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DEVELOPMENT MATERIALS FOR A LOCAL MAINTENANCE PERSONNEL RURAL ROAD SAFETY RECOGNITION PROGRAM

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Disclaimer

Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the Author(s) and do not necessarily reflect the view of the U.S. Department of Transportation.

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List of Acronyms

ARTBA – American Road & Transportation Builders Association
FHWA – Federal Highway Administration TRB – Transportation Research Board
IRF – International Road Federation
ITE – Institute of Transportation Engineers
LEED AP – Leadership in Energy and Environmental Design Accredited Professional
LRRB – Local Road Research Board
LTAP – Local Technical Assistance Program
MUTCD – Manual on Uniform Traffic Control Devices
NACE – National Association of County Engineers
NHI – National Highway Institute
OSHA – Occupational Safety and Health Administration
PMP – Project Management Professional
PTOE – Professional Transportation Operations Engineer
PTP – Professional Transportation Planner
RSA – Road Safety Audit (or Assessment)
SCTPP – Safety Certification for Transportation Project Professionals
TTAP – Tribal Technical Assistance Program

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Introduction

The reduction of severe injury and fatal vehicle crashes within the US requires the involvement of transportation professionals from local, state, and federal agencies. Therefore, a need exists to increase the transportation safety knowledge base at all levels of government. However, the majority of the roadway miles in the US are under local government jurisdiction.

While the wide range of safety knowledge within these local agencies is generally recognized, in many cases, safety is just one of many areas of responsibility for transportation staff within local roadway agencies. Furthermore, rural road maintenance plays a role in safety for roadway users who travel regularly on our secondary roadways.

This project is in response to a proposal that the compilation and summary of information useful to the development of a rural road safety recognition program for local maintenance personnel would be of value to local agency professional development entities (e.g., Local and Tribal Technical Assistance Programs [LTAPs and TTAPs], local road agencies, and state Departments of Transportation [DOTs]). This information might include the identification of roadway safety learning objectives and subject areas that could be included within a curriculum of instruction, courses that are currently available, and a process of recognition for local maintenance personnel who complete this curriculum.

The implementation of this type of program for local agency maintenance personnel should encourage a greater safety culture and hopefully help lead to severe injury and fatal vehicle crash reductions along rural roadways within the US.

This report provides a summary of information for those considering the implementation of roadway safety curriculum and/or recognition programs for local agency maintenance personnel.

Problem Addressed

This project was started because it was recognized that there are currently no nationally based recognition programs for local transportation agency maintenance personnel who work to gain a significant background and knowledge in rural road safety. The authors propose that any type of recognition, whether at the state and/or national level, may help improve the safety of rural roadways within the US. An investigation into the existing state of the knowledge and available information related to this type of program was initiated, and this report is the result of that work.

Objectives

The primary objective of this project was to provide information to professional development entities whose staff members are considering the creation and implementation of a rural roadway

safety curriculum and/or recognition program for local agency maintenance personnel. This objective was met through the investigation and summary of past and current efforts being completed and/or implemented with respect to roadway safety core competencies and curriculum.

In addition, the authors identified potential curriculum subjects and suggested the basic components or logistics of how this type of program might be structured. Finally, as necessary, the authors identified gaps in the safety curricula materials available for future material development.

The overarching goal of this project was to assist those working to increase the rural roadway safety knowledge base of local transportation agency maintenance personnel and recognize those who have completed this professional development.

Report Organization

The remainder of this report includes information about a variety of areas related to roadway safety curricula and recognition programs.

First, a summary is provided of roadway safety curricula and program efforts that have been developed and are currently being offered. Several roadway safety curricula and recognition programs that are under development are also noted, and existing information about potential implementation strategies for these types of programs is included.

Second, lists of suggested learning objectives and potential safety subjects that could be included in a rural roadway safety curriculum and recognition program for local agency maintenance personnel are provided. Available resources, if any, for courses in these subject areas are also noted. Then based on the suggested list of subjects for a rural roadway safety curriculum, some of the gaps that need to be filled to offer a program that contains all the suggested subjects are identified.

Third, some of the main components and logistical issues connected to this type of program are identified and described.

Conclusions and recommendations connected to these gaps and the implementation of a rural roadway safety recognition program for local agency maintenance personnel are then summarized.

Existing Safety-Based Curricula and Programs

As a transportation workforce trained in safety topics has become a need, work has been done to look at various curricula and core competencies that are needed for a properly trained workforce. While much work has been done to develop a curriculum to have a properly trained transportation safety workforce, this effort has mainly focused on training at universities or professional

development for engineers and planners. A need still exists for the development of a rural roadway safety curriculum for maintenance personnel within local transportation agencies.

National Efforts – General

In a study commissioned by the Transportation Research Board (TRB) Joint Subcommittee for Highway Safety Workforce Development, Jovanis and Gross (2006) developed a set of core competencies for transportation safety professionals. The core competencies produced from this study are intended as a minimum set of core knowledge, skills, and abilities to function effectively in the highway safety field.

Five core competencies were developed that were believed to be essential for a person to have a well-rounded knowledge of roadway safety, as follows:

1. Multidisciplinary nature of safety
2. History and institutional setting for safety management
3. Origins, characteristics, and use of crash data
4. Contributing crash factors, countermeasures, and evaluation
5. Development, implementation, and administration of a highway safety management program

Learning outcomes for each competency were also developed and are included in Appendix A.

Multiple curricula have been developed based on these core competencies. However, these curricula have been developed primarily for a university setting. One of these curricula was shared in the National Cooperative Highway Research Program (NCHRP) Report 667: Model Curriculum for Highway Safety Core Competencies (Cambridge Systematics et al. 2010). This curriculum, *Road Safety 101,* features five units with two to six lessons per unit and meets university standards. The audience for this curriculum is road safety professionals (i.e., those who spend most or all of their day on road safety matters).

Road Safety 101 is currently offered as an online certificate program through the University of North Carolina Highway Safety Research Center (see http://www.rsa.unc.edu/101.cfm). A second curriculum has been developed by the Southeastern Transportation Center (Stamatiadis 2016). This curriculum is web-based, modular, and designed for university graduate students.

A study for the American Association of Highway and Transportation Officials (AASHTO) Standing Committee on Highway Traffic Safety also identified current available training and used the core competencies developed by Jovanis and Gross (2006) to develop highway safety training roadmaps for professional development of various professions (Bahar 2011). Nine groups, ranging from elected officials and managers to engineers and planners at both state DOTs and local agencies, had

training roadmaps developed for them based on the varying levels of competency they would require.

Each roadmap included the core competencies and learning concepts that should be targeted for each group, the processes and tools used to support the application of these concepts (e.g., the Toward Zero Deaths program supporting the application of the concept of multidisciplinary relationships necessary to support effective highway safety initiatives), the context or circumstance in which the concepts would be applied, and then, finally, a list of potential sources of training material.

The focus of the roadmaps was more for individuals who have management and technical professional (e.g., engineering and planning) positions than for those who work on the roadways in the day-to-day operations at local transportation agencies (i.e., part of the audience served by LTAPs and TTAPs). The roadmap developed that came closest to targeting local agency maintenance staff might be that shown from Bahar (2011) for Local Agency Mid-Level Managers (Level 1), Urban Planners (Level 1), Transportation Planners (Level 1), Traffic Engineers (Level 2), Field Investigators (Road Safety Audit [RSA] team members), and Safety Engineers (Level 2). While this roadmap included more technical competencies than are probably needed by local agency maintenance personnel, it did provide the basis for what is proposed in this report and included courses that may be relevant to our audience. A copy of this roadmap is included in Appendix B.

In addition to the roadmaps, Bahar (2011) also identified and inventoried 184 courses from sources including LTAPs/TTAPs, universities, professional organizations, and local entities. These courses covered core competencies 1–4 that were listed previously and defined by Jovanis and Gross (2006). These competencies included the multidisciplinary nature of safety, history, and institution setting for safety management; origins, characteristics, and use of crash data and contributing crash factors; countermeasures; and evaluation. A copy of these courses and the core competencies that they cover is included in Appendix C. The majority of the training offered to local agencies by LTAPs/TTAPs that Bahar (2011) identified did not address many of the core competencies.

In an earlier report, Knapp et al. (2003) also acknowledged the general lack of safety training for local agencies and the general gaps that they often have in their road safety knowledge. LTAPs were suggested as a good mechanism to help safety training reach the local audience (Knapp et al. 2003).

National Efforts – Professional Associations

Professional organizations have also begun addressing the need for a professional safety certificate. The Institute of Transportation Engineers (ITE) has begun looking at developing a certification in

safety similar to the certifications that it offers for a Professional Transportation Operations Engineer (PTOE)[1] and a Professional Transportation Planner (PTP)[2].

In addition, the American Road & Transportation Builders Association (ARTBA) offers two Road Safety Academies[3]. These academies generally focus on personal safety and cover Occupational Safety and Health Administration (OSHA) related courses. ARTBA also offers a Safety Certification for Transportation Project Professionals (SCTPP)[4]. The SCTPP recognizes transportation project professionals who have demonstrated the competencies necessary to identify and mitigate potential safety risks on project sites. Again, the programs offered through ARTBA are focused on worker and project safety and not necessarily on broader roadway safety issues.

The International Road Federation (IRF) offers a Road Safety Auditor Team Leader Certification. According to information on their website[5], the certification provides an international accreditation of proficiency for seasoned road safety auditors who wish to further enhance their credentials to seek work abroad.

The Transportation Association of Canada Road Safety Standing Committee has commissioned a report to look at the business models employed by transportation certification programs as it investigates whether to offer a road safety professional designation. In their report, Peterniak and Murphy (2016) summarized these business models. The models include the PTOE and PTP certifications offered by ITE, as well as the Project Management Professional (PMP) from the Project Management Institute and the Leadership in Energy and Environmental Design Accredited Professional (LEED AP) from the Canada Green Building Council.

The characteristics evaluated for each program considered were the certification topic, terms, and annual fee, as well as the number of applicants and certificate holders. Peterniak and Murphy (2016) found that certifications generally range from three to five years and do not include an annual fee, and the number of people in the programs ranged from the hundreds to the millions.

[1] http://www.tpcb.org/ptoe/
[2] http://www.tpcb.org/ptp/
[3] http://www.artba.org/safety/training-programs/
[4] http://www.artba.org/sctpp/
[5] https://www.irf.global/portfolio/road-safety-auditor-team-leader-certification/

LTAP/TTAP Efforts

A scan and assessment of all the LTAP/TTAP websites and discussions with various LTAP directors found a variety of safety program offerings are in place. Four LTAPs in the US appear to have a special training series or certifications that are focused on roadway or worker safety. These are summarized below.

Certificates or Programs

Colorado has recently restructured its Roads Scholars program to emphasize safety. Its four core curriculum courses revolve around safety: (1) signing, pavement marking, and the Manual on Uniform Traffic Control Devices (MUTCD); (2) roadway safety and work zone traffic control; (3) safety on the job; and (4) drainage (Colorado LTAP 2017).

The Connecticut CT Technology Transfer Center offers a Safety Academy program. This program has offered courses in sign installation and maintenance and sign retroflectometer training, local road safety fundamentals, road safety audits (RSAs), data analysis and use, pedestrian safety, local road safety plans, construction zone safety inspection, safety improvements for rural roads, safety countermeasures for roadways, horizontal curve alignment, guardrail use, and the safety edge (Connecticut CT Technology Transfer Center 2017).

The Kansas LTAP offers the Safety Star Program. Courses in this program include workplace, jobsite, and equipment safety; risk and liability issues; engineering functions in public works; MUTCD for technicians; low-cost safety improvements; RSAs; and making roads safer. The Safety Star Program is targeted at city street superintendents and county road supervisors (Kansas LTAP 2017).

The New Hampshire (NH) Technology Transfer Center offers, as part of its Roads Scholars program, the ability to become a Safety Champion. A Safety Champion is someone who has taken 20 hours of safety training. The majority of safety training offered through this program is related to worker safety; however, some of the training offered is on more technical road safety topics (e.g., the MUTCD and Road Safety 365) (NH Technology Transfer Center 2017).

Sample Safety Conferences or Series

In addition to these dedicated safety programs, many LTAPs coordinate, program, or assist with offering an annual conference focused on safety. Some of these LTAPs include the ones in Alabama, Idaho, Iowa, and Kentucky.

The Alabama LTAP at Auburn University holds an annual Rural Road Safety Conference that focuses on the implementation of the safety process through all stages of planning, design, and operations. Some topics that have been covered include intersection and horizontal curve safety, roundabout design, road safety assessments, and pedestrian and bicyclist safety. However, the subjects change each year (Alabama Technology Transfer Center 2017).

The Idaho Technology Transfer Center supports Safety Fests at various locations throughout the state. These Safety Fests are three- to four-day events that include workshops about worker safety topics such as OSHA 10 hour certificates, electrical hazards, respiratory protection, first aid, hazardous materials (HAZMAT), trenching safety, and safety leadership (Idaho Technology Transfer Center 2017).

The Iowa LTAP and Iowa DOT also host an annual series of Local Road Safety Workshops, which include presentations by a multidisciplinary team. Participants learn about improving safety through planning, engineering, enforcement, and education. The workshops include activity updates from the various safety agencies throughout the state and presentations of specific safety subjects of interest (e.g., multidisciplinary safety teams or local road safety plans) (Iowa LTAP 2017).

Kentucky has a Traffic and Safety Academy each year, which includes four training tracks. In past years, these have included technology (e.g., crash data, geographic information system [GIS] mapping, and asset management), regulations and guidelines (e.g., risk management, communications with the press and public, and Highway Safety Manual [HSM] implementation), design (e.g., systemic, intersection, and pedestrian/bicyclist safety), and assessment (e.g., horizontal curves, RSAs, retroreflectivity, the safety edge, and traffic management and inspection) (Kentucky Technology Transfer Program 2017).

Potential Program

Potential Program Learning Objectives

The current curricula and competencies (Jovanis and Gross 2006, Bahar 2011, Cambridge Systematics et al. 2010, Knapp et al. 2003), as well as the information gathered from the LTAPs and TTAPs, were used to develop a suggested roadway safety curriculum for local maintenance personnel. The authors developed a list of the learning objectives that they believe a rural roadway safety recognition program for local maintenance personnel might include. This list should not be considered comprehensive (i.e., other learning objectives can be added) or required (i.e., some can be removed). Local roadway maintenance personnel who satisfactorily complete the courses in a safety curriculum should be able to do the following:

1. Define the current state of safety in the US and their jurisdiction and relate that to why roadways need to be made safer

2. Describe and define the primary causes of crashes
3. Explain the steps in the safety analysis process (i.e., the crash mitigation process) and the differences in approaches for systematic, systemic, and individual site concerns
4. Create or expand upon local agency safety culture and explain their role in improving the safety on and along roadways for all road users through maintenance activities
5. Discuss how they can make themselves safer in the field and the shop
6. Assess the safety of different roadway components (e.g., curves, intersections, segments, and roadsides) by observing potential safety issues (i.e., by "reading the road")
7. Propose appropriate courses of action or maintenance countermeasures to address safety issues
8. Define the purpose of the MUTCD and apply its basic maintenance-related tenets (e.g., sign installation heights, crashworthy sign supports)

The goal of meeting these eight suggested learning objectives with program participants is that, once accomplished, participants will have a relatively well-rounded knowledge base for roadway safety that they can relate to their day-to-day efforts. In other words, upon course completion, participants should have an understanding of what current safety issues are, why they should care about them, and what they can do to help.

This knowledge also includes a basic understanding of the safety analysis or crash mitigation process and an increased capability to improve the safety culture within their local agency by not only caring about but also knowing how to keep themselves safe. Participants will also know what they can do to help improve safety along their roadways and will also receive a refresher on the purpose and tenets of the MUTCD. They will have the ability to understand the approaches used to diagnose issues at the systematic, systemic, and individual candidate site levels. They will also have the ability to assess safety issues by "reading the road" and suggest an appropriate course of action to help address those issues, making sure any relevant maintenance standards are met. These courses of action will focus on maintenance activities that have safety impacts (e.g., vegetation control, fixing roadway drainage issues, or temporary traffic control).

The learning objectives listed above are suggested for staff members who are considering the creation of a safety professional development program for local agency maintenance personnel. The authors believe that, if the courses offered allow the participants to accomplish each of the objectives, participants will obtain a basic understanding of safety and how they can help improve roadway safety through their positions. The suggested learning objectives can easily be modified and reduced or enhanced to be context-sensitive and to fit the situations that exist within a particular state or jurisdiction.

Potential Program Courses

Table 1 includes a list of training courses that are currently available from a variety of sources.

The sources listed in Table 1 include LTAPs, the National Highway Institute (NHI), and professional associations (e.g., ARTBA), as well as the National Center for Rural Road Safety. The professional development entity offering the recognition program, of course, would need to select which courses (or parts of courses) to use.

The table includes courses that could be used as part of the curriculum or as a basis in the development of new courses. This list is not intended to be exhaustive of all the courses available that might be used, and many of those provided in the list were selected because their audience is local agency maintenance personnel and the course materials are generally readily available.

The audience of these courses, when available, is noted in the table. In some cases, the level of applicability of the course material to local maintenance personnel is not known. Therefore, some of the material may need to be adjusted for this level of applicability.

For each course listed, the authors have provided the title, which entity offers the course, the length of the course, and a brief description. The audience for the course is also indicated if it was defined by the offering entity. The learning objectives listed previously that each course addresses are also noted.

Table 1: Summary of Some Existing Courses

Course Title	Agency Offering	Length	Brief Description	Audience	Suggested Learning Objectives Covered[6]
Road Safety 365: A Safety Workshop for Local Agencies	FHWA/ LTAPs	8 hours	Designed to provide local and rural agencies with practical and effective ways to incorporate safety into their day-to-day activities. Topics covered include the safety analysis process and how to identify and address safety issues.	Maintenance supervisors	1,2,3,4,6,7
Road Safety Fundamentals	FHWA/ LTAPs	6–7 hours	This course is intended for road supervisors, maintenance engineers, and maintenance-level personnel in rural areas and small urban communities, and others who have responsibility for operation and management of local roads. Superintendents and safety officers will benefit from this overview. Course topics cover the basics of road safety, identifying and solving traffic safety problems, traffic control devices, roadways, design standards, curves and surface conditions, improving roadside safety, and intersections, railroad grade crossings, and driveways.	Road supervisors, maintenance engineers, maintenance-level personnel in rural areas and small urban communities, and others who have responsibility for operation and management of local roads	1,2,3,6,7

[6] The numbers in this column refer to the learning objectives outlined under Potential Program Learning Objectives in this report.

Course Title	Agency Offering	Length	Brief Description	Audience	Suggested Learning Objectives Covered[6]
Maintenance and Safety	National Center for Rural Safety and Minnesota LRRB	4 hours	Local agency maintenance forces are in the best position to be the "eyes and ears" of the road when it comes to identifying safety issues. This course focuses on maintenance safety solutions that local maintenance forces can implement on a daily basis to address safety issues related to elements such as shoulder drop-offs, right-of-way obstructions, striping and signing, guardrails, mowing, sweeping, patching, drainage, winter maintenance, etc. It includes a hands-on case study.	Maintenance staff and supervisors	4,6,7
Work Zone Safety	Various LTAPS	Varies	Every LTAP offers some form of work zone or flagger training that covers safe flagging and work zone operations.	Varies, but usually those working in or near a work zone	4,5
Tort Liability and Risk Management	West Virginia LTAP	8 hours	This course provides an overview of the legal duties and responsibilities of roadway personnel. Key legal concepts relating to the liability of roadway agencies are reviewed from a risk management standpoint. Common types of claims/lawsuits brought against street departments and roadway agencies are identified through examples and case studies. Risk management principles, aimed at (1) reducing and preventing crashes and claims and (2) helping agencies defend claims, are highlighted. Practical risk management activities are also identified.	Roadway engineers and technicians, public works directors, roadway maintenance supervisors, and elected/appointed officials	4

Course Title	Agency Offering	Length	Brief Description	Audience	Suggested Learning Objectives Covered[6]
MUTCD for Technicians	Traffic Assistance Services for Kansas	8 hours	This one-day course provides an introductory overview of the 2009 edition of the MUTCD, with emphasis on MUTCD applications related to work zones (temporary signing). The course also provides an overview of sign retroreflectivity assessment and management methods, and an introduction to guidelines for incident management (emergency temporary traffic control).	Local traffic/highway technicians	8
Equipment Use and Workplace Safety	University of Wisconsin - Madison	8 hours	This one-day course will help supervisors become more effective by teaching them how to take a leadership role to actively foster a culture of safety in their organizations, investigate accidents to find causes and lessons learned, and reduce job hazards and prevent accidents.	Public works supervisors, employees, and engineers	4, 5
Combating Roadway Departures	FHWA/ NHI	8 hours	This course provides participants with some tools for addressing roadway departure crashes. Topics covered in this course include a discussion of engineering countermeasures as well as implementation strategies.	Federal, state, and local highway engineers, consulting highway design engineers, and maintenance workers	1,2,6,7

Course Title	Agency Offering	Length	Brief Description	Audience	Suggested Learning Objectives Covered[6]
Low-Cost Safety Improvements	FHWA/ NHI	8 hours	This course provides a comprehensive presentation of low-cost, ready-to-use improvements that enhance the safety of highways. The course covers a synthesis of countermeasures and their associated crash reduction factors as identified in the CMF Clearinghouse and additional research. Topics include countermeasures for specific areas of highway safety, including roadside hazards; signing, markings, and lighting; traffic control devices; intersections; traffic signals; and railroad grade crossings are discussed. The course also introduces recent low-cost safety improvements that have been developed by states and local engineers. Through exercises, participants learn how to analyze highway safety situations and apply appropriate countermeasures to those situations.	Federal, state, and local transportation, traffic and safety engineers, and planners involved in reducing crashes	1,2,3,7
Roadside Safety Basics for Local Agencies	National Center for Rural Safety and FHWA	6 hours	This course provides the basics of roadside safety. The roadside safety problem in the United States is defined, and countermeasures to keep vehicles on the road are discussed. The provision of a recovery area is also described, including discussions of clear zone and objects within it. The third session covers the basics of drainage features and sign supports, and the workshop is concluded with a short discussion of barrier basics.	Local agency maintenance/ engineering staff	1,2,6,7

Course Title	Agency Offering	Length	Brief Description	Audience	Suggested Learning Objectives Covered[6]
Roadway Safety+	ARTBA	2–16 hours	An interactive instructional design with 33 modules that can be customized to the needs of the audience. Topics can include areas from night work and traffic control setup to worker safety strategies.	Roadway workers, construction workers, managers, foremen, and supervisors	5
TZD – Proactive Steps for Your Community	National Center for Rural Safety and NACE	1.5 hours	This webinar provides an overview of the Toward Zero Deaths (TZD) National Strategy and teaches participants about fatality trends, TZD, safety culture, and steps for implementation.	Local engineers, road managers, and local representatives with road and transportation responsibilities	1,2,4

Course Title	Agency Offering	Length	Brief Description	Audience	Suggested Learning Objectives Covered[6]
Road and Intersection Safety Fundamentals	Utah LTAP	4 hours	This workshop covers issues of typical intersection problems that affect safety in local governments nationwide. Intersections constitute only a small part of overall highway systems but account for 30% of all crashes in rural areas and 50% of all crashes in urban areas. Participants learn how to identify common problems in intersections and how to significantly reduce crashes through new and proved solutions tried in many areas of the US. The course discusses innovative solutions to remedy intersection location and layout problems, warning signs, traffic signals, regulatory and guide signing, and markings countermeasures to reduce serious injuries and fatalities in participants' jurisdictions.	Not listed	3,6,7
Road Safety for Everyone	Ohio LTAP	2–3 hours	This Circuit Rider class is designed to provide local and rural agencies with an overview of practical and effective ways to mainstream safety solutions into their day-to-day activities and project development process. Topics such as crash data review, hazard identification, and low-cost safety improvements are highlighted.	Local and rural road and/or public works supervisors	3,4,6,7

One of the courses suggested as part of a program curriculum and/or to be used as a basis for classes would be Road Safety 365: A Safety Workshop for Local Governments. This course provides a good introduction to the suggested learning objectives 1–4, 6, and 7. The Maintaining a Safer Roadway course offered through the National Center for Rural Road Safety and Minnesota Local Road Research Board (LRRB) would also be a good course, because it is focused on specific maintenance strategies to improve safety. Both of these courses have local agency maintenance personnel as their primary audience.

Road Safety for Everyone, from the Ohio DOT, also appears to be a good introductory course that provides a knowledge base to address learning objectives 1 and 2.

As noted previously, Bahar (2011) produced a list (Appendix C) of available safety courses. The National Center for Rural Road Safety created a similar list in 2015 that focused on various areas of safety. At the time of their creation, both of these lists were current, but some courses have been "retired" and others added during the years since. However, the authors believe the courses provided in Table 1 are generally available at this time. The National Center for Rural Road Safety would need to be contacted to obtain the list it developed. The courses provided by LTAPs and TTAPs can be found in a document produced by the Local & Tribal Technical Assistance Program (2014).

Many courses are already available that focus on roadway safety, as shown in Table 1, but some gaps need to be addressed in offering a recognition program for local roadway maintenance personnel. One of the main areas of need appears to be courses specific to a local agency maintenance personnel audience that help identify safety issues along various roadway components, such as intersections (e.g., site distance issues), curves (e.g., shoulder drop-offs, run-off-the-road locations), tangents (e.g., vegetation control or drainage issues), and roadsides (e.g., clear zone issues). Each course would focus on the safety issues that maintenance staff could identify and then provide low-cost, maintenance-based strategies to help address.

A course on safety culture for local agencies and local agency staff would be another great course that is currently, to our knowledge, not available. Finally, it is generally acknowledged that many of the training courses developed are not focused on the needs and day-to-day abilities of local agency maintenance personnel. The work being done to adapt the subject material in these courses to this audience should continue. The authors recommend that the material within any course used by a professional development entity for a local agency maintenance personnel safety recognition program be reviewed with the needs and capabilities of this audience in mind, so that adjustments can be made as appropriate.

Potential Program Structure

The overall structure of a rural roadway safety recognition program can vary. Some of the program characteristics that need to be decided include how many courses to provide, how those courses will be offered, how long the courses should be, whether all or some of the courses should be required, cost, and method used for recognition. These decisions are typically based on the wants,

needs, and abilities of the potential audience (i.e., program participants) and the assets and capabilities of the professional development entity offering the program.

For example, the need may be greater for a particular type of safety course in some areas, and the training may be able to be offered face-to-face in the spring of each year. These types of variables must be assessed on a case-by-case basis when designing a program of this nature.

For the same reasons, a review of some LTAP Roads Scholar programs found a similar variability. They have been adjusted to match the needs and abilities of the local agencies within each state or initiatives supported or started within that state. However, most of the programs include either a set of courses that must be completed or a core set of courses along with a number of electives.

A number of programs also have different levels of Roads Scholar based on the number and/or type of courses taken, including (as noted previously) some with a separate safety focus area. A rural roadway safety recognition program for local agency maintenance personnel can take either of these approaches. In either case, the authors recommend that the required or basic courses address the basics of the eight learning objectives noted above, as appropriate (context-sensitive), and that any elective courses provide a more in-depth discussion of the topics or expand upon them. An example of possible elective courses might be something on the relationship between liability and safety decisions or safety culture development for supervisors.

Summary of Findings

Increasing the transportation safety knowledge base of personnel within all levels of government, including local agencies, is needed to help reduce fatal and severe injury crashes in the US. A nationally based safety recognition program doesn't currently exist for local transportation agency maintenance personnel who have completed a significant amount of professional development to achieve a well-rounded background and knowledge in rural road safety.

This project investigated existing safety curricula and recognition programs, defined some potential learning objectives for a local agency maintenance personnel safety recognition program, and identified some of the existing roadway safety training that might be used in this type of program. A general conclusion was that many potential courses are available that could assist in meeting the eight learning objectives suggested.

Some of these courses have even been designed by LTAPs/TTAPs or others for local agency maintenance personnel. However, the authors recommend that each entity considering the development and application of a rural road safety recognition program review the courses noted and others available for relevance to their maintenance personnel audience.

In addition, if changes are necessary for relevancy, the updated materials should be shared as widely as possible, potentially through the LTAP clearinghouse or on the National Rural Road Safety

Center website. Again, the authors recommend that each entity design and apply this type of program in a manner appropriate to the situation within its jurisdiction.

Potential steps an entity's staff members may take to begin the process of developing a program would be to first do a needs assessment. Here, staff would determine the type of program needed and the topics that need to be covered. Staff would then determine the learning objectives for the program. This may include some or all of the learning objectives listed in this report. The program may also include other objectives that were determined in the needs assessment.

Once the learning objectives have been determined, a list of courses can be developed. This can include courses that already exist, those that may need to be updated, and any that need to be developed. For materials that are already available, staff should pursue obtaining those materials and/or instructors. Courses that need to be developed should be outlined and developed. Staff also need to determine the timing and mechanisms for offering the courses (every year versus every other year, for example, and online versus in person, etc.).

Staff members also need to determine the level(s) of recognition that they plan to offer and the courses required to attain each level. Finally, a way to monitor progress and award the recognition need to be determined.

Overall, offering safety training and safety recognition programs for maintenance personnel should lead to a more informed and safety-aware workforce whose members can do their part to help improve safety on our roads and roadsides. In turn, this will possibly help in the reduction of fatal and severe injury crashes along local roadways and improve the safety culture within local agency roadway departments.

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Appendix A: Learning Outcomes for Core Concepts (Jovanis and Gross 2006)

Core Competency	Learning Outcomes
1. Understand the management of highway safety as a complex multidisciplinary system.	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 Es” 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.
2. Understand and be able to explain the history of	1. Understand the historical figures, benchmarks, and decisions underlying highway safety.
	2. Identify the safety aspects of major transportation legislation.

Core Competency	Learning Outcomes
highway safety and the institutional settings in which safety management decisions are made.	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 governments; 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.
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.	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.
4. Demonstrate the knowledge and skills to assess factors contributing to highway crashes, injuries, and fatalities; identify potential countermeasures linked 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.

Core Competency	Learning Outcomes
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.	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 the NCHRP Report 500 series and NHTSA/FHWA Uniform Guidelines for State Highway Safety Programs).
	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 is not implemented.
5. Be able to develop, implement, and manage a highway safety management program.	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.

Appendix B: Excerpt of Training Roadmap from Highway Safety Training Synthesis/Roadmap (Bahar 2011)

Table 4- 7 from Bahar (2011): Knowledge Table for Local Agency Mid-Level Managers (Level 1), Urban Planners (Level 1), Transportation Planners (Level 1), Traffic Engineers (Level 2), Field Investigators (RSA team members), Safety Engineers (Level 2)

Concepts	Processes	Tools	Context	Potential Sources of Training Materials*
Highway safety as a complex, interdisciplinary, multimodal discipline devoted to the avoidance and/or mitigation of fatalities, injuries, and crashes. Demographic trends underlying the need for comprehensive and integrated highway safety management (e.g., social, cultural, age, gender). The "Four Es" of traffic safety: engineering, education, enforcement, and emergency medical services. Strategies to integrate and amplify safety in transportation planning processes. Importance of highway safety relative to other transportation priorities (e.g., congestion, environmental protection, air quality, economic prosperity). Crash cost (economic) components and their magnitude, and how they affect the state and other government budgets. Crash comprehensive costs to society. Human factors (road user	Safety of a location is measured using the recorded number and severity of crashes. Crash historical patterns and roadway characteristics. Pattern identification, traffic volumes, operational changes, and statistical meaning. Diagnostic analyses (office study and field observations and measurements). Documentation review and development. Relationships between crash patterns and traffic operations, maintenance, and land use. Potential treatments (countermeasures) to identified crash patterns and site characteristics. Treatments responding to data-	Communication channels with other agencies (Es). Communication channels with DOT and other local transportation agencies. AASHTO Highway Safety Manual (2010). Police crash reports. Crash diagrams. Statistical testing of exceeding threshold crash proportions. SafetyAnalyst Software tools. Crash data (state and national). Crash costs (comprehensive, economic, state and local, etc.) by crash category. Own databases (crash, traffic volumes, roadway inventory, driver/vehicle registration, citation, hospital/EMS, surveys, operations data, etc.).	When responding to requests from the community at large. When evaluating site/corridor safety performance. When coordinating with other disciplines during the diagnostic and solution-seeking process. When considering treatments/countermeasures based on diagnostic analysis. When considering operating funds allocation with safety explicitly. When conversing with agency management in their consideration of safety at all fronts.	Road Safety 101 (TRB/NHI) Introduction to HSM (NCHRP 17-38/NHI) Highway Safety Improvement Program (NHI) Science of Crash Reduction Factors (NHI) New Approaches to Highway Safety Analysis (NHI) "Overview" and "Crash" (NHTSA) MMUCC Standards (NHTSA) Roadway (NHTSA) SafetyAnalyst (MRI/NHI/AASHTO) Highway Safety Fundamentals (E. Hauer)

Concepts	Processes	Tools	Context	Potential Sources of Training Materials*
and limitations) and positive guidance toward minimizing errors by design. Classification of highway crash and injury severity factors and their relationship to the crash event (i.e., pre-crash, crash, and post- crash). Interaction among crash contributing factors. Crash patterns, graphic, descriptive, and statistics representation. How highway user decision-making is influenced by highway design, transportation planning, traffic operations, speed limit, and vehicle design. Safety performance functions (SPF), crash modification factors (CMF), and standard errors. Definition of safety as expected frequency and severity of crashes per unit of time. Predictive methods to estimate the expected crash frequency and severity of a site under a given set of geometric design and traffic volume in a given time period. Reliability levels of CMFs through standard errors and other attributes of the CMF original	Treatment effectiveness in economic analysis. Crash cost analysis (who pays and how much). Toward Zero Deaths strategic program. Strategic Highway Safety Plans. Safety Conscious Planning. Road, vehicle, and human contribution to crashes. Speed and crash severity (vehicle, occupants, and pedestrians). Haddon Matrix model. Safety projects and budget allocation. Leveraging resources for highway safety program implementation.	Model Minimum Uniform Crash Criteria (MMUCC). Model Minimum Inventory of Road Elements (MMIRE). AASHTO A Policy on Geometric Design of Highways and Streets (2004). MUTCD (2009). NCHRP 500 and 501 Reports. CMFClearinghouse.org Road Safety Audit tools (http://safety.fhwa.dot.gov/rsa/) NHTSA/FHWA Highway Safety Guidelines Alexander, G., Lunenfeld, H., Positive Guidance in Traffic Control (1975). Shinar, D., Traffic Safety and Human Behavior (2007). E-libraries (TRB, NCHRP, ITE, FHWA, NHTSA, etc.).		Explicit Consideration of Safety in Geometric Design of Highways CE-5803 (University of Colorado) CE 552 - Traffic Safety, Operations, and Maintenance (Iowa State University) CEE 679 - Advanced Topics in Transportation Safety Engineering (University of Wisconsin-Madison) Highway Safety Fundamentals: Evaluating Countermeasures (LTAP Virginia by the University of Virginia School of Continuing Professional Studies) Transportation Safety (University of Berkeley, California)

Concepts	Processes	Tools	Context	Potential Sources of Training Materials*
Value of science-based highway safety research and its application as fundamental to achieving further improvements in highway safety. Differences between nominal, subjective, and substantive safety. Explicit and quantitative incorporation of safety in planning (short and long term), operations, design, and maintenance. Alternative treatments and their respective safety effectiveness for specific given conditions. Engineering judgment in selecting and applying multiple CMFs. Expected safety cost/benefit associated with implementing (or not) a treatment in terms of the difference in crashes, fatalities, and injuries likely to occur with or without the treatment. Establishment of priorities for alternative treatments based upon their expected cost and effectiveness and select treatments (countermeasures) to implement.				Safety Aspects of Timing Signalized Intersections (Association of Civil Engineers) Roundabouts – Designing Intersections for Safety (NHI) CEE 6634 - Transportation Safety (Georgia Institute of Technology) Fundamentals of the Highway Safety Manual Predictive Method (ITE) Predicting Crash Frequency on Rural Highways (ITE) Predicting Crash Frequency on Urban and Suburban Arterials (ITE) Applying HSM Crash Modification Factors (ITE)

Concepts	Processes	Tools	Context	Potential Sources of Training Materials*
				Traffic Safety Analysis (University of Central Florida) Introduction to Highway Safety (ITE) Fundamentals of Highway Safety Series (ITE) HSM Applications for Two-Lane Rural Highway Intersections (FHWA Resource Center) HSM Applications to Project Identification (FHWA Resource Center) HSM Applications to Suburban/Urban Multilane Intersections (FHWA Resource Center) HSM Applications for Two-Lane Rural Roadway Segments (FHWA Resource Center)

Concepts	Processes	Tools	Context	Potential Sources of Training Materials*
				HSM Applications to Multilane Highways (FHWA Resource Center) HSM and Pedestrians (FHWA Resource Center) HSM Applications to Horizontal Curves (FHWA Resource Center) HSM Relationship to Roadway Departure Crashes (FHWA Resource Center) HSM Applications to HSIP (FHWA Resource Center) HSM Applications to Rural Multilane Intersections (FHWA Resource Center)

*The database of available training courses at www.USroadwaysafety.org contains additional sources that are not listed here. The instructor is advised to review this source of information.

The concepts are presented in a sequence that may be used by instructors when developing the training/information session/s. These concepts and supporting processes and tools comprise Competency Level 1 to a local agency mid-level manager, an urban planner, and a transportation planner; Competency Level 2 to a traffic engineer and a safety engineer, and Core to field investigators (as RSA team members). The instructor can develop the materials and their delivery based on the duration of session/s. The concepts are listed in a logical learning sequence, while there is flexibility to modify it depending on the years of experience.

Note: It is assumed that safety engineers, traffic engineers, and field investigators (crash reconstruction) have taken the Level 1 Training and have met the requirements as specified in the Knowledge Table for Level 1.

Appendix C: Courses per Organization and Core Competencies Covered (Bahar 2011)

Courses per organization and the core competencies and learning objectives covered

Organization/Course	1a	1b	1c	1d	1e	1f	1g	1h	1i	1j	1k	2b	3a	3b	3c	3d	3e	3f	4a	4b	4c	4d	4e	4f	5a	5b	5c	5d	5e	5f	5g	5h
American Traffic Safety Services Association																																
Intersection Safety					✓															✓												
The Safety Effects of Traffic Sign Upgrades																							✓									
Consortium for ITS Training and Education (CITE)																																
Performance Measures						✓		✓														✓										
Road Safety Audits							✓		✓											✓												
Consortium for ITS Training and Education (CITE)/NHI																																
Improving Highway Safety with ITS	✓																		✓		✓								✓			
FHWA Resource Center																																
HSM and Pedestrians																			✓													
HSM Applications for Two-Lane Rural Highway Intersections																			✓		✓											
HSM Applications for Two-Lane Rural Roadway Segments																			✓													
HSM Applications to Horizontal Curves																			✓													
HSM Applications to HSIP																									✓							
HSM Applications to Multilane Highways																			✓													
HSM Applications to Project Identification																			✓													
HSM Applications to Rural Multilane Intersections																			✓													
HSM Applications to Suburban/Urban Multilane Intersections																			✓													
HSM Introduction and Overview																														✓		
HSM Relationship to Roadway Departure Crashes																			✓													
Florida Transportation Technology Transfer Center																																

Organization/Course	1a	1b	1c	1d	1e	1f	1g	1h	1i	1j	1k	2b	3a	3b	3c	3d	3e	3f	4a	4b	4c	4d	4e	4f	5a	5b	5c	5d	5e	5f	5g	5h
A Community Approach to Safe Routes to School Programs							✓																									✓
Common Sense Solutions for Intersection Safety Problems											✓																					
Community Bicycle and Pedestrian Safety Programs							✓																									✓
Designing Streets for Pedestrian Safety									✓												✓											
Highway Design for Older Drivers and Pedestrians																				✓												
Human Factors for Transportation Engineers																				✓												
Intersection Safety																			✓	✓	✓	✓		✓								
Low Cost Safety Improvements in Urban/Rural Environments																					✓											
Pedestrian/Bicycle GIS Crash Mapping															✓		✓	✓														
Road Safety Assessments for Community Traffic Safety Teams (CTSTs)									✓											✓	✓											
Road Safety Assessments for Local Governments									✓											✓	✓											
Roadside Maintenance Safety						✓																										
Safe Mobility for Life Program: Planning and Designing for Our Aging Population			✓						✓											✓	✓											
Work Zone Training for Law Enforcement																					✓											
Georgia Institute of Technology																																
CEE 6634 - Transportation Safety																			✓	✓												
Idaho LTAP																																
Road Safety Fundamentals																				✓												

Organization/Course	1a	1b	1c	1d	1e	1f	1g	1h	1i	1j	1k	2b	3a	3b	3c	3d	3e	3f	4a	4b	4c	4d	4e	4f	5a	5b	5c	5d	5e	5f	5g	5h
Illinois Center for Transportation																																
A Short Course on Safety Performance Functions (SPFs) and Safety Analysis Techniques																			✓													
Illinois LTAP																																
Highway Safety Improvement Workshop												✓																				
Low Cost Safety Improvement																					✓											
Indiana LTAP																																
Road Safety Workshop																					✓											
Institute of Transportation Engineers																																
Access Management at Intersections Part 2																				✓	✓											
Access Management Techniques for the Design of Safe and Efficient Urban Streets																				✓	✓											
Applying HSM Crash Modification Factors																			✓													
Best Practices for Elderly Mobility and Safety																				✓												
Fundamentals of Highway Safety Series		✓			✓			✓							✓				✓	✓	✓	✓	✓	✓						✓		
Fundamentals of the Highway Safety Manual Predictive Method																			✓													
Intersection Safety and Geometric Design: Sight Distance																				✓												
Introduction to Highway Safety	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Pedestrian Signal Safety for Older Persons																				✓												
Predicting Crash Frequency on Rural Highways																			✓													
Predicting Crash Frequency on Urban and Suburban Arterials																			✓													

Organization/Course	1a	1b	1c	1d	1e	1f	1g	1h	1i	1j	1k	2b	3a	3b	3c	3d	3e	3f	4a	4b	4c	4d	4e	4f	5a	5b	5c	5d	5e	5f	5g	5h
Professional Development Module: Engineering Intersections to Reduce Red- Light Running																					✓											
Safety Analysis–Signalized Intersections					✓																											
Safety Impact of Access Management																				✓	✓											
The Keys to Safe and Efficient Roadside Design																					✓											
Iowa State University																																
CE 552 - Traffic Safety, Operations, and Maintenance				✓	✓	✓	✓	✓					✓	✓	✓				✓	✓	✓					✓						
ITS Berkley-California LTAP																																
TS-01 Safety and Traffic Control Plans for Work Zones																					✓											
Kentucky LTAP																																
Low-Cost Roadway Safety Improvements																					✓					✓						
Kittelson & Associates, Inc.																																
Highway Safety Manual Workshop – Predictive Method Training													✓	✓	✓	✓	✓	✓														
Maryland LTAP																																
Roadway Safety Fundamentals																					✓											
Strategies for Improving Highway Safety							✓	✓													✓							✓				
Michigan LTAP																																
Common Sense Solutions for Intersection Safety Problems																					✓											
Traffic Safety – Finding the Problem to Fixing It																				✓	✓											
What Elected Officials Need to Know About Traffic Safety	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓																					

Organization/Course	1a	1b	1c	1d	1e	1f	1g	1h	1i	1j	1k	2b	3a	3b	3c	3d	3e	3f	4a	4b	4c	4d	4e	4f	5a	5b	5c	5d	5e	5f	5g	5h
Midwest Research Institute/NHI/AASHTO																																
Safety Analyst Software Tools																			✓	✓	✓	✓	✓	✓								
Minnesota LTAP																																
Rural Road Maintenance Safety Workshop					✓																											
Rural Road Safety Solutions Workshop						✓	✓						✓																			
Montana LTAP																																
AASHTO Roadside Design Guide																					✓											
Road Safety Review - MACRS																				✓												
National Center for Safe Routes to School																																
SR2S Safe Routes to School																												✓			✓	✓
National Institute for Advanced Transportation Technology - University of Idaho																																
CE576 - Highway Design and Traffic Safety - Spring 10																			✓	✓	✓											
Nevada LTAP																																
Low Cost Safety Improvements																					✓											
Road Safety Audits									✓											✓												
New Jersey LTAP																																
Crash Data for DHTS Grants												✓						✓														
NHI																																
HSM Practitioner's Guide for Two-Lane Rural Roads								✓	✓										✓		✓	✓	✓	✓								
AASHTO Roadside Design Guide									✓											✓												
Advanced Work Zone Management and Design																				✓	✓											
Application of Crash Reduction Factors (CRF)																					✓	✓										
Bicycle Facility Design																				✓												
Construction Zone Safety Inspection (1.5 day)									✓																							
Construction Zone Safety Inspection (1-Day)									✓																							

Organization/Course	1a	1b	1c	1d	1e	1f	1g	1h	1i	1j	1k	2b	3a	3b	3c	3d	3e	3f	4a	4b	4c	4d	4e	4f	5a	5b	5c	5d	5e	5f	5g	5h
Design and Operation of Work Zone Traffic Control (3-Day)																					✓											
Design and Operation of Work Zone Traffic Control (1-Day)																					✓											
Design, Construction, and Maintenance of Highway Safety Appurtenances and Features (1-Day)																				✓												
Design, Construction, and Maintenance of Highway Safety Appurtenances and Features (2-Day)																				✓												
Design, Construction, and Maintenance of Highway Safety Appurtenances and Features (3-Day)																				✓												
Designing and Operating Intersections for Safety									✓											✓	✓	✓										
Designing for Pedestrian Safety									✓											✓												
Developing a Pedestrian Safety Action Plan								✓	✓		✓																					
Fundamentals of Planning, Design, and Approval of Interchange Improvements to the Interstate System									✓																							
Geometric Design: Applying Flexibility and Risk Management																				✓		✓										
Guardrail Installation Training																				✓												
Highway Safety Improvement Program Manual												✓										✓				✓			✓			
Highway Safety Manual Workshop		✓		✓	✓		✓	✓	✓										✓	✓	✓			✓								

Organization/Course	1a	1b	1c	1d	1e	1f	1g	1h	1i	1j	1k	2b	3a	3b	3c	3d	3e	3f	4a	4b	4c	4d	4e	4f	5a	5b	5c	5d	5e	5f	5g	5h
HSM Practitioner's Guide for Two-Lane Rural Roads, Multilane Rural Highways, and Urban/Suburban Streets								✓	✓										✓		✓	✓	✓	✓								
HSM Practitioner's Guide to Multilane Rural Highways and Urban/Suburban Streets								✓	✓										✓		✓	✓	✓	✓								
Improving Highway Safety with Intelligent Transportation Systems (ITS)	✓																				✓											
Improving Safety of Horizontal Curves					✓				✓												✓	✓										
Interactive Highway Safety Design Model (IHSDM); NHI course FHWA-NHI-380071					✓		✓	✓	✓										✓	✓	✓	✓	✓									
Intersection Safety Workshop																			✓	✓	✓	✓										
Introduction to Context Sensitive Solutions									✓	✓																						
Low-Cost Safety Improvements																				✓	✓	✓										
Low-Cost Safety Improvements Workshop		✓			✓																✓	✓										
New Approaches to Highway Safety Analysis					✓			✓	✓																							
Pedestrian Facility Design																				✓			✓						✓			
Planning and Designing for Pedestrian Safety								✓	✓		✓																					
Road Safety Audits/Assessments									✓											✓	✓	✓										
Roadside Safety Design (3-Day)									✓											✓												
Roundabouts – Designing Intersections for Safety																					✓											
Science of Crash Reduction Factors																					✓											
Signalized Intersection Guidebook Workshop																			✓	✓	✓	✓										

Organization/Course	1a	1b	1c	1d	1e	1f	1g	1h	1i	1j	1k	2b	3a	3b	3c	3d	3e	3f	4a	4b	4c	4d	4e	4f	5a	5b	5c	5d	5e	5f	5g	5h
Transportation Safety Planning	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Work Zone Traffic Control for Maintenance Operations (Short-Term)									✓																							
NHTSA																																
Citation/Adjudication													✓	✓																		
Crash													✓	✓	✓																	
Data Analysis																	✓															
Driver Data															✓	✓																
Injury													✓	✓		✓																
MMUCC Standards															✓	✓																
Motor Carrier Data													✓	✓																		
NEMSIS Standards															✓	✓																
Overview													✓	✓																		
Roadway													✓	✓	✓																	
Vehicle Data															✓	✓																
North Carolina State University																																
CE 509 - Highway Safety																					✓	✓	✓			✓						
Northwestern University																																
Crash Investigation 1															✓																	
Crash Investigation 2															✓																	
Crash Reconstruction for Traffic Engineers					✓										✓					✓												
Heavy Vehicle Crash Reconstruction															✓																	
Identification and Treatment of High Hazard Locations																						✓										
Intersection Design and Channelization Workshop																				✓	✓											
Pedestrian Vehicle Crash Reconstruction					✓				✓						✓					✓												
Traffic Crash Reconstruction 1					✓																											
Traffic Crash Reconstruction 2					✓																											
Traffic Crash Reconstruction Refresher															✓																	
Traffic Studies Workshop															✓																	

Organization/Course	1a	1b	1c	1d	1e	1f	1g	1h	1i	1j	1k	2b	3a	3b	3c	3d	3e	3f	4a	4b	4c	4d	4e	4f	5a	5b	5c	5d	5e	5f	5g	5h
Oregon State University- Kiewit Center for Infrastructure and Transportation																																
Traffic Engineering Fundamentals																			✓	✓												
SAE International																																
Side Impact Occupant Safety and CAE				✓	✓																											
Vehicle Accident Reconstruction Methods				✓																												
Vehicle Frontal Crash Occupant Safety and CAE				✓	✓										✓																	
Texas Transportation Institute																																
Incorporating Safety into the Highway Design Process – Introduction to Workshop Series		✓																	✓		✓		✓									
Incorporating Safety into the Highway Design Process – Multilane Highways and Freeways Workshop		✓																	✓		✓		✓									
Incorporating Safety into the Highway Design Process – Urban/Suburban Arterials Workshop		✓																	✓		✓		✓									
Transportation Safety Institute (TSI)																																
Data Analysis and Evaluation													✓	✓				✓								✓						
Highway Safety Program Management																											✓		✓			
Motorcycles Safety Program Coordination																										✓			✓			
Occupant Protection																										✓		✓	✓			
Safe Communities																																✓
TRB/NHI																																
Road Safety 101	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
University of California																																
Transportation Safety																					✓		✓									
University of Central Florida																																
Traffic Safety Analysis					✓																											

Organization/Course	1a	1b	1c	1d	1e	1f	1g	1h	1i	1j	1k	2b	3a	3b	3c	3d	3e	3f	4a	4b	4c	4d	4e	4f	5a	5b	5c	5d	5e	5f	5g	5h
University of Colorado																																
Explicit Consideration of Safety in Geometric Design of Highways CE-5803	✓	✓			✓			✓							✓				✓		✓		✓										
University of Nevada																																
CEE 767 - Human Factors in Transportation Engineering																				✓												
University of Portland																																
Challenges, Strategies, and Obligations of Law Enforcement Agencies for the 21st Century																				✓	✓											
Highway, Local Roads, and Street Safety for Non-Engineers	✓						✓													✓												
Improving Safety Features of Highways, Local Roads and Streets							✓													✓	✓	✓										
University of Wisconsin- Madison																																
CEE 679 - Advanced Topics in Transportation Safety Engineering																			✓	✓	✓	✓						✓				
Virginia LTAP																																
Highway Safety Fundamentals: Countermeasure Selection					✓			✓													✓	✓										
Highway Safety Fundamentals: Evaluating Countermeasures																							✓									
Highway Safety Fundamentals: Identifying Hazardous Sites	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Low Cost Safety Improvements																					✓											
Road Safety Fundamentals																					✓											
Washington LTAP																																
Horizontal Curves																					✓											
Roadside Safety (B74)																					✓											
Roadside Safety and Roadway Departures																					✓											

Organization/Course	1a	1b	1c	1d	1e	1f	1g	1h	1i	1j	1k	2b	3a	3b	3c	3d	3e	3f	4a	4b	4c	4d	4e	4f	5a	5b	5c	5d	5e	5f	5g	5h
West Virginia LTAP																																
Accident Investigation/Reconstruction									✓											✓												
Roadside Safety																					✓											
West Virginia University																																
Highway Safety Engineering																				✓												
Wyoming LTAP																																
Traffic Safety: Identifying Projects																					✓	✓										