A TRAINING COURSE

ON HIGHWAY SAFETY IMPROVEMENT PROGRAMMING

Your Job Title: _____

Your Work Responsibility: _____

_____

Please circle the number on the scales below each session title which best represents your opinion. The rating should be based on the following scale:

7 Excellent
6 Very Good (Well above average)
5 Good (Above average)
4 Average (Acceptable)
3 Below Average
2 Well Below Average (Needs some improvement)
1 Poor (Requires substantial revision)

A. INDIVIDUAL SESSION EVALUATION

The material, the presentation and the visual aids should be evaluated for each session. The criteria for evaluation are

Material - accuracy and depth of coverage as they relate to the session objectives.

Presentation - clarity and simplicity of presentation, effective use of the visual aids and holding the interest of the group.

Visual Aids - quality and suitability to the subject material.

B. OVERALL COURSE EVALUATION

1. Please rate the overall value and significance of the course to you. 1 2 3 4 5 6 7

Comment: _____

_____

_____

EXHIBIT 5 (Continued)

2. Have the stated objectives of the course been reasonably accomplished in the available time?

_____ Yes _____ No

3. The length of the course was:

___Much Too Long ___Too Long ___About Right ___Short

___Very Short

4. What additional TOPICS should be covered?

_____

_____

_____

5. Should some topics be reduced or eliminated?

____Yes ____No

Explain: _____

_____

_____

6. For meeting the needs of the safety program manager, the level of technical detail was:

___Far Too Detailed ___Too Detailed ___About Right

___A Little General ___Too General

Comment: _____

_____

_____

7. What constructive suggestions would you offer for improvement of similar workshops? Please be as specific as possible.

_____

_____

_____

The evaluation form was given to each participant at the beginning of the course. Participants were asked after each training session to evaluate the session and add written comments, suggestions, criticisms, etc. so that the instructors could evaluate the effectiveness of the course. Participants were instructed to be "bluntly" honest and forthright in criticisms and/or plaudets--names were not requested; however, occupation and experience were requested to assist in evaluating the effectiveness for particular disciplines. The course concluded with a verbal discussion of the effectiveness of the course and comments and suggestions were solicited from participants regarding possible improvements or refinements for future courses. A discussion of the course evaluation is presented in the following section of this report.

TRAINING COURSE CONDUCT

The one-week course was conducted May 23-27, 1977 at the Georgia Institute of Technology in Atlanta, Georgia. Participants, selected by the FHWA, included personnel from the following organizations:

1. Federal Highway Administration, Washington
2. Federal Highway Administration, Regional Offices, Regions 1, 4, 6, and 8
3. Federal Highway Administration, Georgia Division Offices
4. National Highway Institute/FHWA
5. Alabama Highway Department
6. Florida Department of Transportation
7. Georgia Department of Transportation
8. Mississippi State Highway Department
9. North Carolina Department of Transportation

10. South Carolina State Highway Department

11. Tennessee Department of Transportation

12. Tennessee Governor's Highway Safety Program

The instructional team included two engineers from the Texas Transportation Institute and three from the Texas State Department of Highways and Public Transportation. All computer programs were supplied to the Georgia Institute of Technology by the Texas SDHPT and put "on-line" prior to the conduct of the course. A representative of the Civil Engineering Department at Georgia Institute of Technology visited the Texas SDHPT prior to the course to become acquainted with the computer software packages.

Projection equipment, audio equipment meeting facilities transportation equipment, etc., were provided by the Georgia Institute of Technology through arrangements with the Federal Highway Administration. All course materials (course text, visual aids, etc.) were provided by the Texas Transportation Institute and the Texas SDHPT.

III. COURSE EVALUATION

The evaluation ratings for the questions listed on the Course Evaluation Form are summarized in Exhibit 6. Exhibit 7 presents a summary of the ratings on each training session with regard to the quality of the material, the presentation, and the visual aids.

The questions were posed to (1) assess the usefulness of the course in achieving the stated FHWA objectives, (2) determine if the course produced a product of significance to the participants, (3) identify deficiencies in course content, format and teaching technique. The evaluation ratings on each training session were requested to provide a data base with which to evaluate the quality of the material, classroom presentation and visual aids in successfully transmitting the intended information. Results from each portion of the Evaluation Form are discussed separately.

EVALUATION OF RESPONSES TO QUESTIONS

Three questions (questions 1, 2, and 6) are considered somewhat interrelated and of vital interest to TTI in assessing the quality of the study product. Exhibit 6 indicates that 95 percent considered that the stated course objectives were accomplished, 77 percent rated the course value and significance as "Good" or "Very Good," and 68 percent stated that the level of technical detail was "About Right" in meeting the needs of the safety program manager. The comments received from question 7 indicated reasons why certain ratings were given.

The most overwhelmingly stated constructive suggestion was that more time should be allotted for and devoted to field inventory and

EXHIBIT 6

SUMMARY OF EVALUATIONS -- OVERALL COURSE EVALUATION

1. Please rate the overall value and significance of the course to you.

	Frequency	Percentage
1 Poor	0	0%
2 Well Below Average	1	2%
3 Below	2	5%
4 Average	7	16%
5 Good	21	49%
6 Very Good	12	28%
7 Excellent	0	0%

2. Have the stated objectives of the course been reasonably accomplished in the available time?

	Frequency	Percentage
Yes	39	95%
No	2	5%

3. The length of the course:

	Frequency	Percentage
Much Too Long	2	5%
Too Long	3	8%
About Right	26	65%
Short	8	20%
Very Short	1	2%

4. What additional topics should be covered?

5. Should some topics be reduced or eliminated:

	Frequency	Percentage
Yes	17	50%
No	17	50%

6. For meeting the needs of the safety program manager, the level of technical detail was:

	Frequency	Percentage
Far Too Detailed	4	10%
Too Detailed	6	15%
About Right	27	68%
A Little General	3	7%
Too General	0	0%

7. What contructive suggestions would you offer for improvement of similar workshops? Please be as specific as possible.

EXHIBIT 7

SUMMARY OF EVALUATIONS -- INDIVIDUAL TRAINING SESSIONS

SAFETY IMPROVEMENT PROGRAMMING FOR ROADSIDE OBSTACLES -- A TRAINING COURSE

TOPIC	PRESENTOR	MATERIAL			PRESENTATION			VISUAL AIDS		
		LOW	HIGH	AVERAGE	LOW	HIGH	AVERAGE	LOW	HIGH	AVERAGE
Introduction and Concept of Cost Effectiveness	TTI	3	7	5.25	4	7	5.53	4	7	5.60
NCHRP 148 Conceptual Model	TTI	3	7	4.97	4	7	6.00	4	7	5.30
Texas Cost-Effectiveness Analysis Procedure Development	TTI	3	7	5.25	3	7	5.60	3	7	5.27
Application of Procedure	TTI	3	7	5.09	1	7	5.30	3	7	5.18
Roadside Hazard Inventory	SDHPT	3	7	4.86	1	7	4.33	3	7	5.04
Roadside Hazard Improvement Form	SDHPT	3	7	4.76	3	7	4.64	2	7	4.82
Encoding of Case Examples (Workshop Activity)	TTI	4	7	5.40	4	7	5.93	4	7	5.20
Conduct of Field Inventory Process (Field Activity)	SDHPT	1	7	4.84	1	7	4.45	1	7	--
Building and Updating of Inventory Master File	SDHPT	2	7	4.43	1	7	4.48	3	7	4.80
Accident Data Incorporation	TTI	3	7	5.33	3	7	5.61	3	7	5.32
Procedure Adaptation for Individual States	TTI	2	7	5.22	4	7	5.62	4	7	5.30
Management Programs	SDHPT	2	6	4.82	3	6	4.50	4	6	4.79
Preparation of Field Data for Computer Analysis (Workshop Activity)	SDHPT	1	6	4.17	1	6	3.71	1	6	--
Inspection of Computer Output and Correction of Errors (Workshop Activity)	SDHPT	1	7	4.17	1	7	3.58	1	7	--
Development of Safety Program	SDHPT	2	6	4.80	3	7	4.57	3	7	4.81
Experience in Texas	SDHPT	3	7	5.32	4	7	5.30	2	7	4.92
Development of Safety Program (Workshop Activity)	SDHPT	1	7	4.90	1	6	4.40	1	6	--

case example solution. This phase of the course was considered by many of the participants to be the most important portion of the training since the inventory procedure forms the basis for the complete procedure. The quality of improvement analysis is directly related to the accuracy and completeness of the data file developed during the inventory process.

The selection of participants attending the course influences the rating of objective achievement, course content evaluation and degree of technical material. The course was specifically developed and designed to train potential users in applying a procedural methodology. In addition, emphasis was to be placed on "hand-on" application. This objective is somewhat different than one in which emphasis is to be placed on identifying managerial uses of such a procedure or defining reasons why such a procedure should or should not be used as opposed to some other analysis methodology. It is stressed that these other objectives are vitally important to different levels of administration; however, the three objectives were not to be achieved within this one course. Since the participant attendance included several administrative engineers, several comments and suggestions were directed toward the need for a shift in emphasis to the other two objectives to more nearly satisfy their particular needs. This is understandable, since from their veiwpoint, the technical details of procedural implementation are secondary to the overall decision of justifying one methodology versus another or if, in fact, a codified prioritizing procedure should be implemented at all. It is emphasized here that these objectives are considered to be important in the overall acceptance of the procedure by managers, because the procedure is a managerial tool.

TRAINING SESSION RATINGS

The ratings regarding material, presentation, and visual aids summarized in Exhibit 7, indicate on overall average rating of 4.91 on a 1-to-7 scale. In evaluating other training courses prepared and conducted by TTI, an average rating of 4.0 for a session has been the desired "acceptable" minimum rating by TTI staff members. Exhibit 7 indicates that no session received a rating below this value in the material or visual aid categories. Two workshops received a rating less than 4.0 in the presentation category because computer turn-around time problems and systems problems did not permit the printouts to be available to some teams at the scheduled workshop sessions. This logistical problem and recommendations for alleviation are discussed in the section entitled, "Conclusions and Recommendations."

The results of the questions posed on the first page of the Evaluation Form and the individual session ratings are somewhat inconsistent. Although the participant enrollment comprised a wide spectrum of experience (from technical level to administrative engineers), the ratings on individual sessions were consistently favorable with the few exceptions noted above. Although the course conduct was hampered to a certain extent by the fact that computer facilities could not be totally placed under the control of the course administrators, session scheduling to work within the constraints was possible. Although this resulted in scheduling certain sessions at times later in the week than was considered optimal from a sequential learning standpoint, the ratings did not indicate this to produce a derogatory effect on the course in meeting the objectives and presenting a quality course.

Substantial modifications were made to the Course Text and to the visual aids in response to the comments and suggestions from the participants and from the FHWA Contract Manager. The Instructor's Manual was modified to reflect FHWA comments and suggestions also.

IV. CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

Evaluation of the participant ratings and comments indicates that,

(1) the stated objectives of the course were achieved for a very high percentage of attendees

(2) the course was considered to be of considerable value and significance to state highway personnel in particular

(3) the material, presentation techniques and visual aids are considered to represent the correct blend of content, instructional strategy and visual aid quality to present a course for which the primary objective is to demonstrate implementation of the cost-effectiveness methodology.

(4) prior to conducting additional courses, consideration should be given to presenting an abbreviated course in which emphasis is directed specifically to explaining "why" a prioritizing procedure is necessary and "how" the subject procedure can assist the administrator in developing a roadside safety program. Such a course should be developed specifically for the administrator and contain only as much technical application as is necessary to permit assessment of the problems that might be encountered in applying the procedure in a particular state.

RECOMMENDATIONS

The objective of the course in its initial presentation was to provide necessary background information on the Texas cost-effectiveness analysis

procedure and an opportunity for participants to receive maximum exposure to application techniques in its implementation. Since the total procedure involves a computerized process to manage a comprehensive data base of roaside obstacle inventory information, these two elements are considered vital to the training procedure. Integrating field activity and computer application into a one-week course presents certain logistical problems that could be solved in the pilot presentation only by scheduling sessions to fit within the computer facility constraints and the field-inventory travel constraints imposed by the size of the class. Although this did not adversely affect the course to a large degree, several recommendations are presented here that will improve the course effectiveness in future offerings.

Field Inventory

The field inventory activity is considered to be one of the most important training sessions in the course structure because it provides the participant the opportunity to assess the roadside hazard situation under real-world operating conditions. No amount of classroom teaching and case example solution can simulate the variety of combinations of roadside hazard situations that may be encountered in the field. It was found, during implementation training in Texas, that many apparently insignificant technicalities in the classroom become extremely important when the participants were forced to make coding decisions in the field. The primary attribute of the field activity was that it emphasized the need for accuracy and completeness in the coding procedures -- a point that was identified dramatically by review of initial computer output of the inventory data.

In the initial course presentation, a four-hour field activity was scheduled. Class size dictated that the class be divided and each half travel to nearby highways to inventory roadside obstacles on separate half days. This necessitated presenting three lectures twice -- once to each half of the class remaining in the classroom. To alleviate this, and increase the effectiveness of the instruction, it is recommended that class size in future courses be constrained to a maximum of twenty-five participants.

A second alternative suggested by a few participants advocated replacement of the field inventory activity with slide presentations of actual roadside situations in which participants would code the inventory and improvement forms under the pseudo real-world case example situation. The singular advantage of this modification is that it would alleviate traveling to nearby roadways and the problems associated with it -- van arrangements, distance measurement equipment installation and possible inclement weather. Several offsetting disadvantages are presented. As stated previously, the classroom, even with realistic ease examples, cannot simulate the operating roadside environment in one vital aspect -- the participant is forced to identify each roadside obstacle when in the field and then assess the adjacent features to code the hazards as a single hazard, one grouping, several groupings, or combinations of these possibilities. Scenes of the roadside would not proivde sufficient detail within the viewing area to allow realistic coding; but equally important, the identification process is removed in the classroom -- the particular obstacle has already been identified. Also, data such as slope steepness, lateral and longitudinal dimensions, decisions regarding beginning and ending milepoints of selected groups and other required data must be supplied in a classroom environment because they could not be obtained from the visual.

Serious consideration of the advantages and disadvantages should be given to conducting future courses in which the field inventory activity is simulated in the classroom rather than actually conducted.

Computer Application Workshops

Since "hands-on" experience with the computerized procedure was specifically required in the initial course presentation, workshops were included in which participants were required to actively develop priority programs using the computerized data management programs. The primary attribute of the Texas procedure is that virtually unlimited data review and prioritizing under a wide variety of variables are possible through the use of automated data processing equipment with the management programs. This aspect provides the manager a tool that far surpasses manual data review both in terms of time savings and comprehensive evaluation of many options.

It is well known that there is no adequate substitute for personal application when using the computer. The singular "disadvantage" of the computer is that it will accept data only in the prescribed format which includes not only input format but completeness as well. The data management programs developed for this procedure are structured such that the user may evaluate many safety improvement alternatives; however, the selection of potential variables must be dependent upon the particular evaluation intent. Therefore, a user must be familiar with the selection, sort, and reporting data input codes and have a thorough working knowledge of what data will be output under various input conditions. In essence, the usefulness of the procedure is highly influenced by the user's versatility and knowledge of the data management procedures. It is believed

that potential users can acquire the necessary level of expertise only through application of the principles using the computer.

Special precautions were taken at the Atlanta course to assure that a sufficient data file was available from which the participants could select, sort, and report particular safety alternatives. A "canned" data file containing several thousand inventory records was placed on-line for operational use in the workshops. Printouts of this data file were provided for each team prior to the workshop. Although it would be desirable to have each team use the inventory data collected during the field activity, a much larger data file than could be developed is necessary to provide an opportunity to select several alternatives in the safety program development workship. Also, providing a "canned" data file assured that the data file was error-free and in operational condition. It is strongly recommended that similar precautions be taken in future course presentations in which the participants are required to use the computer.

One of the most difficult logistical problems in presenting the course involved scheduling sessions within computer turn-around time contraints while maintaining continuity of learning. This problem could be pratically eliminated in future course offerings by arranging for complete administrative control (priority) of the computer facilities. This would entail presenting the course at state or federal agency locations where priorities could be established during the workshop periods. Similarly, keypunch operators could be made available for the few times that their services are needed. Overnight turnaround time may be more easily obtained on many computer facilities such as those used by highway departments without imposing severe operational

problems to the agency. The data management programs require only short running time and minor data input; hence several runs could be made during the safety program development workshop with almost instant turnaround time if the proper computer priorities were obtained. This would greatly enhance the effectiveness of the course. It is recommended that future course presentations be made at locations where computer priorities are available.

It was suggested by a few participants that the computer application workshops might be replaced by comprehensive case examples of selected situations to illustrate the use of the data management processes. This is a possible alternative; however, it is stressed that if the intent is to provide participants the opportunity to gain first-hand experience in applying the total procedure, omission of actual application may produce less than desirable training. It is recommended that "hands-on" computer application be required for those participants who will be required to actively implement the procedure in a particular state following the training course. The computer application is not needed for administrative engineers and the emphasis should be placed on the decision-making assistance that the management programs offer. This could be accomplished through case examples with corresponding computer output.

Course Format

It would be advantageous to present the training sessions concerning data file building prior to conducting the field inventory activity. Participants having prior technical knowledge concerning the file-building process could be expected to accomplish the field inventory activity more effectively. It would be desirable, also, to schedule certain portions

of the data management training sessions early in the course, preferably before the field activity was conducted. This was not possible in the initial presentation of the course, for logistical reasons stated previously; however, the course could be restructured to accomplish this if the class size was restricted and the computer priorities could be arranged.

Evening training sessions would probably be required, however, to allow sufficient time to present the material and retain workshop sessions.

An alternative to weighting the early portion of the course with procedural principles would be a division of the course into two phases. The first phase would include coverage of the lecture material and case examples. The participants could then return to their respective state(s), study the course text and determine, through preliminary trials, potential problems in implementation. Participants could attend the second phase in which they would actually apply the principles using the computer. This alternative exhibits the advantage of offering each participant time to "absorb" the procedural details; however it offers two disadvantages also. First it would substantially increase the cost of course presentation, and secondly, many potential implementation problems are not identified by the user until the procedure is actually applied under the operating policies and equipment in his (her) state.

A second alternative technique would involve lengthening the course to allow more training time to be devoted to field inventory, solution of case examples, and computer application. If no material was deleted, this would necessitate extending the course over a weekend, a practice which, generally, is not desirable. Considering the amount of technical content that is presented in this course, it is believed that a course longer than five days would severely tax a participant's mental absorption level.

If the course were extended, it is recommended that at least one of the weekend days be reserved for a non-meeting day in which participants could receive a work break.

Instructors and Instructional Strategies

The content of this training course is somewhat different than conventional short courses in that it is highly channeled to a particular codified precedure. The fact that it involves use of the computer to apply the procedure places it in yet a more specialized training area. Instructors presenting this course msut be thoroughly knowledgable in the intricacies of the concept on which the procedure is based (NCHRP No. 148), the cost-effectiveness analysis computer program, the data file management programs and the problems that can be expected in application of the procedure in a particular state. It is emphatically stressed that instructors should become well acquainted with the material in the Course Text and the documents referenced therein prior to presenting the material to an audience composed of practicing highway engineers.

Objectives of Future Course Presentations

The safety improvement programming procedures discussed in this course apply to personnel within a highway agency having differing objectives dependent upon agency responsibilities. As was stated previously in this report, there is a need to develop an abbreviated training seminar to advise administrators of the potential benefits to be derived from application of this procedure. Such a course should desirably be conducted prior to conduct of the subject training course. Once the decision is made to investigate the feasibility of applying the procedure, personnel can be selected to attend the course concerning technical application. Attendees

at this procedural application course would desirably include those personnel who would be directly responsible for implementing the procedure in a particular state.

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4. Weaver, Graeme D. and Woods, Donald L. "Cost-Effectiveness Evaluation of Roadside Safety Improvements on Texas Highways". TTI Research Report 15-2F, Research Study 2-18-74-15. August, 1975.

5. Weaver, Graeme D. and Woods, D.L. "Cost-Effectiveness Evaluation of Roadside Safety Improvements on Texas Highways - Appendix, Cost-Effectiveness Analysis Manual". TTI Research Report 15-2F (Appendix), Research Study 2-18-74-15. August, 1975.