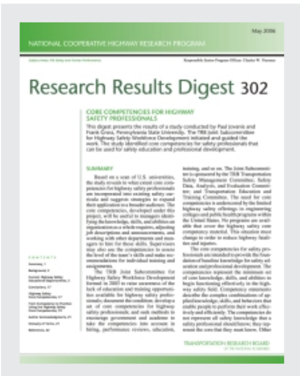

Core Competencies for Highway Safety Professionals

DETAILS

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CORE COMPETENCIES FOR HIGHWAY SAFETY PROFESSIONALS

This digest presents the results of a study conducted by Paul Jovanis and Frank Gross, Pennsylvania State University. The TRB Joint Subcommittee for Highway Safety Workforce Development initiated and guided the work. The study identified core competencies for safety professionals that can be used for safety education and professional development.

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SUMMARY

Based on a scan of U.S. universities, the study reveals to what extent core competencies for highway safety professionals are incorporated into existing safety curricula and suggests strategies to expand their application to a broader audience. The core competencies, developed under this project, will be useful to managers identifying the knowledge, skills, and abilities an organization as a whole requires, adjusting job descriptions and announcements, and working with other departments and managers to hire for these skills. Supervisors may also use the competencies to assess the level of the team's skills and make recommendations for individual training and assignments.

The TRB Joint Subcommittee for Highway Safety Workforce Development formed in 2003 to raise awareness of the lack of education and training opportunities available for highway safety professionals; document the condition; develop a set of core competencies for highway safety professionals; and seek methods to encourage government and academe to take the competencies into account in hiring, performance reviews, education, training, and so on. The Joint Subcommittee is sponsored by the TRB Transportation Safety Management Committee; Safety Data, Analysis, and Evaluation Committee; and Transportation Education and Training Committee. The need for core competencies is underscored by the limited highway safety offerings in engineering colleges and public health programs within the United States. No programs are available that cover the highway safety core competency material. This situation must change in order to reduce highway fatalities and injuries.

The core competencies for safety professionals are intended to provide the foundation of baseline knowledge for safety education and professional development. The competencies represent the minimum set of core knowledge, skills, and abilities to begin functioning effectively in the highway safety field. Competency statements describe the complex combinations of applied knowledge, skills, and behaviors that enable people to perform their work effectively and efficiently. The competencies do not represent all safety knowledge that a safety professional should know; they represent the core that they must know. Other

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knowledge and skills are advisable or even required for effective functioning in the safety field.

The competencies include: (1) understanding the management of highway safety as a complex multidisciplinary system; (2) understanding of and the ability to explain the history of highway safety and the institutional settings in which safety management decisions are made; (3) understanding the origins and characteristics of traffic safety data and information systems to support decisions using a data-driven approach to managing highway safety; (4) (a) demonstrating the knowledge and skills to assess factors contributing to highway crashes, injuries, and fatalities; (b) identifying potential contributing factors; (c) applying countermeasures to user groups or sites to reduce crashes and injuries; and (d) implementing and evaluating the effectiveness of the countermeasures; and (5) developing, implementing, and managing a highway safety management program.

This study suggests strategies for a wide range of audiences to use the core competencies. A glossary is included. The competencies themselves are defined in entirety beginning on page 8.

BACKGROUND

The core competencies for safety professionals identified in this document are intended to provide a foundation for the safety education and development of safety professionals. The competencies represent the minimum set of core knowledge, skills, and abilities to function effectively and efficiently in the highway safety field. Competency statements describe the complex combinations of applied knowledge, skills, and behaviors that enable people to perform their work.

The competencies apply to new hires and existing practitioners. Applicable learners include professionals from state highway safety offices, departments of transportation, the FHWA, National Highway Traffic Safety Administration (NHTSA), Federal Motor Carrier Safety Administration (FMCSA), the public health community, professionals in local public works and city engineering departments, and the consultants and private sector employees supporting these functions.

The structure and content of the competencies is comprehensive, multidisciplinary, and systematic. They are comprehensive because they apply to anyone with professional responsibilities within an organization (e.g., engineer, planner, safety manager or administrator, governor's highway safety representative, and other professional staff positions). The competencies are multidisciplinary because they include public health, injury prevention, and behavioral science concepts along with components from engineering, education, and law enforcement. They are systematic in that they treat highway safety as a set of interrelated components (e.g., vehicles, roadway users, and the highway) that interact and result in crashes.

The need for core competencies is underscored by the limited highway safety offerings in engineering and public health university programs within the United States. A paper by Gross and Jovanis (*11*) describes a survey of U.S. universities and an assessment of existing college-level courses in those fields. The review focuses on the programs most likely to contain highway safety elements: transportation courses within civil engineering departments and injury prevention courses within public health programs. While the safety field draws from social and behavioral science fields as well, the course offerings in those areas specific to safety and injury prevention were expected to be substantially less than in engineering and public health. The report concludes that no current programs are available that cover the highway safety core competency material.

The competencies do not represent all safety knowledge that a safety professional should know. They represent the core that they must know. Other knowledge and skills are advisable or even required for effective functioning in the safety field. Detailed knowledge of statistics, program evaluation, public affairs, engineering, communications, social marketing, and psychology are but a few of many additional in-depth skills that may apply depending on one's position within an organization. The core competencies are intended to define the floor of knowledge in a way that is common to many disciplines and skills currently practicing in the field. They are intended to include applications to highway safety in fields such as: engineering, road user behavior, public policy, and injury prevention and control. Finally, the competencies do not address skills that are important to highway safety management, but that are considered peripheral to an education that is focused on safety (e.g., public speaking, budgeting, policy analysis, program administration, etc.)

One phrase frequently used in this report is "highway safety management." The researchers define highway safety management as the sum of all prevention and mitigation activities that affect the number and severity of future crashes. The competencies support the development of the science of safety. The evolution of new perspectives and methods in safety analysis should be based upon fact and thorough evaluation of our actions. To assist in clarifying terms, a glossary is included.

The next section reviews a university scan to determine the level at which the core competencies are currently being utilized to train the future highway safety workforce. It is followed by five core competencies for highway safety professionals. Each core competency is described in greater detail as a set of learning objectives. The use of learning objectives is intended to facilitate the translation of the core competencies into an integrated curriculum or in the development of individual courses based upon individual competencies. The next section provides a comprehensive list to the potential uses of the competencies. The final section provides a glossary of terms.

CURRENT HIGHWAY SAFETY EDUCATIONAL OPPORTUNITIES

Introduction

Safety has always been recognized as an important aspect of transportation engineering and traditionally has been an integral part of injury prevention and disease control. Safety is included as one of the U.S. DOT's strategic objectives (*1*) and is prominent in other important strategic goals in the engineering profession [e.g., ITS (*2*)].

Safety researchers have been supportive of these goals by developing new analytical approaches that offer the promise of significantly improving safety evaluations and the investments in safety that follow. Examples include the *Highway Safety Manual* (*3*), the *Interactive Highway Safety Design Model* (*4*), and *SafetyAnalyst* (*5*). Despite these research advances, some in the education and research community believe that safety education has not kept pace, particularly within undergraduate and graduate civil engineering programs that supply engineering talent to the profession (*6*).

Some have argued that traffic safety is not a field of legitimate scientific inquiry, but is derived from "good" planning, design, and traffic operations. Proponents of these positions argue that adherence to existing professional guidelines [e.g., AASHTO Green Book (*7*) and MUTCD (*8*)] adequately addresses safety. Furthermore, there is a perception that courses in design, operations, and planning are offered more broadly across U.S. universities and are covered in much more detail within these universities; therefore, there are fewer professional educational opportunities in traffic safety. The apparent deficiency in highway safety education was recognized as far back as the early 1960s when a series of case studies assessed the state of university-based highway traffic safety education (*9*). The results of this work helped to identify resources to address the mounting concern of traffic-related fatalities and congestion. More recently, a policy study completed by TRB in 2003 (*10*) identified workforce issues in the transportation field as a whole, but did not focus on safety.

Partially in response to these concerns, TRB formed the Joint Subcommittee, drawing professionals from the FHWA (Office of Safety, Office of Research, and National Highway Institute), NHTSA, FMCSA, Governors Highway Safety Association (GHSA), several universities, and other safety-related organizations. The subcommittee represented a diverse set of safety interests, which viewed highway safety management and its educational needs from a variety of perspectives. The participants identified the following list of objectives for the subcommittee:

1. Secure the necessary resources for conducting a TRB policy study on workforce safety education and training. The policy study will seek to define the issues and provide information that will enlighten the profession, the government, and elected officials as to the seriousness of the problem.
2. Identify, organize, and catalogue the core competencies necessary for performing transportation safety decision-making and research. Core competencies are defined as the collective knowledge, skills, and abilities that allow transportation professionals to fully understand the safety implications of transportation policies and actions.

3. Develop a set of multidisciplinary curricula, including course objectives and outlines, to train the existing and future transportation professionals on safety issues.
4. Develop proposed pathways for training transportation safety professionals in the specific knowledge and skills required for science-based safety decision-making.
5. Identify the human and financial resources necessary for developing courseware for multidisciplinary courses and university-based research curricula.
6. Identify and convene a network of transportation safety professionals, as well as a group of managers in need of those skills, to develop action priorities, monitor progress, and identify resources for accomplishing the committee's objectives.

Funding was secured to initiate the policy study. This RRD reports on the findings of a scan of university-based safety courses conducted in support of the development of core competencies in safety education (*11*).

Approach

To assess current educational opportunities for transportation safety professionals in the United States, a series of email-based surveys were distributed to universities and transportation research centers (see Table 1). Engineering programs were initially contacted through the Council of University Transportation Centers (CUTC), while public health/injury prevention centers were contacted through a list of Centers for Disease Control (CDC) university injury prevention centers. A limited effort was also

Table 1 Summary of Survey Contacts Used to Assess Education and Training Opportunities

Contact Group	Date	Organization Contacted	Objective of Contact	Number of Contacts
Engineering Programs	March 2004	CUTC Members	Initial survey request to all CUTC members	63
	June 2004	CUTC Members	Request for additional course Information from responding CUTC members	18
	June 2004	CUTC Members	Second round of requests to nonrespondents	42
	September 2004	State DOT Research Directors	Request to identify missing universities	50
	October 2004	Governors' Highway Safety Representatives	Request to identify missing universities	50
	March 2005	FHWA Field List and T-2 List-Serve	Request to identify missing universities	25
Public Health Programs	August 2004	Centers for Disease Control (CDC) and Injury Prevention	Request to identify CDC and Injury Prevention courses that cover transportation safety topics	34
International Programs	January 2005	Selected TRB Attendees at Safety Sessions	Identify international safety courses	2
	February 2005	Accident Analysis and Prevention frequent authors	Identify international opportunities in safety training and education	15

undertaken to identify international courses and programs; however, this was not a primary focus of the study and is not discussed here. As illustrated in Table 1, several efforts were made to contact members of engineering and public health organizations. State highway agency research directors, members of FHWA education list-serves, and GHSA representatives were also canvassed for missing university names. The intention was to comprehensively contact all possible university-based safety programs. While it is possible that contact may have been established with the wrong person or work unit, many different sources were consulted to develop as complete a list as possible. Using this series of contacts, the researchers are confident that the majority of transportation programs were provided at least one and probably several opportunities to respond.

The following sections provide a detailed description of the survey process and an analysis of the survey responses. Existing safety courses were compared with the draft safety core competencies (*12*) to show the breadth and depth of coverage of important safety topics (as identified by the Joint Subcommittee). The comparison of the course content and core competencies allowed an assessment of the adequacy of the current educational opportunities.

Survey Methodology

Survey of Engineering Programs

The initial survey consisted of four questions and was kept short to encourage a high response rate. The purpose of the survey was to obtain a broad understanding of the level of safety-related training and education for transportation professionals. The questions were:

1. Do you offer a major, minor, or certificate in highway/traffic safety?
2. Do you offer any courses related to highway/traffic safety?
3. Do you offer any continuing education programs, seminars, etc., related to highway/traffic safety?
4. Please provide your contact information.

The survey was distributed via email to the listing of current CUTC members, which was obtained from the CUTC web site. Of the 63 universities surveyed, only 18 responded positively (see Table 2). The responses indicated that just four programs offer some type of advanced degree in transportation safety, which is consistent with the team's prior expectations.

After summarizing initial survey results, it was evident that the scan of university safety programs was incomplete. The first concern related to the amount of detail obtained from the initial responses. Second, a number of universities with known safety-related courses were identified to be missing from the responses, which led to the concern of incomplete coverage. The subcommittee provided comments on the first round of responses, particularly concerning nonresponding universities, and CDC Injury Prevention Centers. A slightly revised survey was developed which included questions related to course content and the regularity of course offerings. The follow-up survey acquired more detailed course information (i.e., syllabus, course outline, web pages, etc.) that was used to summarize course content and determine the extent to which specific material was being covered. In addition, the follow-up survey identified whether the course had been offered recently and whether it was offered on a regular basis.

Of the 18 CUTC respondents surveyed for additional information, eight provided some type of specific course information. Respondents provided additional information ranging from detailed lectures

Table 2 Summary of Responses Concerning Prevalence of Safety Education

Contact Source	Total Number Surveyed	Undergraduate Courses	Graduate Courses	Courses Regularly Offered	Continuing Education
Engineering Universities	117	6	23	19	23
Public Health and Injury Prevention Universities	34	0	7	6	4

by date to a general description of the course. All syllabi and course outlines were used to compare curriculums. However, only detailed syllabi were used to determine the extent to which material is covered within courses.

In an attempt to increase the response rate, a number of additional contacts were attempted with nonrespondents. In a second round of requests, a revised survey was distributed via email to all nonresponding CUTC members. A note was attached asking recipients to forward the survey, in the event that the survey was not reaching the correct individuals. The follow-up survey of nonrespondents resulted in six additional responses from CUTC members. This increased the number of responses from 18 to 24.

Even after the additional attempts to reach people by email, it was evident from the list of responses that there were a number of well-known safety programs that had not responded. An effort was then undertaken to identify any missing universities through outside resources. GHSA representatives and state DOT research directors were contacted to identify transportation safety programs that may not be affiliated with CUTC. Each GHSA representative and state research director received a list of universities that had been contacted, highlighting those already responding. The request was to identify any nonresponding universities that may have a transportation safety program as well as universities that were missing from the list. Contacts were also made through the FHWA Safety Field List and the Transportation Technology Transfer (T^2) list-serve.

Responses were obtained from 12 state DOT research directors identifying 10 additional universities, of which six were confirmed to have a transportation safety course. Governor representatives helped identify two additional safety programs. The FHWA Field List and T^2 list-serve resulted in another six universities confirmed to offer a safety course. Results obtained from the follow-up surveys were combined with the initial survey results for a total of 38 responses summarized in Table 3. In all, 25 universities indicated a safety course was offered, but only 19 offered it on a regular basis. Of the 25 universities with safety courses, four universities offered two courses related to transportation safety.

Survey of Public Health and Disease Control Programs

The survey of public health and injury prevention programs was conducted to identify courses outside the engineering field that cover issues related to transportation safety. Prior to the development of core competencies in transportation safety, similar competencies were developed for injury and violence prevention through the Training Initiative for Injury and Violence Prevention (*13*). A university scan of accredited Schools of Public Health was completed during their study to "review the schools' capacity toward advancing an injury science agenda (*14*)." The university scan included a list of 31 accredited universities and provided contact information for each program. The revised transportation safety survey was distributed to all 31 accredited schools of public health. A total of 34 surveys were distributed including 15 schools of public health and 19 schools for injury training and research. In a few of the universities there was overlap. Of the 34 programs surveyed, seven positive responses were obtained with four providing some type of additional course information. The responses are summarized in Table 3.

Summary of Survey Results

These survey responses provide an initial assessment of the actual safety content within the identified courses. The following points are offered as a summary of the university scan.

- Results confirmed the limited number of safety courses available in engineering. Of 117 universities contacted, 29 self-identified as offering a safety course. At this point the substantive content of the courses is unclear, at least until detailed course syllabi are reviewed.
- There are limited safety offerings by major engineering research centers funded through the U.S. DOT. Only 24 of 63 members of the Council of University Transportation Centers (CUTC) self-identified as offering a safety course.
- Numerous resources had to be used to obtain contact information, which indicates the lack of a central location to survey or contact major transportation engineering programs.
- Public health and injury prevention centers also appear to offer a limited number of safety courses related to transportation (only 7 of 34 universities identified a safety course).

The next section assesses the content of the courses for those respondents that included detailed syllabi.

Table 3 Summary of Individual Course Availability and Regularity

University	1. Transportation Safety Course(s)?	2. Regularly Offered?	3. Continuing Education?
Engineering Courses			
University of Alabama at Tuscaloosa	X	X	X
University of California, Berkeley	X	X	X
University of Connecticut	X	X	X
George Washington University	X	X	X
Iowa State University	X	X	X
University of Kentucky	X	X	X
University of Massachusetts	X	X	X
Montana State University (Western Transportation Institute)	X	X	X
University of Nebraska-Lincoln	X (2 Courses)	X	X
Pennsylvania State University	X (2 Courses)	X	X
Portland State University	X	X	X
Purdue University	X	X	X
Virginia Polytechnic Institute	X (2 Courses)	X	X
Wayne State University	X (2 Courses)	X	X
West Virginia University	X	X	X
University of Wisconsin	X	X	X
University of Arizona	X	X	
University of Idaho	X	X	
University of Maine	X	X	
Texas A&M University	X		X
University of Central Florida	X		
University of North Carolina	X		
South Carolina State University	X		
University of South Florida	X		
University of Tennessee	X		
University of Minnesota			X
Central Missouri State University			X
Northwestern University			X
University of Rhode Island			X
Rutgers University			X
University of Washington			X

Note: Questions 1 to 3 along the top row correspond to the following questions, respectively:

1. Do you teach any graduate or undergraduate courses in highway/traffic safety? Please list course titles and disciplines.
2. When was the last time the course was offered and is it offered on a regular basis?
3. Do you offer any continuing education programs, workshops, seminars, etc., that specifically address roadway/highway/traffic safety?

(*Continued*)

Table 3 (Continued)

University	1. Transportation Safety Course(s)?	2. Regularly Offered?	3. Continuing Education?
Public Health and Injury Prevention Courses			
University of California, Berkeley	X	X	X
Harvard Injury Control Research Center	X	X	X
University of North Carolina	X	X	X
University of Pittsburgh	X	X	X
University of California, Los Angles (UCLA)	X	X	
Yale University	X	X	
George Washington University School of Public Health and Health Services	X		

Note: Questions 1 to 3 correspond to the following questions, respectively:

1. Do you teach any graduate or undergraduate courses in highway/traffic safety? Please list course titles and disciplines.
2. When was the last time the course was offered and is it offered on a regular basis?
3. Do you offer any continuing education programs, workshops, seminars, etc., that specifically address roadway/highway/traffic safety?

Course Content vis-à-vis Core Competencies

Over the course of several months, the Joint Subcommittee developed a draft set of safety core competencies to outline the fundamental knowledge and skills that should be possessed by all transportation safety professionals (*12*). There are a total of five core competencies, each with detailed learning objectives. This section compares the detailed course curricula obtained from the university scan with the safety core competencies developed by the subcommittee.

The core competencies are intended to represent a curriculum in highway safety, not the content of an individual course. Nevertheless, the authors believed a comparison of the core competencies to existing courses could be useful in identifying trends in offerings, including their strengths and potential weaknesses. The comparison also provided a sketch of the content in highway safety that was available from U.S. universities. It is recognized that continuing education offerings are not covered as part of this assessment; the focus was on undergraduate and graduate offerings.

The core competencies and their associated learning objectives are each listed in the first column in Table 4. The second and third columns contain a percentage which is computed as the number of courses that contain coverage of that competency and learning objective (in at least one lecture), divided by the total number of courses that provided detailed syllabi. The percentage was calculated separately for engineering (n = 22) and public health courses (n = 4). As the objective was to reveal coverage of content and also shortcomings, this aggregate percentage provides an indication of the extent to which the core competencies are currently reflected in existing engineering and public health courses. The following sections provide a general description of each competency as well as a comparison of relative coverage by engineering and public health courses.

Core Competency 1: Multidisciplinary Nature of Safety The first core competency provides a broad context for studying highway safety management as a complex multidisciplinary field. There are 11 learning objectives that span a broad range of knowledge and skills. Examples include understanding the need to utilize contemporary research to effectively manage today's safety problems; understanding the relationship between crash and injury factors and the crash event [e.g., as depicted in the Haddon Matrix (*15*)]; understanding contributing factor interaction, illustrated, for example by the Task Capability Interface Model (*16*); and understanding several other fundamental concepts of safety analysis and management.

Table 4 Overall Course Coverage of the Safety Core Competencies

Core Competency and Learning Objectives	Coverage Eng.	Coverage P.H.
1 – Understand the management of highway safety as a complex multidisciplinary system.		
1a. Describe highway safety as a complex, interdisciplinary, multimodal discipline devoted to the avoidance and/or mitigation of fatalities, injuries, and crashes.	31%	50%
1b. Understand, value, and utilize science-based highway safety research and its application as fundamental to achieving further improvements in highway safety.	55%	50%
1c. Describe the demographic trends underlying the need for comprehensive and integrated highway safety management (e.g., social, cultural, age, gender).	36%	50%
1d. Describe the classification of highway crash and injury severity factors and their relationship to the crash event (i.e., pre-crash, crash, and post-crash) by using models such as the Haddon Matrix.	45%	100%
1e. Identify how crash contributing factors interact.	55%	50%
1f. Explain how effective safety management can be used to prevent morbidity and mortality associated with crash events.	27%	100%
1g. Explain the "Four E's" of traffic safety: engineering, education, enforcement, and emergency medical services.	36%	25%
1h. Recognize the effectiveness of combining countermeasures to achieve improvements in safety.	5%	0%
1i. Recognize how highway user decision-making is influenced by highway design, transportation planning, traffic operations and vehicle design.	45%	75%
1j. Recognize the barriers that hinder collaboration across and within institutions.	0%	0%
1k. Identify and demonstrate opportunities and the ability to improve safety through collaboration with individuals from diverse cultural, disciplinary, and educational backgrounds and institutions.	0%	0%
2 – Understand and be able to explain the history of highway safety and the institutional settings in which safety management decisions are made.		
2a. Understand the historical figures, benchmarks, and decisions underlying highway safety.	59%	75%
2b. Identify the safety aspects of major transportation legislation.	59%	75%
2c. List and describe the goals of interest groups with a stake in safety-related policy, legislation, and investment decisions.	18%	0%
2d. Describe the institutional roles and responsibilities within which safety is managed (e.g., local, regional, state, and federal government, transportation modes and the private sector).	14%	0%
2e. Explain and provide examples of the importance of highway safety relative to other transportation priorities (e.g., congestion mitigation, environmental protection, air quality, economic prosperity).	23%	0%
2f. Identify the availability of current highway safety training and education programs.	0%	0%
3 – Understand the origins and characteristics of traffic safety data and information systems to support decisions using a data-driven approach in managing highway safety.		
3a. Describe state and local information systems and data elements that can be used for safety management (e.g., crash, roadway inventory, driver/vehicle registration, citation, hospital/EMS, surveys, operations data, etc.).	68%	75%
3b. Describe the specialized national databases available for safety management and how they address deficiencies in the systems above (e.g., FARS, GES, CVISN, and WISQARS).	45%	50%
3c. Describe the process by which crash data are collected, including constraints associated with accurate, reliable field data.	64%	50%

(*Continued*)

Table 4 (Continued)

Core Competency and Learning Objectives	Coverage Eng.	Coverage P.H.
3d. For each of the information systems, describe strengths and weaknesses as well as opportunities for improvements (compliance with MMUCC and NEMSIS and automated collection methods).	45%	75%
3e. Ability to access and use traffic safety and public health data systems for identifying and tracking crash trends, targeting high-risk groups, and planning programs at the national, state, and local levels.	45%	0%
3f. Describe the importance of using crash injury or fatality data to evaluate the implications of safety management actions, policies, and programs.	82%	75%
4 – Demonstrate the knowledge and skills to assess factors contributing to highway crashes, injuries, and fatalities, identify potential countermeasures linked to the contributing factors, apply countermeasures to user groups or sites with promise of crash and injury reduction, and implement and evaluate the effectiveness of the countermeasures.		
4a. Identify current and potential highway safety problems using suitable scientific methods (e.g., those controlling for regression-to-the-mean).	64%	0%
4b. Identify the linkages among human factors and behavior, vehicle design, roadway design, and the environment and their interactions with respect to identified crash problems.	100%	100%
4c. Identify effective countermeasures that address specific crash factors.	100%	100%
4d. Establish priorities for alternative interventions/countermeasures based upon their expected cost and effectiveness and select countermeasures to implement (e.g., utilizing current science-based research methods such as *NCHRP Report 500* series and NHTSA/FHWA *Highway Safety Guidelines*).	36%	25%
4e. Evaluate the effectiveness of the implemented intervention/countermeasure using appropriate statistical techniques in safety management; [e.g., use of Empirical Bayes (EB) and/or case-control designs].	50%	25%
4f. Understand the importance of computing the expected safety cost/benefit associated with implementing a countermeasure as the difference between the crashes, fatalities, and injuries likely to occur with the countermeasure in place and the number of crashes, fatalities, and injuries expected to occur if the countermeasure were not implemented.	64%	25%
5 – Be able to develop, implement and manage a highway safety management program.		
5a. Utilize scientific management techniques in planning, implementing, and evaluating highway safety programs.	14%	0%
5b. Identify strategies to integrate and amplify safety in transportation planning processes.	0%	0%
5c. Explain the need to provide leadership and funding for ongoing service/support enhancements such as professional development, staff education and training, upgraded computer hardware and software and more.	0%	0%
5d. Establish multidisciplinary relationships necessary to support effective highway safety initiatives.	32%	0%
5e. Identify opportunities for internal and external coalition-building and strategic communications for highway safety initiatives.	5%	0%
5f. Identify sources of current research that support effective highway safety management (e.g., *NCHRP Report 501,* TRIS, *Accident Analysis and Prevention, Morbidity and Mortality Weekly Review,* SAE, *Injury Prevention*).	23%	0%
5g. Understand the value of leveraging resources for highway safety program implementation.	5%	0%
5h. Assess and promote effective outreach/public involvement program development and implementation.	23%	0%

Table 4 indicates significant variation in the coverage of Core Competency 1 within existing safety courses. Some learning objectives such as combining countermeasures and multidisciplinary collaboration and potential barriers (i.e., learning objectives 1h, 1j, and 1k) are virtually nonexistent in current curricula while others such as the understanding of transportation engineering problems from a science-based approach (i.e., 1b) receive coverage in about half of the engineering and public health courses. Public health courses are providing thorough coverage of the classification of highway crash and injury severity factors in relation to the crash event as well as recognizing how highway user decision-making is influenced by highway design, transportation planning, traffic operations, and vehicle design. In addition, public health courses far exceed the engineering curricula in demonstrating how effective safety management can be used to reduce the morbidity and mortality risk associated with crash events. In general, the basic material in the first core competency is present in less than 50% of current engineering courses. Public health courses are providing slightly better coverage in most areas. However, it is evident that a thorough introduction to the fundamentals of safety is missing from many current safety courses, in both engineering and public health.

Core Competency 2: History and Institutional Setting for Safety Management Road safety history and legislation is a good starting point for the second core competency. Safety has not had as strong a presence as planning, design, and operations in the transportation community, but beginning with the Highway Safety Act in 1966 awareness slowly increased. Recent trends such as the Americans with Disabilities Act (ADA), the creation of the FMCSA, and the emergence of strong consumer-oriented safety interest groups show the growing importance of highway safety.

Road safety history and legislation (learning objectives 2a and 2b) are the only learning objectives covered with some regularity (59% in engineering and 75% in public health). Public health courses are completely absent in coverage of Core Competency 2 beyond learning objectives 2a and 2b. Safety interest groups and the notion of decision-making tradeoffs are present in about 20% of the responding engineering courses while the current state of safety curricula does not appear in any of the evaluated courses. Institutional structure is only covered in 14% of engineering courses. There appears to be a major gap between the objectives set forth in the second core competency and the current content of safety courses.

Core Competency 3: Origins, Characteristics, and Use of Crash Data Inherent in the scientific assessment of safety is the collection and analysis of crash data. Before data collection or analysis occurs, one must first understand the limitations of data and data collection issues. Crash data are often recorded by law enforcement at the scene of a crash describing the details (e.g., type of collision, direction of vehicles, number and severity of injuries), information regarding the driver and vehicle (e.g., VIN, license number), and a description of the crash scene (e.g., collision diagram). The coordination among law enforcement and safety professionals is one commonly discussed issue concerning the accuracy and consistency of data collection.

Traffic safety information systems include crash data elements, injury type and severity, and roadway inventory. This information may then be used to summarize past trends, evaluate current implications, and estimate the future level of safety expected from the implementation of actions, policies, or programs. Suggestions to improve the current state of data collection (i.e., quality and consistency) include specialized training for data collectors and the widespread adoption of local, state, and federal databases. These databases are continuing to be used in assessments of important safety initiatives and policies; about half the courses introduce these databases. Some provide hands-on experience in analysis of problems as well.

It is encouraging that nearly all learning objectives, within Core Competency 3, are receiving at least 50% coverage by safety courses in both fields. Public health courses provide better coverage of describing data information systems and identifying deficiencies of these systems. However, there is minimal use of these systems for safety evaluation. Engineering courses tend to provide better coverage of the data collection process and use of crash data in the evaluation of safety management actions. While many courses do not fully cover the third set of learning objectives, this core competency is the most highly recognized by far.

Core Competency 4: Contributing Crash Factors, Countermeasures, and Evaluation Core Competency 4 focuses on the ability to identify sites worthy of treatment, assess contributing factors, identify potential countermeasures linked to the contributing factors, and evaluate effectiveness after implementation. Contributing factors are typically associated with the driver, vehicle, and infrastructure. Other areas that deserve attention within infrastructure countermeasures include context-sensitive design, design alternatives for pedestrians or bicyclists, and work zone safety. There remains much to be explored in the area of countermeasure development and evaluation. However, there are many current science-based research studies that have developed improved tools and techniques for the evaluation of countermeasures.

The coverage of Core Competency 4 varies significantly across learning objectives. The initial task of identifying current and potential highway safety problems is receiving adequate coverage in only 64% of engineering courses and no public health courses. Addressing current safety problems is a much more popular topic of discussion. Crash contributing factors are receiving thorough coverage with at least some mention in each of the responding courses. In addition, relevant countermeasures associated with the crash contributing factors are present in all responding courses. It should be noted, however, that within the discussion of safety-enhancing countermeasures in engineering courses, the primary focus is on roadway infrastructure (91%) followed by the road user (73%) and vehicular issues (45%). On the public health side, human and vehicle issues receive priority with 75% coverage and the infrastructure follows with only 50% coverage.

Interestingly, many courses are addressing countermeasures based on engineering texts and design guides rather than using references reflecting the science-based approach. Table 5 lists references provided by 12 courses. Many courses are referencing the AASHTO *Green Book* and *Roadside Design Guide* as well as the MUTCD, *Highway Capacity Manual* (HCM) and some traffic engineering textbooks. The more important issues of prioritizing projects, using appropriate statistical techniques, and computing expected safety benefits are not receiving adequate attention. Partially as a result of using these design guides and nonsafety texts, many of the remaining learning objectives do not exist in public health courses and are receiving limited coverage by engineering courses.

The final step of any safety program should include outcome evaluation and dissemination of results. Results should be rigorously analyzed using sound statistical methodology and expected safety benefits should be computed. The movement towards more advanced statistical modeling is a critical link to the scientific basis for safety. Administrators and senior management should realize the importance of scientific evaluation for decision-making purposes and while basic statistical competency is necessary for every safety professional, the level of knowledge will likely vary among individuals. At a minimum, safety professionals should be able to identify appropriate experimental design techniques and interpret the analysis of expected safety benefits. Sound experimental design, interpretation, and dissemination of results will help broaden knowledge and advance the state of the practice.

In summary, it should be emphasized that this competency represents knowledge of the critical analysis techniques and the perspective required to properly apply them. Unfortunately, there are many courses that use material well outside the safety research literature (e.g., the HCM) that does not provide needed skills or perspective. There is also a predominate use of existing practical guidelines such as the AASHTO *Green Book,* at the expense of providing a more rigorous methodological approach. These are generalizations and there are exceptions, but the coverage of learning objectives 4d, 4e, and 4f is particularly disappointing in this regard. There is research literature that provides coverage of this material; it is simply not being fully utilized.

Core Competency 5: Develop, Implement, and Administer a Highway Safety Management Program

The final core competency is focused on the ability to develop and administer a road safety management program. While the majority of the learning objectives within Core Competency 5 are institutional-level issues, it is important to be aware of the general concepts. The relative lack of progress in improving safety (as reflected in national injury and fatality rates) is a major concern to transportation safety professionals. Unfortunately, this is not perceived as a grave problem in the eyes of the public. Young safety professionals should be mindful of this issue so that they may respond to the challenge of developing awareness among decision-makers, special interest groups, and the general public. At the institutional level, objectives should focus on the multidisciplinary perspective of safety as well as the increasing importance of partnerships and potential

Table 5 Summary of the Course Reference Material

	Course											
Transportation Engineering Texts and References	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
A Policy on Geometric Design of Highways and Streets. American Association of State and Highway Transportation Officials, Washington, D.C., 2001.			X							X		
Accident Investigation and Surveillance Manual, ALDOT.	X											
Barfield, W. W. and T. A. Dingus. *Human Factors In Intelligent Transportation Systems.* Erlbaum, London, 1998.									X			
Evans L. *Traffic Safety and the Driver.* Van Nostrand Reinhold, New York, NY, 1991.		X					X					
Garber, N. J. and L. A. Hoel. *Traffic and Highway Engineering.* PWS Publishing, New York, 1999.					X					X		
Highway Capacity Manual. TRB, National Research Council, Washington D.C., 2000.			X		X							
Highway Risk Management System—A Procedural Guide.											X	
Highway Safety Improvement Program by FHWA, U.S. DOT.											X	
Hauer, E. *Observational Before-After Studies in Road Safety.* Pergamon Press, Elsevier Science Ltd., Oxford, UK, 1997.						X		X				
Identification, Analysis and Correction of High-Accident Locations. Technology Assistance Transfer Program, Missouri Highway and Transportation Department, 1990.	X											
Manual on Uniform Traffic Control Devices. FHWA, U.S. DOT, Washington, D.C., 2000.			X	X	X							
Ogden, K. W. *Safer Roads: A Guide to Highway Safety Engineering.* Avebury Technical, 1996.					X							X
Pline, J. *Traffic Engineering Handbook.* Fifth Edition, Institute of Transportation Engineers, Washington, D.C., 1999.					X					X		
Road Safety Manual. World Road Association, Paris, France, 2003.								X				
Roadside Design Guide. American Association of State Highway and Transportation Officials, Third Edition, Washington, D.C., 2002.	X					X		X				
Robertson, H. D., J. E. Hummer, and D. C. Nelson. *Manual of Traffic Engineering Studies.* Institute of Transportation Engineers, Washington, D.C., 1994.					X							

(*Continued*)

Table 5 (Continued)

Transportation Engineering Texts and References	Course											
	1	2	3	4	5	6	7	8	9	10	11	12
Roess, R. P., E. S. Prassas, and W. R. McShane. *Traffic Engineering,* 3rd Edition, Prentice Hall, Upper Saddle River, New Jersey, 2004.			X		X						X	
Lamm, R., B. Psarianos, and T. Mailaender. *Highway Design and Traffic Safety Engineering Handbook.* McGraw Hill Handbooks, New York, NY, 1999.				X								
Shinar, D. *Psychology on the Road, the Human Factor in Traffic Safety,* Wiley, New York, NY,1978.							X					
Synthesis of Safety Research Related to Traffic Control and Roadway Elements, Volumes 1 and 2, FHWA, 1982.	X											
Traffic Accident Investigation Manual, Traffic Institute, Center for Public Safety, Northwestern University, Evanston, IL, 2002.	X											
Traffic Accident Reconstruction, Traffic Institute, Center for Public Safety, Northwestern University, Evanston, IL, 2002.	X											
The Traffic Safety Toolbox: A Primer on Traffic Safety, Institute of Transportation Engineers, Washington, D.C., 1999.	X				X					X		

cost-sharing opportunities. In a technologically advancing society, emphasis should also be placed on the importance of maintaining competent staff and up-to-date equipment through professional development and technical upgrades.

Establishing multidisciplinary relationships is a leading topic of discussion within this competency (32% in engineering). The remaining learning objectives do not appear consistently within any of the identified engineering safety courses and this competency is completely absent from public health curricula. While it is not critical for safety courses to address all aspects of program management in depth, a general overview of the structure of safety management systems should be provided.

Summary

Although many transportation courses indicated a strong presence of safety content, the majority only incorporate aspects of safety with primary content in design and operations. Of the 29 positive responses from universities, six did not even incorporate safety in the course title. While this is not the only measure to be applied to an assessment of safety content, it is an indicator of the stature of safety in graduate and undergraduate curricula. As revealed by the review of supplied curricula, safety content most often included an introduction to safety-related data (e.g., accident and fatality rates), basic safety engineering treatments (e.g., roadway and roadside design issues), and perhaps a discussion of crash countermeasures using the Haddon Matrix. The shortcoming, as expected prior to the survey, is the frequent lack of analysis content and context for safety; the placing of safety within operations and design material, rather than as a discipline of its own, with important principles and basic concepts.

Only four universities indicated two safety course offerings; these four "programs" are evaluated in Table 6, which contains an "X" for each learning objective covered by at least one of the two courses in the "safety programs." It is interesting to compare Table 4 and Table 6. Students within the safety

Table 6 Program Coverage of Safety Core Competencies

Core Competency and Learning Objectives	Universities			
	1	2	3	4
1 – Understand the management of highway safety as both a complex multidisciplinary field and one that must be understood systematically.				
1a. Describe highway safety as a complex, interdisciplinary, multimodal discipline devoted to the avoidance and/or mitigation of fatalities, injuries, and crashes.	X	X	X	X
1b. Understand, value, and utilize science-based highway safety research and its application as fundamental to achieving further improvements in highway safety.	X	X	X	X
1c. Describe the demographic trends underlying the need for comprehensive and integrated highway safety management (e.g., social, cultural, age, gender).		X		X
1d. Describe the classification of highway crash and injury severity factors and their relationship to the crash event (i.e., pre-crash, crash, and post-crash) by using models such as the Haddon Matrix.	X	X	X	
1e. Identify how crash contributing factors interact.		X	X	
1f. Explain how effective safety management can be used to prevent morbidity and mortality associated with crash events.	X	X		X
1g. Explain the "Four E's" of traffic safety: engineering, education, enforcement and emergency medical services.	X	X		
1h. Recognize the effectiveness of combining countermeasures to achieve improvements in safety.		X		
1i. Recognize how highway user decision-making is influenced by highway design, transportation planning, traffic operations, and vehicle design.		X	X	X
1j. Recognize the barriers that hinder collaboration across and within institutions.				
1k. Identify and demonstrate opportunities and the ability to improve safety through collaboration with individuals from diverse cultural, disciplinary, and educational backgrounds and institutions.				
2 – Understand and explain the history of highway safety and the institutional setting in which safety management decisions are made.				
2a. Understand the historical figures, benchmarks, and decisions underlying highway safety.	X	X	X	X
2b. Identify the safety aspects of major transportation legislation.	X	X	X	X
2c. List and describe the goals of interest groups with a stake in safety-related policy, legislation, and investment decisions.		X		
2d. Describe the institutional roles and responsibilities within which safety is managed (e.g., local, regional, state, and federal government, transportation modes and the private sector).				
2e. Explain and provide examples of the importance of highway safety relative to other transportation priorities (e.g., congestion mitigation, environmental protection, air quality, economic prosperity).	X	X		
2f. Identify the availability of current highway safety training and education programs.				
3 – Understand the origins and characteristics of traffic safety data and information systems and their use in managing highway safety.				
3a. Describe state and local information systems and data elements that can be used for safety management (e.g., crash, roadway inventory, driver/vehicle registration, citation, hospital/EMS, surveys, operations data, etc.).	X	X	X	X

(*Continued*)

Table 6 (Continued)

Core Competency and Learning Objectives	Universities 1	2	3	4
3b. Describe the specialized national databases available for safety management and how they address deficiencies in the systems above (e.g., FARS, GES, CVISN, and WISQARS).	X	X	X	
3c. Describe the process by which crash data are collected, including constraints associated with accurate, reliable field data.	X	X	X	X
3d. For each of the information systems, describe strengths and weaknesses as well as opportunities for improvements (compliance with MMUCC and NEMSIS and automated collection methods).	X	X		
3e. Ability to access and use traffic safety and public health data systems for identifying and tracking crash trends, targeting high-risk groups, and planning programs at the national, state, and local levels.		X		X
3f. Describe the importance of using crash injury or fatality data to evaluate the implications of safety management actions, policies, and programs.	X	X	X	X
4 – Demonstrate the knowledge and skills to assess factors contributing to highway crashes, injuries and fatalities, identify potential countermeasures linked to the contributing factors, and implement and evaluate the effectiveness of the countermeasures.				
4a. Identify current and potential highway safety problems using suitable scientific methods (e.g., those controlling for regression-to-the-mean).	X	X		X
4b. Identify the linkages among human factors and behavior, vehicle design, roadway design, design, and the environment and their interactions with respect to identified crash problems.	X	X	X	X
4c. Identify effective countermeasures that address specific crash factors.	X	X	X	X
4d. Establish priorities for alternative interventions/countermeasures based upon their expected cost and effectiveness and select countermeasures to implement (e.g., utilizing current science-based research methods such as *NCHRP Report 500* series and NHTSA/FHWA *Highway Safety Guidelines*).		X		X
4e. Evaluate the effectiveness of the implemented intervention/countermeasure using appropriate statistical techniques in safety management [e.g., use of Empirical Bayes (EB) and/or case-control designs].	X	X		
4f. Understand the importance of computing the expected safety cost/benefit associated with implementing a countermeasure as the difference between the crashes, fatalities, and injuries likely to occur with the countermeasure in place and the number of crashes, fatalities, and injuries expected to occur if the countermeasure were not implemented.	X	X	X	
5 – Ability to develop and administer a highway safety management program.				
5a. Utilize scientific management techniques in planning, implementing, and evaluating highway safety programs.				
5b. Identify strategies to integrate and amplify safety in transportation planning processes.				
5c. Explain the need to provide leadership and funding for ongoing service/support enhancements such as professional development, staff education and training, upgraded computer hardware and software and more.				
5d. Establish multidisciplinary relationships necessary to support effective highway safety initiatives.	X	X	X	
5e. Identify opportunities for internal and external coalition-building and strategic communications for highway safety initiatives.	X			

Table 6 (Continued)

Core Competency and Learning Objectives	Universities 1	2	3	4
5f. Identify sources of current research that support effective highway safety management (e.g., *NCHRP Report 501*, TRIS, *Accident Analysis and Prevention*, *Morbidity and Mortality Weekly Review*, SAE, *Injury Prevention*)		X		
5g. Understand the value of leveraging resources for highway safety program implementation.	X			
5h. Assess and promote effective outreach/public involvement program development and implementation.				

programs (i.e., two courses as opposed to one) are provided with a broader and deeper understanding of safety context and perspective as reflected by the coverage of Core Competency 1. Understanding crash data collection and safety data systems (Core Competency 3) is also a strong point of the programs. Many actually provide students the opportunity to work with and conduct analyses with crash data. More importantly, the areas of more consistent coverage included science-based principles as reflected in learning objectives 1b, 4a, 4d, and 4f. Instructors in these programs are covering the fundamental safety analysis issues as important in their own right. It is evident that there is consistently better coverage of the core competencies within the safety programs compared to universities offering a single course.

CONCLUSIONS

The scan of U.S.-based university courses in safety identified relatively few current offerings within engineering programs (29 of 117) and a comparable lack of coverage within public health programs (7 of 34). Findings support the hypothesis that highway safety is underrepresented in transportation curricula throughout the United States. An in-depth review of course materials revealed that many current safety courses are not addressing several key issues identified by the safety core competencies (*12*). Many courses that utilize engineering texts (both design- and operations-oriented) represent the content as "safety-oriented." This finding further supports the working hypothesis that there is a prevalent view, even among university educators, that "good" design and operations, as described in professional guidebooks, will lead to quantifiable safety improvements. The relative lack of existing safety research material to provide a more fundamental and rigorous safety educational experience is a particular concern.

This digest is not intended to criticize individual courses or universities, but rather to identify and shed light on an important educational deficiency that exists throughout the United States. While progress continues to be made in the development of better tools and analysis techniques for safety management, these techniques are absent in most university-based education programs. Perhaps more importantly, there are only a handful of universities that treat safety as a discipline in its own right, with principles and a scientific perspective underlying its practice and future development. Correct and sustained use of contemporary techniques can only be assured if the safety-science perspective is understood and accepted by the workforce. This situation must change if reductions in highway fatalities and injuries are to be sustained into the future. It is unrealistic to assume that new, more effective strategies will be developed and implemented by professionals trained using old materials.

HIGHWAY SAFETY CORE COMPETENCIES

Core Competency 1

Understand the management of highway safety as a complex multidisciplinary system.

Learning Objectives

Highway safety professionals should be able to:

1. Describe highway safety as a complex, interdisciplinary, multimodal discipline devoted to the avoidance and/or mitigation of fatalities, injuries, and crashes.
2. Understand, value, and utilize science-based highway safety research and its application

as fundamental to achieving further improvements in highway safety.
3. Describe the demographic trends underlying the need for comprehensive and integrated highway safety management (e.g., social, cultural, age, gender).
4. Describe the classification of highway crash and injury severity factors and their relationship to the crash event (i.e., pre-crash, crash, and post-crash) by using models such as the Haddon Matrix.
5. Identify how crash contributing factors interact.
6. Explain how effective safety management can be used to prevent morbidity and mortality associated with crash events.
7. Explain the "Four E's" of traffic safety: engineering, education, enforcement, and emergency medical services.
8. Recognize the effectiveness of combining countermeasures/interventions to achieve improvements in safety.
9. Recognize how highway user decision-making is influenced by highway design, transportation planning, traffic operations, and vehicle design.
10. Recognize the barriers that hinder collaboration across and within institutions.
11. Identify and demonstrate opportunities and the ability to improve safety through collaboration with individuals from diverse cultural, disciplinary, and educational backgrounds and institutions.

Core Competency 2

Understand and be able to explain the history of highway safety and the institutional settings in which safety management decisions are made.

Learning Objectives

Highway safety professionals should be able to:

1. Understand the historical figures, benchmarks, and decisions underlying highway safety.
2. Identify the safety aspects of major transportation legislation.
3. List and describe the goals of interest groups with a stake in safety-related policy, legislation, and investment decisions.
4. Describe the institutional roles and responsibilities within which safety is managed (e.g., local, regional, state, and federal government, transportation modes, and the private sector).
5. Explain and provide examples of the importance of highway safety relative to other transportation priorities (e.g., congestion mitigation, environmental protection, air quality, economic prosperity).
6. Identify the availability of current highway safety training and education programs.

Core Competency 3

Understand the origins and characteristics of traffic safety data and information systems to support decisions using a data-driven approach in managing highway safety.

Learning Objectives

Highway safety professionals should be able to:

1. Describe state and local information systems and data elements that can be used for safety management (e.g., crash, roadway inventory, driver/vehicle registration, citation, hospital/EMS, surveys, operations data, etc.).
2. Describe the specialized national databases available for safety management and how they address deficiencies in the systems above (e.g., FARS, GES, CVISN, and WISQARS).
3. Describe the process by which crash data are collected, including constraints associated with accurate, reliable field data.
4. For each of the information systems, describe strengths and weaknesses as well as opportunities for improvements (compliance with MMUCC and NEMSIS and automated collection methods).
5. Access and use traffic safety and public health data systems for identifying and tracking crash trends, targeting high-risk groups, and planning programs at the national, state, and local levels.
6. Describe the importance of using crash injury or fatality data to evaluate the implications of safety management actions, policies, and programs.

Core Competency 4

Demonstrate the knowledge and skills to assess factors contributing to highway crashes, injuries, and fatalities, identify potential countermeasures linked to the contributing factors, apply countermeasures to user groups or sites with promise of crash and injury reduction, and implement and evaluate the effectiveness of the countermeasures.

Learning Objectives

Highway safety professionals should be able to:

1. Identify current and potential highway safety problems using suitable scientific methods (e.g., those controlling for regression-to-the-mean).
2. Identify the linkages among human factors and behavior, vehicle design, roadway design, and the environment and their interactions with respect to identified crash problems.
3. Identify effective countermeasures that address specific crash factors.
4. Establish priorities for alternative interventions/countermeasures based upon their expected cost and effectiveness and select countermeasures to implement (e.g., utilizing current science-based research methods such as *NCHRP Report 500* series and NHTSA/FHWA *Highway Safety Guidelines*).
5. Evaluate the effectiveness of the implemented intervention/countermeasure using appropriate statistical techniques in safety management [e.g., use of Empirical Bayes (EB) and/or case-control designs].
6. Understand the importance of computing the expected safety benefit/cost associated with implementing a countermeasure as the difference between the crashes, fatalities, and injuries likely to occur with the countermeasure in place and the number of crashes, fatalities, and injuries expected to occur if the countermeasure were not implemented.

Core Competency 5

Be able to develop, implement, and manage a highway safety management program.

Learning Objectives

Highway safety professionals should be able to:

1. Utilize scientific management techniques in planning, implementing, and evaluating highway safety programs.
2. Identify strategies to integrate and amplify safety in transportation planning processes.
3. Explain the need to provide leadership and funding for ongoing service/support enhancements such as professional development, staff education and training, upgraded computer hardware and software and more.
4. Establish multidisciplinary relationships necessary to support effective highway safety initiatives.
5. Identify opportunities for internal and external coalition-building and strategic communications for highway safety initiatives.
6. Identify sources of current research that support effective highway safety management (e.g., *NCHRP Report 501,* TRIS, *Accident Analysis and Prevention, Morbidity and Mortality Weekly Review,* SAE, *Injury Prevention*).
7. Understand the value of leveraging resources for highway safety program implementation.
8. Assess and promote effective outreach/public involvement program development and implementation.

FROM COMPETENCY TO PRACTICE: USING THE HIGHWAY SAFETY CORE COMPETENCIES

Competencies ⇔ Knowledge, Skills, and Abilities ⇔ Job Descriptions
⇕ ⇕
Learning Objectives ⇔ Courses ⇔ Curricula ⇔ Credentials

General

The Core Competencies may be used to:

- Assess individual abilities relative to a list of standard competencies;
- Identify the knowledge, skills, and abilities an organization requires;
- Determine workforce requirements (e.g., number of people with what skills, at each level, and in what combination);
- Identify prerequisite skills for employees, instructors, faculty, or researchers;
- Develop or modify job descriptions;
- Assess the skill level of a team and develop recommendations for hiring, as well as individual training and assignments;

- Develop model curricula;
- Use as learning objectives in course development, which in turn influences course content, instructional methods, and assessment;
- Assess course materials to determine how thorough or complete the material is for a given audience or purpose;
- Make decisions about education and training activities to undertake, offer, or recommend;
- Advise students interested in a particular profession; and
- Use as the basis for credentials, certificates, or degree programs.

Educational Institutions

Students can review competencies to make decisions in selecting careers, schools, and courses.

Educators may use competencies to assess and modify existing courses, develop new courses, or propose as new curricula.

Educational Institutions may use competencies to identify or specify the skills of faculty, instructors, or researchers; select course offerings; adjust required curricula, advise students interested in a particular career; and offer specialized certificates or degrees.

Certification Programs should use clearly identified competencies as the basis for curricula or evaluation upon which credentials are granted.

Professional Institutions or Committees may use competencies to advise other organizations of minimum or ideal skills, and to develop model curricula.

Safety Organizations

Human Resources Departments may use the competencies to identify what knowledge, skills, and abilities the organization as a whole requires, adjust job descriptions and announcements, and work with other departments and managers to hire for those skills.

Training Coordinators use the competencies to assess what topics should be available to meet training needs. Ideally, the coordinator would identify a source of training for all competencies applicable to their audience. With the help of a clearinghouse, coordinators should be able to map competencies to courses.

Supervisors may use the competencies to assess the level of a team's skills and make recommendations for individual training, assignment, and hiring to enhance the skills of the team and its members.

Employees use competencies to assess ones own abilities relative to a list of standard competencies, for a current or considered job or career path, and to make decisions about training or activities to undertake.

Technology Transfer Agents

Training Developers and Authors should use competencies as the bases for learning objectives, content, instructional and communication techniques, and assessment.

Instructors may compare competencies to existing course material to determine how thorough or complete the material is for a given audience or purpose. The comparison may be used to adjust either the course content or the manner in which the course is marketed.

Training Centers can use the competencies to assess what topics should be available for training. Ideally, the center would identify a source of training for all competencies applicable to their audience. With the help of a clearinghouse, coordinators should be able to map competencies to courses.

Clearinghouses should make competencies available, and help link customers from competencies to specific resources (documents or training) related to these resources. This may be accomplished by key word searches, but highly specialized databases may link records to specific competencies. This service would be useful to any other users of the competencies.

Levels of Proficiency

A set of competencies may represent the minimum criteria or ideal mastery for a position, depending on their application vis-à-vis the role of the position in the organization to which they are applied. Thus, core competencies could be covered in a one-day course to give a new employee with tangential safety responsibility insight into the field. Full mastery of the same competencies may take several years of study or part of a career to achieve, and would be an appropriate expectation for leaders and full-time highway safety professionals. Certifications of any type can therefore help to communicate a particular level or degree of mastery.

Model Curricula

A curriculum is a program of study, usually in sufficient detail to thoroughly address all required learning objectives. Several curricula could be developed for the same set of competencies, depending upon the timeframe, organization, audience, and source materials. A model curricula should outline a program of study guaranteed to satisfy all of the intended objectives (e.g., competencies), which can be used by an instructor or modified to suit their audience. This combination of ideal and flexibility is especially important when use of the curricula is voluntary.

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GLOSSARY OF TERMS

Contributing Factors—Risk factors related to the road-user, vehicle, and roadway environment that increase the likelihood of a crash event.

Countermeasure—Any program, plan, or action that is implemented to reduce the likelihood or severity of crashes.

CVISN (Commercial Vehicle Information Systems and Networks)—Elements of the Intelligent Transportation System (ITS) that support commercial vehicle operations (CVO). CVISN includes information systems owned and operated by governments, carriers, and other stakeholders. It excludes the sensor and control elements of ITS/CVO.

EMS—Emergency Medical Services.

FARS (Fatality Analysis Reporting System)—A database that contains data on a census of fatal traffic crashes within the 50 states, the District of Columbia, and Puerto Rico. To be included in FARS, a crash must involve a motor vehicle traveling on a traffic way customarily open to the public, and must result in the death of an occupant of a vehicle or a non-motorist within 30 days of the crash.

FHWA (Federal Highway Administration)—A modal administration within the U.S. DOT with the mission to enhance mobility through innovation, leadership, and public service.

GES (General Estimates System)—A database that contains data from a nationally representative sample of police-reported crashes of all severities, including those that result in death, injury, or property damage. To be eligible for the GES sample, a police accident report (PAR) must be completed for the crash, and the crash must involve at least one motor vehicle traveling on a traffic way and must result in property damage, injury, or death.

Haddon Matrix—A framework used by safety professionals for understanding the relationship among crash contributing factors and for identifying multiple countermeasures to address those issues. In highway safety, this matrix consists of three rows representing time phases (before the incident, during the incident, and after the incident) and four columns representing the road-user, vehicle, infrastructure, and the cultural environment.

Interdisciplinary—A group of professionals with expertise in different disciplines who collaborate to develop and evaluate management alternatives.

MMUCC (Model Minimum Uniform Crash Criteria)—Voluntary guidelines developed to improve and standardize state crash data.

Multidisciplinary—The involvement of two or more disciplines or professions in the provision of integrated and coordinated services including evaluation and assessment activities.

NCHRP Report 500 Series—A series of guides, developed by the National Cooperative Highway Research Program (NCHRP 17-18), to assist state and local agencies in reducing injuries and fatalities in targeted areas.

NCHRP Report 501—A tool, developed by the National Cooperative Highway Research Program (NCHRP 17-18), to assist in integrating safety-related implementation actions by proposing a method for bringing together agencies within a jurisdiction that are responsible for highway safety.

NEMSIS (National EMS Information System)—A method of collecting, analyzing, and sharing local and state EMS data to facilitate improved EMS systems and improved patient care.

NHTSA (National Highway Traffic Safety Administration)—Established by the Highway Safety Act of 1970, as the successor to the National Highway Safety Bureau, to carry out safety programs under the National Traffic and Motor Vehicle Safety Act of 1966 and the Highway Safety Act of 1966.

Regression-to-the-Mean—Technical term in probability and statistics to describe the tendency for things to return to normal. In highway safety, this refers to the random nature of crashes and the tendency for relatively high or low crash frequencies to regress to the mean in subsequent years.

SAE (Society of Automotive Engineers)—A membership society dedicated to advancing mobility engineering worldwide.

Task-Capability-Interface Model—Provides a conceptualization of the necessary tasks related to the driving process and the conditions under which the demands of the task for safe mobility exceed driver capability.

TRIS (Transportation Research Information Services)—A searchable database of articles produced and maintained by the TRB at the National Academies.

WISQARS (Web-based Injury Statistics Query and Reporting System)—An interactive database system that provides customized reports of injury-related data.

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