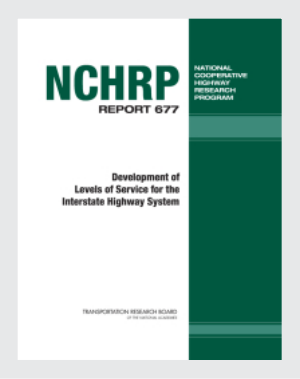

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NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

NCHRP REPORT 667

Model Curriculum for Highway Safety Core Competencies

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NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

Systematic, well-designed research provides the most effective approach to the solution of many problems facing highway administrators and engineers. Often, highway problems are of local interest and can best be studied by highway departments individually or in cooperation with their state universities and others. However, the accelerating growth of highway transportation develops increasingly complex problems of wide interest to highway authorities. These problems are best studied through a coordinated program of cooperative research.

In recognition of these needs, the highway administrators of the American Association of State Highway and Transportation Officials initiated in 1962 an objective national highway research program employing modern scientific techniques. This program is supported on a continuing basis by funds from participating member states of the Association and it receives the full cooperation and support of the Federal Highway Administration, United States Department of Transportation.

The Transportation Research Board of the National Academies was requested by the Association to administer the research program because of the Board's recognized objectivity and understanding of modern research practices. The Board is uniquely suited for this purpose as it maintains an extensive committee structure from which authorities on any highway transportation subject may be drawn; it possesses avenues of communications and cooperation with federal, state and local governmental agencies, universities, and industry; its relationship to the National Research Council is an insurance of objectivity; it maintains a full-time research correlation staff of specialists in highway transportation matters to bring the findings of research directly to those who are in a position to use them.

The program is developed on the basis of research needs identified by chief administrators of the highway and transportation departments and by committees of AASHTO. Each year, specific areas of research needs to be included in the program are proposed to the National Research Council and the Board by the American Association of State Highway and Transportation Officials. Research projects to fulfill these needs are defined by the Board, and qualified research agencies are selected from those that have submitted proposals. Administration and surveillance of research contracts are the responsibilities of the National Research Council and the Transportation Research Board.

The needs for highway research are many, and the National Cooperative Highway Research Program can make significant contributions to the solution of highway transportation problems of mutual concern to many responsible groups. The program, however, is intended to complement rather than to substitute for or duplicate other highway research programs.

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FOREWORD

By Charles W. Niessner
Staff Officer
Transportation Research Board

This report and enclosed CD-ROM presents course materials, including the instructor's guide and student workbook, for a fundamental highway safety training course. The course presents the core competencies all highway safety practitioners should have or acquire. The CD also includes a brochure and short Microsoft Power Point presentation for marketing the training course. The report will be of particular interest to personnel responsible for professional staff development and managing safety programs.

The highway safety field draws upon engineering, economics, public law and policy, law enforcement, psychology/human factors, social marketing, medicine, public health, administration, education, statistics, and physics, among others. It is a specialized field created by the landmark Highway Safety Act of 1966. Many of the professionals drawn into the field during the early days have retired or soon will be retiring. The need for professionals to replace them is a serious challenge, and the means of recruiting, educating, and training future highway safety professionals are inadequate. It is also necessary to provide education and training for existing professionals to enhance their highway safety background and/or knowledge. A workshop organized by Institute of Transportation Engineers, American Association of State Highway and Transportation Officials through the Standing Committee on Highway Traffic Safety, Federal Highway Administration, and the Transportation Research Board clearly defined the seriousness and critical nature of the problem. A scan of university highway safety education and training programs further emphasized the void by finding a lack of broad-based, multidisciplinary safety educational offerings at the advanced undergraduate and graduate levels

In light of the findings from that scan, a set of "core competencies" for highway safety professionals was developed (see *NCHRP Research Results Digest 302*). The core competencies for highway safety professionals are intended to provide a broad framework for educating new safety professionals and training the existing workforce. They represent the fundamental set of knowledge, skills, and abilities needed to effectively function as a professional in highway traffic safety. As such, they establish the foundation considered to be necessary for effective performance by all safety professionals, including those specializing in engineering, analysis, public policy, road user behavior, injury prevention and control, and safety management.

Under NCHRP Project 17-40, "Model Curriculum for Highway Safety Core Competencies," Cambridge Systematics, Inc. transformed these core competencies into a curriculum that can be applied in various educational and training settings. This instructional tool will guide the delivery of effective training and educational programs for existing and future highway safety professionals.

CONTENTS

CHAPTER 1

Introduction

Safety workforce development is an important concern within the transportation safety community. Retirements among experienced professionals could leave a gap in the knowledge base and slow progress on building a safe and efficient transportation system. Critical to the success of any workforce development effort is ensuring a sufficient number of professionals are entering the field. In April 2002, FHWA hosted a workshop to discuss topics related to workforce development specifically for the road safety community and to identify strategies for building the supply of road safety professionals. To further the ideas and goals of the workshop, the TRB created a Joint Subcommittee on Road Safety Workforce Development[1] to accomplish the following objectives:

- Raise awareness of the need for education and training opportunities for road safety professionals;
- Develop a set of core competencies for road safety professionals; and
- Encourage use of the core competencies in training and education programs, hiring decisions, performance evaluations, and professional development.[2]

[1]In 2007, the Joint Subcommittee became a Task Force to continue the development work and determine the need for a permanent standing committee to support road safety workforce development issues and programs. In 2010, the Task Force was extended for another three years to complete its work.

[2]*Special Report 289: Building the Road Safety Profession in the Public Sector,* the Transportation Research Board of the National Academies, Washington, D.C., 2007.

This report presents a model curriculum based on the core competencies developed by the Joint Task Force. The curriculum is named *Road Safety 101* (Model Curriculum for Highway Safety Core Competencies) to highlight the fact that the course meets university standards and represents a beginning understanding of road safety as a discipline. The NCHRP funded the program in 2007, followed by a pilot test in 2008–2009 which included a blended learning environment (e.g., five webinars, several on-line assignments, and a three-day classroom seminar). In 2009, NCHRP provided additional resources to continue pilot testing the curriculum using different learning environments (e.g., one all classroom and one on-line).

All instructional components of this project were developed utilizing Instructional Systems Design (ISD) methodology and processes. The ISD model was designed in 1975 to solve Department of Defense training problems. It grew out of the systems analysis concepts that became popular after World War II. Today, it is the most extensively used instructional design model.

A CD is attached with this report that contains the training materials, including the instructor and participant guides, PowerPoint presentations and speaker notes, and other ancillary materials, such as certificate examples, an evaluation form, a participant sign in sheet, etc. Appendix A of this report provides an outline of the materials contained on the CD.

CHAPTER 2

Background

The need for road safety education was recognized as early as the 1960s when a series of studies identified gaps in the availability of training. A 2003 TRB policy study identified transportation workforce issues as a whole but did not focus on safety; nevertheless, the study reported an FHWA finding that training was critically needed in safety and planning.

To gain a better understanding of the problem, the TRB Joint Subcommittee conducted a scan of university road safety education and training programs. The scan revealed a lack of broad-based multidisciplinary safety educational offerings. A more thorough survey of universities found six to 10 programs with graduate offerings; however, they typically consisted of a single course not representative of the depth and breadth of coverage needed for educating road safety professionals.

In light of the scan findings, a set of "core competencies" for highway safety professionals was developed (see *NCHRP Research Results Digest 302: Core Competencies for Highway Safety Professionals*). The core competencies are intended to provide a broad framework for educating new safety professionals and training the existing workforce. They represent the fundamental set of knowledge, skills, and abilities (KSA) needed to effectively function as a professional in road safety.[3]

To effectively recruit, educate, and train future highway safety professionals and members of the existing work force, this curriculum was developed to support implementation of the core competencies through a suite of instructional tools.

Core Competencies

1. The Nature of Road Safety
2. History and Institutional Settings of Road Safety Management
3. Origins, Characteristics, and Uses of Crash Data
4. Contributing Crash Factors, Countermeasure Selection, and Evaluation
5. Road Safety Program Management

[3]Ibid.

CHAPTER 3

Intended Audience

Road safety core competencies can be described in general as the set of KSAs underlying any of the associated safety disciplines. TRB *Special Report 289: Building the Road Safety Profession in the Public Sector* defines road safety professionals as "... workers who spend all or most of their workday on matters pertaining directly to road safety, such as assessing safety performance and needs; planning, developing, and implementing safety initiatives; and taking specific actions related to safety. Examples of full-time safety professionals are road safety engineers, directors and staff of governors' highway safety offices, safety regulators, safety data analysts, safety program developers and evaluators, and patrol officers dedicated to traffic safety."[4]

Certain other occupations have a direct bearing on safety, such as traffic engineers. *Special Report 289* estimated roughly 10,000 full-time road safety professionals are employed in federal, state, and local government, and a much larger workforce contributes to road safety on a regular basis, even though many of these workers may not view their jobs as safety related. The entire audience for *Road Safety 101* may be as large as 100,000 professionals.

[4] *Special Report 289: Building the Road Safety Profession in the Public Sector* (2008). Transportation Research Board of the National Academies, Washington, D.C.

CHAPTER 4

Description of the Course Modules

Road Safety 101 is designed to build out the core competencies each of which represents a discrete unit of the course. Each unit is further broken down into modules or segments. These modules represent the key elements or concepts under each of the core competencies. The units and modules are outlined in the following paragraphs:

Unit 1: The Nature of Road Safety

1.1 The Nature of Road Safety

Definitions of road safety may vary depending on an individual's background, education, and experience. This module defines and examines various perspectives on road safety particularly the scientific underpinnings of successful road safety management.

1.2 Road Safety—A Complex Field

Road safety professionals work hard to reduce the number and severity of crashes. This module highlights the involvement and expertise of individuals from multiple disciplines and multiple modes of transportation.

1.3 Road Safety Demographics

The combined efforts of safety professionals to analyze and understand safety data reveal important relationships between road safety and demographic, cultural, and social trends. This module focuses on some of those relationships, looking in detail at how the likelihood of being killed or injured in a crash changes with factors like age, gender, race, ethnicity, and disposition towards a specific travel mode.

1.4 Road User Decisions

This module presents examples of how road design, land use, and vehicle design have positive and negative safety consequences for driver decision-making.

1.5 Science-Based Road Safety Research

This module addresses the importance of science-based safety research by examining the weaknesses of traditional methods; science-based methods used by both engineers and public health professionals; the relationship between science and data; and the relationship between data driven approaches and positive crash outcomes.

1.6 Intervention Tools

This module discusses statistical models for identifying "sites with promise" or those sites with worse than expected safety performance, and tools, such as the Haddon Matrix and road safety audits, used to identify effective countermeasures and interventions.

Unit 2: History and Institutional Structures of Road Safety Management

2.1 Foundation for Road Safety Management Policy

This module discusses legislation and institutional structures that shape road safety management practices.

2.2 Safety Management Roles and Responsibilities

This module identifies public agencies, private sector and nonprofit interest groups, professional associations, and research associations across all modes with a role in managing safety.

2.3 Road Safety Education Opportunities

This module takes a look at the education and training opportunities available to road safety professionals.

2.4 Funding Sources, Requirements, and Opportunities

Safety competes with a variety of other important transportation programs, including maintenance, congestion, and construction. This module helps safety professionals become familiar with available funding sources and requirements to support their priorities and programs.

Unit 3: Origins, Characteristics, and Uses of Crash Data

3.1 State, Local, and Federal Data and Information Systems

This module examines state and local data and information systems used in transportation safety planning. It reviews the types of data available, sources of information, elements of the state crash database, and data improvement strategies. Data and information systems available from the federal government are discussed, and the students are shown how the information can be used to improve road safety management.

3.2 Crash Data Collection and Uses

This module highlights accepted practices of using data to guide actions and assess their effectiveness. Topics discussed include the environment in which road safety decisions often take place and data supported decision-making in terms of problem identification, intervention planning, and evaluation.

Unit 4: Contributing Crash Factors, Countermeasure Selection, and Evaluation

4.1 Contributing Crash Factors and Interactions

This module examines the factors that contribute to crashes and methods used for studying them.

4.2 Scientific Principles for Effective Road Safety Analysis

This module introduces students to the importance of using suitable scientific methods in the analysis of road safety problems. The discussions include: rational versus pragmatic style of road safety research; regression-to-the-mean; applying exposure data; the use of safety performance functions for comparison, and with-without rather than before-after analysis.

4.3 Problem Identification

Identifying problem entities must be conducted carefully as all the subsequent steps in analysis of a safety problem are based on this first step. This module seeks to help the student understand the importance of using scientific procedures to identify road safety problem locations, drivers, and vehicle types.

4.4 Countermeasure Selection

This module discusses and examines helpful tools and methods for selecting effective countermeasures and targeting specific audiences.

4.5 Cost Effectiveness of Alternative Countermeasures

This module suggests methods for prioritizing a list of proposed countermeasures or interventions.

Unit 5: Road Safety Program Management

5.1 Transportation Safety Planning

The traditional transportation planning process is responsible for programming most of the funding for the surface transportation system. This module explores opportunities for integrating an explicit consideration of safety into the process.

5.2 Leadership and Champions

The importance of strong leadership support is discussed throughout the course. This module delves deeper into the characteristics and methods associated with effective leadership.

5.3 Collaboration and Coalition Building

Collaboration is the key to successful multidisciplinary road safety planning and countermeasure implementation. This module explores successful collaboration methods.

5.4 Outreach and Communication

In this module, participants learn methods for stimulating change through effective communication and outreach activities.

5.5 Current Research Supporting Road Safety Management

Methods and sources for improving technical knowledge are presented in this module. Safety professionals are introduced to methods for updating their knowledge on a regular basis.

Eleven exercises are incorporated into the learning experience. They are designed to help participants practice the information presented; enhance the learning experience; facilitate

a collaborative learning environment; and lead students to additional information sources. The following is the subject matter covered in each exercise:

1. Defining safety from a multidisciplinary perspective,
2. Using Census data in safety analysis,
3. Using the Internet to obtain safety information,
4. Using data to influence public policy,
5. Identifying crash factors using the Haddon Matrix,
6. Demonstrating the use of safety performance functions (SPFs),
7. Using market research techniques,
8. Developing performance measures,
9. Demonstrating leadership roles and responsibilities,
10. Building coalitions, and
11. Assessing public information and education programs.

CHAPTER 5

Summary

Course Evaluation

Evaluations were conducted for each of the pilot classes. The scores were generally positive, although the on-line course evaluations were not as high as the all classroom results. (See Appendix B for the evaluation results from the final course delivered.) The students were asked to rank each of the following statements on a scale of one to five with five being the highest score. The following is a list of the questions that were used along with the average scores listed in parenthesis.

1. The sequence of content was logical and easy to follow. (4.5)[5]
2. The level of detail was appropriate. (4.2)
3. The instructors were well prepared to facilitate the course (by individual instructor).
   a. Susan Herbel (4.9)
   b. Bernardo Kleiner (4.5)
   c. Pam Beer (4.7)
   d. Paul Jovanis (4.9)
4. The content was technically accurate. (4.5)
5. The content was relevant to my professional responsibilities. (4.1)
6. Participating in this course was a good use of my time. (4.3)
7. I will use this information in the future. (4.3)
8. How would you rate this course on a scale of 1–5 with 5 being the best score? (4.3)
9. Do you have suggestions for improving the course?

In all cases, the students ranked the statements four or above. Some confusion resulted from #4 because in many cases, the students said they did not have the technical background or knowledge to provide a score. After the first pilot, the evaluation form was changed to provide "not applicable" or "no answer".

Certificates

The students were issued two types of certificates following the course. If they completed all of the requirements, they received a *Certificate of Completion*. If they participated in the course but missed a lesson or two, didn't complete all of the assignments, and/or did not take the pre- and post-tests, they received a *Certificate of Attendance*. Most students finished the course but many did not complete all the assignments. This was especially true of the on-line pilot test where only about half of the students received Certificates of Completion.

Format

Road Safety 101 was offered in the following three formats:

1. Blended learning—webinars, on-line assignments, and classroom;
2. Classroom; and
3. On-line.

During the blended learning experience, the students found the webinars difficult to follow, and many indicated they did not have sufficient background to follow the instruction. Although webinars are designed to be interactive, the students found it difficult to interact and ask questions which resulted in complaints about the lack of interaction. However, the classroom experience received positive feedback. The course sponsors were particularly pleased with the coalition building and camaraderie the course generated among the different disciplines, especially the engineering and law enforcement communities. In fact, the Louisiana Department of Transportation and Development sponsored an additional course and plans another in the spring of 2011.

[5]Following each of the pilots, the course materials were refined and updated. These scores represent the final class evaluation.

Exercises and Homework

The students were all full-time working professionals, and they had difficulty finding enough time to complete the homework exercises. An incentive, such as continuing education credits, might be needed to encourage greater participation. However, the students agreed the exercises broadened their knowledge and enhanced the learning experience.

Tests

The students were instructed to take a before and after test. Each time the curriculum was presented, the test questions were reviewed and fine tuned to eliminate confusing test items. The final test bank is included on the CD.

Results

Arguably, one of the greatest benefits realized from *Road Safety 101* was networking among the various disciplines represented in the pilots. Other benefits from the classroom, blended learning, and on-line course versions include updating student knowledge of current federal legislation, regulations, and requirements; helping students identify gaps in their road safety knowledge; and either providing information to fill the gaps or preparing the students to find it themselves. The course develops the base of a "common language" among the various safety disciplines and encourages working together to address problems using multidisciplinary methods.

Next Steps

Discussions about how to further implement *Road Safety 101* took place throughout the pilots, in meetings of the TRB Task Force on Road Safety Workforce Development, and in other venues. Some states have expressed interest in sponsoring one or more courses themselves. However, it is clear that some type of formal certification and/or continuing education credits will be needed to serve as an incentive for time-starved professionals to participate. While all the volunteer students were interested in safety and learning more about the discipline, their interest is probably not enough in most cases to sustain course involvement.

APPENDIX A

CD-ROM Content

1. Instructor Guide Front Matter
2. Instructor Guide
3. Instructor PowerPoint files
4. Student Workbook Front Matter
5. Ancillary Materials
6. *Road Safety 101* Marketing Materials

APPENDIX B

Evaluation Sample

Sequence	Detail	Instructors	Technical	Relevance	Time Use	Future Use	Overall	Suggestions
5	5	5	5	5	5	5	5	
4	4	5	4	5	5	5	5	
4	4	5	4	5	5	5	5	
2	4	4	2	4	3	3	3	
4	4	5	4	4	4	4	4	Wanted more interaction among the agencies
4	4	4	4	4	4	4	4	Several suggested more discussion of countermeasures
4	4	5	5	4	3	4	4	Some suggested more breaks
5	5	5	5	5	5	5	5	Some wanted more technical information, e.g., SPFs, etc. while others found the course too technical
4	4	5	4	3	4	4	4	
4	5	4	5	5	4	4	4	First day is lecture heavy
4	4	4	4	5	4	4	4	
4	3	5	5	3	3	4	3	A few suggested we do away with the homework assignments
4	4	5	4	5	5	4	5	More multimedia
5	4	5	4	5	5	5	5	Print handouts two to a page - font too small on 3-ups
4	4	4	3	2	3	3	3	
3	4	4	3	4	4	4	4	
4	4	4	4	3	4	3	4	
4	2	4	4	4	4	4	4	
4	4	4	4	4	4	4	4	
3	3	4	5	2	2	2	3	
5	4	5	5	5	4	4	4	
3	4	3	4	2	2	2	3	This person said he shouldn't have been in the class - has no authority, etc.
5	5	5	5	5	5	5	5	
4	5	5	5	5	5	5	5	Wants post-test given in class
5	5	5	4	3	4	4	4	End final day earlier for travel!
4	4	4	4	3	3	3	4	
5	4	5	5	4	5	5	5	
4	5	5	4	4	4	4	4	
								Summary
4.1	**4.1**	**4.5**	**4.2**	**4.0**	**4.0**	**4.0**	**4.1**	

Abbreviations and acronyms used without definitions in TRB publications:

AAAE	American Association of Airport Executives
AASHO	American Association of State Highway Officials
AASHTO	American Association of State Highway and Transportation Officials
ACI–NA	Airports Council International–North America
ACRP	Airport Cooperative Research Program
ADA	Americans with Disabilities Act
APTA	American Public Transportation Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATA	Air Transport Association
ATA	American Trucking Associations
CTAA	Community Transportation Association of America
CTBSSP	Commercial Truck and Bus Safety Synthesis Program
DHS	Department of Homeland Security
DOE	Department of Energy
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
HMCRP	Hazardous Materials Cooperative Research Program
IEEE	Institute of Electrical and Electronics Engineers
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
ITE	Institute of Transportation Engineers
NASA	National Aeronautics and Space Administration
NASAO	National Association of State Aviation Officials
NCFRP	National Cooperative Freight Research Program
NCHRP	National Cooperative Highway Research Program
NHTSA	National Highway Traffic Safety Administration
NTSB	National Transportation Safety Board
PHMSA	Pipeline and Hazardous Materials Safety Administration
RITA	Research and Innovative Technology Administration
SAE	Society of Automotive Engineers
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (2005)
TCRP	Transit Cooperative Research Program
TEA-21	Transportation Equity Act for the 21st Century (1998)
TRB	Transportation Research Board
TSA	Transportation Security Administration
U.S.DOT	United States Department of Transportation