ALABAMA DOT ROAD SAFETY WORKFORCE DEVELOPMENT

The Key to Success

prepared for

Alabama Department of Transportation

prepared by

Auburn University

with

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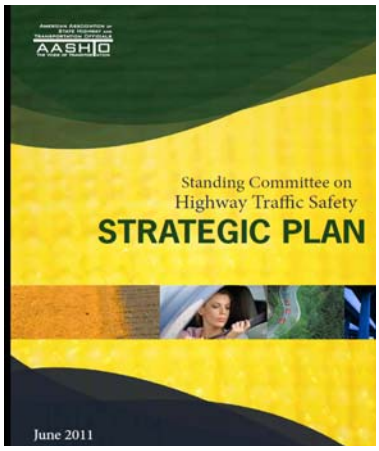
1.0 Introduction

The objective of this project is to develop a comprehensive report on the Alabama Department of Transportation's (ALDOT) safety workforce development challenges and opportunities as the Department transitions to a more regionalized, decentralized approach. ALDOT's past approach has been to centralize safety expertise in the central office in Montgomery. However, a decentralized approach requires the development of safety expertise in the Regions as well as the Central Office. On a national level, this study reflects Goal 5 of the Strategic Plan for AASHTO's Standing Committee on Highway Traffic Safety, the objective of which is to ***ensure a knowledgeable and competent safety workforce***.



This report contains an introduction (purpose and need) and a proposed training framework based on:

1. The relevant literature;

2. Numerous interviews with ALDOT employees across the functional areas, which mirror the functions carried out by most DOTs across the nation, such as planning, design, construction, etc.;

3. A survey and discussion with DOT Transportation Training Directors and the AASHTO Standing Committee on Highway Traffic Safety to learn the training and education opportunities other DOTs provide; and

4. A summary of in-state training and educational opportunities currently available to ALDOT personnel.

The report concludes with suggestions regarding improvement methods and proposed next steps.

2.0 Background

The road safety profession is undergoing a significant evolution as emphasis is placed on managing the safety performance of the surface transportation system, and scientific, statistically sound approaches are increasingly available. The need for an adequately prepared transportation workforce to manage road safety and make the best use of resources also has been well-documented.

Thousands of public agencies carry out safety-related tasks. Together they employ hundreds of thousands of workers who have road safety responsibilities. The 2007 Transportation Research Board (TRB) Special Report 289: *Building the Road Safety Profession in the Public Sector*, reviewed the demand for road safety professionals and the current capacity of the system to prepare them. According to the report, approximately 10,000 public-sector employee positions are focused primarily on road safety; and another 100,000 public-sector employees' decisions influence road safety.

Safety-related job roles, responsibilities, and educational backgrounds are varied, diverse, and located across many work units and levels of transportation, safety, and public health agencies. Providing road safety education to support sound decision-making to positively impact road safety is challenging because building road safety workforce capacity has been a largely ad hoc and unstructured process. The National Cooperative Highway Research Program's (NCHRP) Research Results Digest 302 (RRD 302) outlined the fundamental knowledge and skills for the transportation safety workforce. The core competencies and specific learning objective are illustrated in Table 2.1.

Table 2.1 RRD 302 Core Competencies and Learning Objectives

Core Competencies	Learning Objectives
CC1. Multidisciplinary Nature of Safety	Understand the management of highway safety as a complex multidisciplinary system
CC2. History and Institutional Setting for Safety Management	Understand and be able to explain the history of highway safety and the institutional settings in which safety management decisions are made
CC3. Origins, Characteristics, and Use of Crash Data	Understand the origins and characteristics of traffic safety data and information systems to support decisions using a data-driven approach in managing highway safety
CC4. Contributing Crash Factors, Countermeasures, and Evaluation	Demonstrate the knowledge and skills to assess factors contributing to highway fatalities and serious injuries, identify potential countermeasures linked to the contributing factors, apply countermeasures to user groups or sites with promise of fatality and injury reduction, and implement and evaluate the effectiveness of the countermeasures
CC5. Develop, Implement, and Administer a Highway Safety Management Program	Be able to develop, implement, and manage a highway safety management program

The purpose of the Alabama Department of Transportation (ALDOT) Safety Workforce Development Study is to catalogue a comprehensive list of tasks to adequately prepare ALDOT employees to effectively manage road safety and improve roadway safety in Alabama.

3.0 Study Goals, Objectives, and Organization

This study provides the goals, objectives, and actions that ALDOT (and other state transportation agencies) could implement to further efforts to adequately sustain and increase a qualified, diverse, and robust road safety workforce. To achieve the greatest impact on highway safety, ALDOT needs to ensure its employees have been trained in, and are using, the latest safety tools appropriate to their jobs. The following goals provide a framework for this process:

- Goal #1. Increase the number of qualified individuals in the ALDOT workforce to meet Alabama's diverse and dynamic safety needs;
- Goal #2. Expand the capacity of Alabama's incumbent transportation engineering and planning workforce to meet Alabama's safety needs; and
- Goal #3. Facilitate a DOT-wide campaign to bring awareness to, support for, and implementation of Alabama's Strategic Highway Safety Plan (SHSP).

Achieving the goals may require changes in existing ALDOT policy and/or development of new policies.

This study was conducted in two phases. Phase 1, completed in 2015, focused on documenting safety-related responsibilities and training needs in ALDOT, developing an action plan, and identifying existing opportunities to address the identified training needs. Chapters 4 through 9 describe this effort. The objectives of the Phase 1 work were:

- Review road safety core competencies (Chapter 2)
- Interview ALDOT personnel to identify the road safety specific subject matter needs on road safety for different function areas (Chapters 4 and 5)
- Develop a high-level training plan, matching training needs and core competencies to the subject matter required for specific ALDOT functional positions (Chapter 6)
- Survey training directors in state DOTs to assess the state of highway safety training in these agencies (Chapter 7)
- Identify current training and education resources available at Alabama universities, and elsewhere to implement the core competencies (Chapter 8)

4.0 Methodology

The ALDOT Office of Safety Operations engaged the services of Auburn University (AU) and Cambridge Systematics (CS) to schedule and conduct a series of interviews across functional areas and analyze the results. Rod Turochy (AU) serves as the Principal Investigator (PI), with assistance from CS staff. With assistance from the Project Manager, Tim Barnett, interviews were arranged within each of the functional areas as shown in Table 4.1. A total of 33 ALDOT employees were interviewed between December 2013 and February 2014.

The research team developed a survey instrument for use in all interviews. An addendum was created specifically for transportation planners because Federal legislation requires an explicit consideration of safety in transportation planning processes and documents.

The survey questions were designed to develop an understanding of the job functions within the DOT; to define the functions requiring safety training and education; and to determine the current availability and status of safety training. The goal is to identify safety-related education needs for ALDOT employees by work unit and job role. The basic questions in the survey are as follows:

1. Describe your position and title in relation to the overall DOT organizational structure.
2. What are the job functions and tasks associated with your position and that of your employees?
3. What safety-related technical skills are needed for carrying out your section's responsibilities?
4. Is safety education and knowledge important for people in your position and on your staff?
5. If you have safety technical knowledge, how did you achieve it?
6. What safety subjects would help you perform better on the job?
7. Have you participated in the development and/or implementation of the SHSP? (If yes, please explain your role.)
8. If the Bureau you work in were to disappear next week, would it impact SHSP implementation or updating?
9. What decisions do people in your work unit make that might impact safety?
10. Please describe any safety training you think needs to be provided to the employees in your unit.

Table 4.1 Persons Interviewed by Functional Area

Alabama Department of Transportation

Traffic Safety Engineering			
Tim Barnett (Safety Operations) Sonya Baker, Safety Engineering Manager		Waymon Benifield (Safety Section)	
Administration		**Policy and Planning**	
Lamar Woodham, Deputy Director for Administration		Don Arkle, Assistant Chief Engineer for Policy and Planning	
John Lorentson, Deputy Director for Operations		Bob Jilla, Chief, Transportation Planning Bureau	
Ronnie Baldwin, Chief Engineer		Jim Doolin, Senior Transportation Planner	
Maxine Wheeler, Chief, Training Bureau		Victor Jordan, Transportation Planner and MPO Liaison	
Cheryl Klein, Training Coordinator			
Steve Dukes, Chief, Personnel Bureau			
Phillip McIntosh, Assistant Personnel Director			
Engineering			
Design	**Construction**	**Maintenance**	**Division 6**
Stan Biddick, Assistant Bureau Chief, Roadway Design Engineer;	Curtis Vincent, Chief, Construction Bureau, State Construction Engineer	Stacey Glass, Assistant Bureau Chief, Deputy State Maintenance Engineer	Steve Graben, 6th Division Engineer;
Gary Moore, Assistant Bureau Chief, Traffic Design Engineer	Jeff Benefield, Assistant Bureau Chief, Road Construction Engineer	Kerry NeSmith, Assistant Bureau Chief, State Traffic Engineer	Nikki Preston, 6th Division (Design)
David Welch, Assistant Bureau Chief, Consultant Management Engineer		Eric Christie, Assistant Bureau Chief, Bridge Maintenance Engineer	Mark Waits, District 3 Manager (6th Division)
Theresa Barksdale, Assistant Quality Control Engineer		Ron Newsome, Assistant Bureau Chief, Road Maintenance Engineer	Rex Thompson, District 5 Manager (6th Division)
Brian Ingram, Assistant Bureau Chief, Location Engineer - Field;		Randy Braden, Assistant Bureau Chief, Permits and Operations	Josh Kervin, 6th Division Maintenance Engineer
Keith Kirkland, Assistant Location Engineer			Kris Kiefer, 6th Division Traffic Engineer
Taylor Stoudenmire,			

Assistant Location Project Manager			

5.0 Results

Following is a synopsis of the information given during the interviews which was used to develop and training and education framework.

5.1 Administration

The research team interviewed employees to obtain management, training, and personnel perspectives. The Deputy Director for Administration, Deputy Director for Operations, Chief Engineer, Training Bureau Chief, and other administrative and personnel staff participated. The Assistant Chief Engineer for Policy and Planning is a position held by an engineer with a background in traffic, design, and environment and extensive history in several different positions within ALDOT. He also has served on AASHTO and TRB committees, notably the AASHTO Committee on Design, which oversees development of *A Policy on Geometric Design of Highways and Streets*, commonly known as "the Green Book". The Administration's perspective is employees who work in the field every day receive training, but those who rarely work in the field, e.g. designers, do not. Following are the findings from the Administration interviews:

- The first job of safety is to reduce crashes. Safety engineering requires a specific set of skills, which is why the job is managed by the Office of Safety Operations (OSO), which was established specifically to address safety issues. However, OSO lacks sufficient personnel to conduct statewide network screening, develop plans and programs, and implement safety strategies in the field. Furthermore, decentralization demands that safety expertise be brought to the Regions.
- The design stage provides the "biggest bang for the buck" for more safety related training because the Design Bureau touches all projects; hence, design personnel could screen all projects for potential safety impact and improvements.
- The design group requires safety expertise to understand the safety impact of their decisions. However, the design engineers are likely to ask the OSO for assistance, especially in the case of design exceptions, but in some cases, they may not know to ask for assistance.
- OSO's job is to program safety funds to gain the greatest safety improvement for the least cost. However, the interviews revealed a potential disconnect within the Department. OSO does not program the funds (identify specific projects), because it has been the responsibility of the Divisions/Regions.

This can lead to unobligated funds. With the ALDOT's reorganization, it is not clear where this responsibility may ultimately fall. One high-level manager suggested OSO should tell the divisions/regions where the problems are and what needs to be done to correct them.

- ALDOT spends significant resources on safety.[1]
- Planning documents are focused on "state of good repair"; therefore, safety is not fully integrated into the planning process and documents.
- Many ALDOT employees believe following the standards in the AASHTO Green Book produces safe projects; hence, they are unlikely to consider the unintended consequences of a project, i.e., "If I implement 10 percent more rumble strips; what would be the impact on safety?"
- It would be helpful to have a traffic (not just traffic, but all forms of mobility should be considered) safety engineer in each of the Divisions/Regions.
- Specialized training should be provided for the traffic engineers at the Division level.
- Utilization of the Highway Safety Manual (HSM) in design should be a high priority.
- Training is readily available in ALDOT, if it is requested.
- Unlike some other agencies, ALDOT is putting more resources into training rather than less. In part, this is because, due to economic constraints, training is often the only incentive management can offer employees.
- Each division has a training coordinator, but only three of them are educated to provide training and facilitation. Otherwise, the coordinators must hire a consultant to develop and deliver training. They often are dependent on volunteers to conduct training.
- ALDOT works with the National Highway Institute (NHI), the International Management Signal Association (IMSA), and the T2 or Local Technical Assistance Program (LTAP) to address training needs. The LTAP does not have a stable of trainers as do some states, e.g. Louisiana, Michigan, et al. It relies on consultants and Auburn professors for training delivery.
- Succession planning is a critical issue because of the manner in which safety engineers learn the science which generally comes in the form of ad-hoc workshops, self-learning practices, peer networking, and on-the-job training. In other words, formal university safety training programs are nonexistent at present. ALDOT does not have a formal program for succession planning, but

[1] Note: The specific amount is not documented, and to do so is beyond the scope or the needs of this project. The implication of the comment is safety funding is not limited to the Highway Safety Improvement Program funds.

the Personnel Bureau has tools to assist. If ALDOT does not hire from within the Department, the State personnel department provides a list of ten candidates, and ALDOT is required to choose from the list. For example, they work with the State personnel department to study job requirements and set guidelines for hiring, which sometimes includes a test. The positions are generic, but it is possible to establish a probation period during which an employee can be required to attend certain classes, which may or may not be enforced at the Bureau level. They can also overfill a position to enable job sharing for a period of time. Finally, they can hire retired employees for a limited number of hours each month; however, the pay may not be commensurate with what the employee could earn as a consultant.

5.2 Bureau of Transportation Planning and Modal Programs

One concern of the Transportation Planning Bureau is the large number of employees who drive every day as a job requirement, particularly the Traffic Monitoring Section of the Bureau. They wonder if enough attention is being given to the safety of their own employees.

The Bureau is responsible for the long range transportation plan (LRTP), but the statewide transportation improvement program (STIP) is managed by the Bureau of the Office of Engineering. Planning also is responsible for reviewing all the metropolitan planning organization (MPO) documents, e.g. LRTPs, Transportation Improvement Programs (TIP), congestion management plans (CMP), freight plans, etc. Additional items of note are as follows:

- Alabama has 14 MPOs with only one ALDOT employee to review the documents listed above.
- ALDOT provides a structure for the MPO planning documents, so every plan has a safety section. However, the MPOs choose how to address safety, which illustrates a relatively “hands off” ALDOT policy. However, ALDOT policy does not allow the MPOs to publish safety data, which makes it very difficult for them to seriously address safety in their documents.
- Technical assistance is provided by distributing examples from other MPOs.
- Although an MPO Planning Guidebook is desirable, the Bureau has not had the resources to develop one.
- The LRTP safety sections were very vague at first but are becoming more specific, e.g., a Safe Routes to School program is required.
- More advanced safety sections can be found in the Huntsville, Tuscaloosa, Mobile, and Anniston LRTPs.
- The ALDOT LRTP is due for an update.

- Planning indicated safety training could help them understand safety issues so the needs could be documented in the planning documents.
- An experienced safety engineer in each Division to review the safety sections would be helpful. They believe each Division should have a designated safety engineer/planner responsible for safety with the caveat: safety personnel would need to be trained appropriately in highway safety analyses, rather than simply designating someone with the responsibility.[2]

5.3 Design Bureau – Project Location Section

The location section executes critical tasks early in project design. A key product of their work includes establishment of a tentative horizontal and vertical alignment for a roadway, as well as some refinement of project scope. It would be beneficial for these team members to be knowledgeable on how to evaluate the impact of scope and alignment decisions on highway safety; for example, quantifying the relationship between horizontal curve radius and expected crash frequency and severity. In addition to the preliminary design work, the location section work activities include field surveying efforts. Field work often involves work in or adjacent to an existing roadway, raising the need for some field crew members to be knowledgeable about temporary traffic control to protect their personal safety.

The survey crews are directly exposed to traffic every day; yet, they receive little safety training other than instructions, such as “wear your vest; put out your signs, etc.” The survey employees do not receive formal training in work zone traffic control.

Generally, horizontal and vertical alignment design is completed before it leaves the location engineer’s desk. They address safety concerns only if a need is identified by examining the data. They do not use CARE (Critical Analysis Reporting Environment), Alabama’s crash database system enough to stay current, even though most have received some training on it in the past. Frequent refresher training is probably warranted. When asked about their training needs, they suggested additional training is needed for both their group within the Design Bureau and the Divisions, such as:

- Low cost safety improvements at intersections, e.g. signal timing, signing, striping;
- Reducing conflict points at interchanges;
- Cost benefit analysis;

[2] ALDOT is in the process of decentralizing much of the responsibility to five Regions. The timing is ripe for requesting safety expertise in the Regional Offices.

- Other training on data analysis, such as network screening, hot spot analysis, systemic safety analysis, etc.;
- HSM training, such as the predictive methods, crash modification factors, etc. as it relates to the specific job functions and requirements;
- Cross training with other DOT units; and
- Road Safety Audits, specifically on intersections.

5.4 Design Bureau – Design sections

The design-oriented sections of the Design Bureau are responsible for several functions: roadway design, traffic signal design, roadway lighting on interchanges and some road segments, Intelligent Transportation Systems (ITS), and oversight of design consultants. They have had HSM training, but it was mainly theoretical and lacked follow up or implementation training.

- Safety is not directly considered a responsibility of the Design Bureau. They use the Green Book and Roadside Design Guide. They may use the HSM on design exceptions, but they usually send those issues to OSO for evaluation.
- For the most part, the Bureau addresses capacity or mobility projects.
- The design engineers believe safety is more likely addressed at the Division level during project development.
- They do sometimes look at safety in resurfacing projects. They do not do this often but are going more in that direction because the Federal guidelines are becoming more complicated and technical.
- ALDOT is in the process of shifting responsibilities to the Regions with “State of Good Repair” or maintenance as the primary objective. In other words, they now spend more time on maintenance, bridges, and smaller capacity projects. The shift means some capacity projects may be moved outside the 20 years horizon.
- They review all Interstate projects with a safety analysis and add clear zone, guardrail, and drainage structures to the list of priorities.
- The Design Bureau has many consultant workers who were formerly DOT employees, but it is unlikely they have received safety education and training.
- Individuals in the Bureau mainly rely on on-the-job training and learning by doing for safety knowledge. They do the jobs they are assigned. They do not participate in the decision making process for project selection because it is a political decision. The data they examine is related to the project scope.
- HSM refresher and implementation training is needed, especially for newer employees who are more open to change.

- The required guidelines do not address safety. Bureau employees believe following the AASHTO Green Book ensures safety, and safety issues arise only in cases of design exceptions, which relates to scope. Most of the time, the design engineers use the environmental documents as the scope. They may not review and update the scope because the time and funding required would increase the costs too significantly or fail to meet the schedule established by elected officials. These circumstances raise the issue of the potential need to educate the elected officials on safety issues.
- Federal law requires MPO approval for projects within their boundaries, but they lack the expertise to understand the projects and usually rely on consultants. Both are in need of training on the use of the HSM.
- Employees need to know and understand policies and how to implement them. Line workers need training as much as supervisors.
- Entry level engineers are increasingly dependent on computers and lack an understanding of the reasoning behind the computerized decisions. They may not understand the reasoning behind those decisions and are generally not trained to understand the safety impact of those decisions.
- The Construction Bureau may ignore or override the results from the Design Bureau and use their own judgments as to the best approach.

5.5 Maintenance Bureau

The Maintenance Bureau is responsible for all types of maintenance activities, e.g. maintenance of roads and bridges, traffic operations, emergency management, access permits, rest areas, welcome centers, etc. Traffic engineering is part of maintenance, but it also is dispersed throughout the department, e.g. planning, design, all divisions, etc.

Training is available and required for bridge inspections, hazardous materials, and employee safety; however, no formalized training on the science of road safety is in place. Maintenance personnel prioritize roadway maintenance by examining the crash data, e.g., wet weather crashes, slope, etc. They set priorities mainly according to pavement condition, but they add safety elements into the prioritized projects, such as cable median barrier, paving two feet of unpaved shoulders (on rural two-lane highways), changing the cross-slope, etc. Once the projects are prioritized, the Divisions develop the scope. Some personnel think the Divisions regularly ask the Safety Section to review the crash data. Some disconnect appears in individual attitudes about the attention to safety at this stage.

The need for training is particularly acute now with decentralization because more decisions will be made at the Region level and many, if not most, of these personnel have no experience or training in road safety. Periodically, training is made

available, but it is not offered often enough to keep the workforce current, and no requirements are associated with specific positions.

Personnel interviewed in the Maintenance Bureau suggest the coursework should be available and required for employees in those positions. Even if they have received university or on-the-job training in some of the areas, they may not have been educated on the safety impact or issues in their formal training programs. Training is needed in numerous areas including the following:

- Road Safety Assessments (RSAs,) low-cost safety improvements, work zone traffic control, signal design and operations, signal warrant studies, intersection analysis, interchange signing and marking, network screening, crash data access and data analytic techniques, countermeasure identification, correct MUTCD applications, the Traffic Signal Design Manual, and ALDOT's new Access Management Manual. For all of these subjects, some level of annual training should be developed, e.g. classroom, roll call, tip cards, etc.
- Traffic engineers need training on how to manage consultants. Much of the work (e.g., traffic impact studies) is accomplished by consultants. ALDOT traffic engineers need to know enough to supervise consultant decisions and work efforts and to choose from among the alternatives a consultant might suggest.
- Employees need training on public relations and communications so they can articulate the problems and offer solutions in language the public and elected officials can understand.
- Additional training on the HSM for employees and consultants is needed. However, the current training can be overwhelming and lack practical application. It should be broken down into pieces and each piece should be associated with practical application.
- ALDOT's Access Management Manual, which was published in 2013, provides DOT staff and consultants safety considerations for the access management process. ALDOT has plans to conduct access management training at the District level.

5.6 Construction

The Construction Bureau occasionally changes the design to conserve resources or improve safety, e.g., flatten slopes, remove guardrail, etc. These changes are driven by errors in design and constructability, and are the last step in the plan review process. Construction does not conduct a thorough in-depth review because time is limited, but they examine how much time the contractor has to get the job done.

- When Construction receives a project, it may have been moving forward for many years, and they typically are not given much time to review projects at a point where changes can be made.
- Construction follows guidelines on when work zone signs should be covered or removed. Several people mentioned the problem of work zone signage remaining in place when no work is being conducted, which is more likely a problem associated with contractors. This practice may create disrespect for the signs.
- Construction does not have the opportunity to go onsite at a work zone; probably only the onsite inspectors do this, but they have many other responsibilities.
- Construction conducts major plan reviews at two stages: 1) when "the plan is in hand" or approximately 30 percent complete, e.g., alignment and major features established) and 2) plans, specifications, and estimates (PS&E) stage or approximately 65 percent complete.
- An inspector trained in temporary traffic control should be assigned on every project.
- Law enforcement presence (e.g., a "blue light") should be considered on every project, and the officers should be trained and assigned other duties related to safety improvement.
- Construction has a growing number of entry-level engineers with some training on design but none on traffic safety. They constitute an "army" across the state that could be trained on traffic safety issues to improve traffic safety culture at the DOT.

5.7 Safety Section

Safety issues in ALDOT are addressed by the Bureau of Transportation Planning and Modal Programs – the Safety Section and OSO. The Highway Safety Improvement Program (HSIP) and safety engineering issues are managed by OSO. The Safety Section is responsible for outreach, behavior issues, and collaboration with other safety organizations.

The Safety Section is responsible for safety outreach, work zone awareness, Section 405 traffic records funds, and 163 and 157 transfer funds. They work with the Governor's Office of Highway Safety, which has nine traffic safety coordinators throughout the state who reside in various locations, e.g. junior colleges. They all attend CARE classes, learn to analyze crash data, and administer the local enforcement funds. Some of the coordinators are quite experienced, and a few have a medical background.

The Safety Section develops the annual crash facts booklets, spearheads outreach campaigns, and manages crash data improvement. They work with law enforcement, ADECA (Alabama Department of Economic and Community Affairs), the Education Department, and others to deliver CARE training and other outreach activities.

- The Safety Section delivers CARE training at the Central Office in a computer lab, which can be a problem for locals because their resources may not allow travel to the training site.
- They are working on linking crash data to roadway data, i.e., GIS data. Currently, the different groups use different maps, but they are building a statewide base map.
- CARE is the crash database. The Center for Advanced Public Safety (CAPS) at the University of Alabama offers training on the following subjects, but it is unclear how many ALDOT employees actually have access to the training.
  - Data analysis, e.g. network screening, hot spot analysis, systemic safety analysis, etc.;
  - SHSP integration training, e.g. the LRTP, statewide and MPO TIPs, pedestrian/bicycle plans, etc.;
  - HSM, e.g. predictive methods, crash modification factors, etc.;
  - Road Safety Audits and low cost safety improvements;
  - Model Infrastructure Roadway Elements (MIRE); and
  - Crash data analysis to Maintenance and law enforcement, specifically on how to code road defects to avoid liability.
- The Safety Section supports SHSP implementation by conducting outreach, awareness, overtime enforcement, etc. and works primarily with the Highway Safety Office. The analysis showed the outreach seems not to extend to ALDOT employees beyond personnel focused on safety work.
- Safety training needs:
  - Host Safety Summits more often than simply tying them to SHSP updates;
  - Provide training to MPOs on safety planning methods and techniques; and
  - The Safety Section could use additional training in data analysis, network screening, countermeasure selection, and crash modification factors (CMFs).
- Each division needs an assigned “safety advocate” with clear roles and responsibilities. Someone is assigned to safety in each Division but they are not organized and the role varies from one Division to another.

- A meeting of all the Public Information and Education (PIKE) managers and Public Information Officers (PIO) should be convened and training provided on how they can work together and support each other on safety campaigns and initiatives
- Alabama has one regional safety team, but they would be pleased to increase the number, based on safety corridors.

5.8 Division Offices

Key personnel in the ALDOT 6th Division were interviewed to gain this information. The Divisions' view safety as generally programmed through the Central Office and implementation takes place below the Division, e.g. county, local, consultants, ALDOT Districts, et al. The Divisions have always been the lead on safety projects, but ALDOT management wants OSO to take the lead and inform the divisions/regions of the issues and how they should be addressed. Unfortunately, OSO does not have the staff to assume that level of activity.

The Divisions view safety as an unfunded mandate, e.g., they are responsible for addressing safety but none of the Federal safety funding is distributed to the Divisions or the Districts. For example, 90 percent or more of the safety funds go to the divisions/districts for contract work (projects), not force-account work). They accomplish safety-related tasks, such as retroreflectivity quality control and access management, but without safety funds, they have to find other ways to accomplish the task. It is unlikely the Divisions will address safety issues without specific requirements or incentives.

- The Divisions need guidelines and some funding to operate comfortably without fear of liability. In other words, they will follow standards regardless of the safety consequences to void lawsuits without safety training.
- Division 6 has created a new position to monitor quality control in project design; one of the focus areas for this position will be safety elements. The employee will work with the Division and determine the Division's responsibilities with respect to road safety. This employee also will be responsible for identifying safety training needs for Division staff.
- The Divisions do not have safety engineers, so the responsibility is assigned to an existing position. The employee who fills that position may or may not have any safety qualifications.
- The Division Engineer or the Assistant regularly attends MPO meetings to enable building on current work programs.

5.9 County Transportation Bureau

This unit manages the Federal funds allotted to Alabama's 67 counties, and they assist with all phases of the project life cycle on county roads eligible for Federal aid. Each county in Alabama is required to have a licensed Professional Engineer (P.E.), and ALDOT pays part of the engineer's salary in some cases. Most of them have an assistant. The counties also receive oversight from the ALDOT Division Office and the Construction Bureau.

The county design policy is based on the type of project and average daily traffic (ADT), so the county policy is less restrictive than the Green Book. The counties are trained on CARE, if they request it, which is used to identify hot spots. The analysis is done by either the Bureau or the counties themselves. The Bureau is responsible for reviewing plans following the design/environmental stages. Once a project is let, the Construction Bureau assumes responsibility for project management and inspection, if not done by the counties. However, the counties are responsible for completing an annual inspection of all projects, except bridges. Additional specific points are as follows:

- The counties seek guidance from the County Transportation Bureau. For safety issues, they contact the FHWA Division Safety Engineer.
- Network screening is accomplished through CARE, i.e. identification of hot spots and safety corridors. In some counties, the county engineer (or someone in that office) has been trained on the use of CARE.
- Project selection is a political process, but the Alabama County Commissioners Association provides training on transportation issues. The National Association of County Engineers also provides useful information.
- The counties have access to any training offered by the Alabama Technology Transfer Center ("T^2") or ALDOT.

6.0 Action Plan

Section 6.0 provides a road safety education and training action plan for the ALDOT workforce. It includes five tables addressing the relevant ALDOT functional areas:

1. Policy and Planning
2. Design
3. Construction

4. Maintenance

5. Road Safety Management

Each table describes the following elements:

- Position within the functional areas;
- Training and education needs and opportunities;
- Estimated time for development and implementation (e.g., short (zero to six months), medium (six months – two years), and long (two to five years);
- Source for existing materials and/or development requirements; and
- Relationship of the training to the core competencies outlined in RRD 302 (see Table 1.1).

Table 6.1 Policy and Planning

Needs and Opportunities	Timeline	Source	Core Competencies				
			CC1. Multidisciplinary Nature	CC2. History and Setting	CC3. Crash Data	CC4. Crash Factors	CC5. Safety Management
Position – Transportation Planners (General)							
Transportation Safety Planning (TSP) Framework and Workshop	Short	NCHRP 08-76 framework and 1 day workshop	✓	✓	✓	✓	✓
TSP graduate and undergraduate curriculum materials	Short	NCHRP 17-46 3-hour workshop	✓	✓	✓	✓	✓
SHSP awareness and implementation[a]	Short	Development required	✓	✓	✓	✓	✓

[a] This training is appropriate for all ALDOT employees to ensure the Department positions itself as a leading safety agency and employees serve as safety ambassadors.

Table 6.2 Design

Needs and Opportunities	Timeline	Source	Core Competencies				
			CC1. Multidisciplinary Nature	CC2. History and Setting	CC3. Crash Data	CC4. Crash Factors	CC5. Safety Management
Position – Design Engineer							
IHSDM	Short	FHWA			✓	✓	✓
HSM[a]	Medium	Development – tailor materials			✓	✓	✓
Establish work zone speed limits and signage (traffic control)	Medium	Development – curriculum and training materials				✓	✓
Position – Location Section (Surveyors)							
Temporary traffic control (survey and work zone safety)	Short	Alabama T^2 Center (LTAP)				✓	✓
Position – Location Section (Engineer)							
Road safety assessments	Short	FHWA and other sources	✓		✓	✓	✓
Low-cost safety improvements	Short	FHWA	✓		✓	✓	✓
HSM	Medium	Development – tailor materials			✓	✓	✓

[a] Training on the Highway Safety Manual (HSM) should be tailored to explicit job functions. The ALDOT Safety Engineer and others would meet to decide the training suitable for functional positions and curriculum developers and appropriately adapt the existing materials to specified training audiences.

Table 6.3 Construction

Needs and Opportunities	Timeline	Source	Core Competencies				
			CC1. Multidisciplinary Nature	CC2. History and Setting	CC3. Crash Data	CC4. Crash Factors	CC5. Safety Management
Position – Project Engineers and Inspectors							
Temporary traffic control (work one safety)	Short	Alabama T^2 Center (LTAP)				✓	✓
Position – Plan Review Engineers							
HSM	Medium	Development – tailor materials			✓	✓	✓
Temporary traffic control (work zone safety)	Short	Alabama T^2 Center (LTAP)				✓	✓
Establish work zone speed limits and signage in traffic control plans	Medium	Development – curriculum and training materials				✓	✓

Table 6.4 Maintenance

Needs and Opportunities	Timeline	Source	Core Competencies				
			CC1. Multidisciplinary Nature	CC2. History and Setting	CC3. Crash Data	CC4. Crash Factors	CC5. Safety Management
Position – Maintenance Workers (Applies to Divisions, Districts, and the Central Office)							
Temporary traffic control (work zone safety)	Short	Alabama T^2 Center (LTAP)				✓	✓
Position – Roadway Maintenance Engineers							
Relationship between pavement condition and safety	Medium	Development – curriculum and training materials			✓	✓	✓

Table 6.5 Road Safety Management

Needs and Opportunities	Timeline	Source	Core Competencies				
			CC1. Multidisciplinary Nature	CC2. History and Setting	CC3. Crash Data	CC4. Crash Factors	CC5. Safety Management
Position – Safety Managers and Practitioners							
Road Safety 101	Medium	Development – update and pare curriculum for delivery through on-line training	✓	✓	✓	✓	✓
HSM Implementation Assessment	Short	FHWA			✓	✓	✓
Succession Planning	Medium	Development – policy	✓	✓	✓	✓	✓
Problem Identification	Short	Network Screening Methods (HSM)			✓	✓	✓
Problem Identification	Medium	Systematic Analysis Tool			✓	✓	✓
Problem Identification	Medium	usRAP			✓	✓	✓
Road safety assessments	Medium	FHWA and other sources	✓		✓	✓	✓
Low-cost safety improvements	Short	FHWA	✓		✓	✓	✓

Table 6.6 Division and District Personnel

Needs and Opportunities	Timeline	Source	Core Competencies				
			CC1. Multidisciplinary Nature	CC2. History and Setting	CC3. Crash Data	CC4. Crash Factors	CC5. Safety Management
Position – Position – Division Maintenance Engineers (and Assistants as Applicable)							
Road safety assessments	Medium	FHWA and other sources	✓		✓	✓	✓
Low-cost safety improvements	Short	FHWA	✓		✓	✓	✓
Access management	Short	Alabama T^2 Center (LTAP)	✓		✓	✓	✓
Temporary traffic control (work zone safety)	Short	Alabama T^2 Center (LTAP)				✓	✓
Position – Division Traffic Engineers (and Assistants as Applicable)							
Road safety assessments	Medium	FHWA and other sources	✓		✓	✓	✓
HSM	Medium	Development – tailor materials			✓	✓	✓
Low-cost safety improvements	Short	FHWA	✓		✓	✓	✓
Access management	Short	Alabama T^2 Center (LTAP)	✓		✓	✓	✓
Crash history analysis	Medium	Development curriculum and training materials	✓		✓	✓	✓
Temporary traffic control (work zone safety)	Short	Alabama T^2 Center (LTAP)				✓	✓

Needs and Opportunities	Timeline	Source	Core Competencies				
			CC1. Multidisciplinary Nature	CC2. History and Setting	CC3. Crash Data	CC4. Crash Factors	CC5. Safety Management
Position – District Engineers (and Assistants as Applicable)							
Low-cost safety improvements	Short	FHWA	✓		✓	✓	✓
Access management	Short	Alabama T^2 Center (LTAP)	✓		✓	✓	✓
Temporary traffic control (work zone safety)	Short	Alabama T^2 Center (LTAP)				✓	✓
Position – Permit Specialists (and Assistants as Applicable)							
Access management	Short	Alabama T^2 Center (LTAP)	✓		✓	✓	✓
Temporary traffic control (work zone safety)	Short	Alabama T^2 Center (LTAP)				✓	✓

7.0 Road Safety Training in Other States

The study team turned to two sources seeking information on road safety training programs in other states.

7.1 NTTD Survey

To seek information on how other state DOTs address safety training needs, a Highway Safety Workforce Development Survey was distributed to the National Transportation Training Directors (NTTD) via an online survey with a set of five questions:

1. Does your agency require any routine transportation safety training for all or select DOT employees?
2. Has your agency conducted training on the Highway Safety Manual?
3. Does your agency offer training or awareness materials on the State's Strategic Highway Safety Plan?

4. Does your agency offer training on safety data analysis?

5. To whom do you turn for safety training and education courses?

7.2 NTTD Survey Results

Seventeen state transportation agencies responded to the survey, as follows: Alabama, Arizona, Arkansas, Idaho, Indiana, Kentucky, Louisiana, Maine, Massachusetts, Michigan, Mississippi, Missouri, Nevada, Oregon, Rhode Island, South Carolina, Tennessee, Texas, and Washington.

The NTTD survey confirmed the following:

- Comprehensive transportation safety training programs (e.g. a training program for various transportation professionals which outlines what safety courses professionals with various responsibilities/roles should take and when they should be taken) were not evident in any of the responding states.

- Safety training is largely reactive and not comprehensively administered.

- DOTs do not typically train persons programming safety funds on the science of safety, e.g. the HSM.

- DOTs do not provide a baseline safety training curriculum for other professionals who influence safety (e.g. design, construction, and maintenance professionals).

7.3 AASHTO SCOHTS-SMS Survey

In addition, to the NTTD survey, similar questions were asked at the AASHTO Standing Committee on Highway Traffic Safety – Subcommittee on Transportation Safety Management (SCOHTS-SM). This separate questionnaire focused on whether other state DOTs have a safety training program, whether they were interested in establishing a program, and if they were pursuing a needs assessment and/or gap analysis for training needs.

Only 10 individuals (representing 10 states) responded, and presumably the respondents represent individuals interested in safety training whether or not they had specific programs to report. Most of the respondents have a safety program with a few discussing or developing a program. While four of the respondents said they were pursuing an analysis, a comparable number said they were not. Overall, most of the respondents did state that they were interested in establishing a safety training program or already had one in place.

8.0 Road Safety Educational Opportunities in Alabama's Universities

Due to the multidisciplinary nature of highway safety, opportunities exist for the topic to appear in coursework across many disciplines, such as civil engineering (CE), community planning, and public health. However, within state DOTs, highway safety analyses are typically the domain of civil engineers. The purpose of this investigation into current practice in highway safety education at the university level is to identify current methods for addressing highway safety and opportunities for enhancement. This study is confined to CE curricula in Alabama Universities.

8.1 Study Method

For this analysis, telephone interviews were conducted with transportation-focused members of civil engineering faculties teaching in accredited programs. Responses contained in this report are from:

- Steven Jones, University of Alabama
- Virginia Sisiopiku, University of Alabama at Birmingham
- Mike Anderson, University of Alabama in Huntsville
- Min-Wook Kang, University of South Alabama
- Rod Turochy, Auburn University

8.2 University of Alabama (UA)

Currently, highway safety is one of the topics included in the junior-level required introductory course in transportation engineering. This course was significantly revamped for the fall 2014 semester. Previously, only general safety policy and crash rate analyses were included. An overview of the HSM and the basics of safety performance functions and crash modification factors are now included in the course. Beyond the first course, highway safety is not explicitly addressed in any current offerings. A highway safety course (three semester credit hours at the graduate level) was regularly offered by Dan Turner until his retirement in 2010, but it has not been offered since that time. UA has no immediate plans to offer the course again. A new graduate level course offered in fall 2014, Statistical and Econometric Practices for Transportation Engineers, focuses on statistical model development and includes analysis of crash data and trends throughout the course.

8.3 University of Alabama at Birmingham (UAB)

In the first/introductory course in transportation engineering, highway safety is briefly addressed, but it does not constitute a major component of the course. Among upper-level undergraduate and graduate courses, highway safety is addressed in courses on intelligent transportation systems (ITS) and non-motorized transportation. The ITS course addresses safety primarily through a module on advanced vehicle control and safety systems. The bicycle and pedestrian course addresses safety for these specific modes, but does not utilize the *HSM*.

8.4 University of Alabama in Huntsville (UAH)

In the spring 2014, UAH offered an introductory course in transportation engineering that includes approximately two hours of coverage on highway safety with a focus on countermeasure identification and corridor-level analyses of highway safety problems and potential solutions. The main goal is to create an awareness of highway safety and the HSM. Beyond the first course, in spring 2014, five students took an independent study course for which an HSM-based full semester course was developed, including lecture notes, presentation slides, and homework problems. UAH has no immediate plans to offer the full-term course, but it is a long-term goal. In the meantime, some of the materials developed in the independent study will be used in the introductory class.

8.5 University of South Alabama (USA)

The introductory course in transportation engineering includes approximately two hours of coverage on highway safety addressing crash rate calculations, prediction models, and human factors concerns. As a dual upper-level undergraduate and graduate course, Highway Safety is offered every 3rd semester (i.e. twice in a three-year period). This is a full-semester class which follows the general structure of the HSM.

8.6 Auburn University (AU)

Currently, highway safety is one of the topics included in the junior-level required introductory transportation engineering course. Approximately one week of the course is devoted explicitly to highway safety, including crash rate analyses, as well as an overview of the HSM and crash modification factors. In the dual upper-level undergraduate and graduate Traffic Engineering Analysis course, approximately one week is devoted to highway safety, which addresses evolving highway safety history and trends, as well as an overview of the HSM and crash modification factors.

8.7 Summary

In general, the universities are consistent in the extent to which highway safety is addressed in the entry-level transportation engineering course (which is typically required for the undergraduate civil engineering degree). This course typically devotes about two to three hours to highway safety (out of approximately 40 contact hours for a three-semester credit hour class). The course content typically includes crash rate calculations, an introduction to the *HSM*, and a brief discussion and application of crash modification factors and/or predictive methods. This has likely been the case for no more than four years since the HSM was released in 2010. Beyond the introductory course, opportunities to learn about highway safety are more varied.

- At one extreme, USA offers a full-semester course in highway safety once every 18 months.
- UA has offered a full-semester course in the past but not for several years.
- At Auburn and UAH, offering a semester course every 12-18 months is a long-term goal, but there are no immediate plans to do so.
- A class period or two on highway safety shows up in some elective courses at some universities.

8.8 Opportunities

Based on an analysis of the current coverage of highway safety in CE curricula, opportunities may exist to strengthen coverage of highway safety. However, constraints associated with funding, human resources, and an inability to add required courses were noted by many of the faculty members interviewed.

Outside of full-term courses focused on highway safety, it is apparent the curricula focus on analysis skills, such as problem identification, countermeasure selection, and performance evaluation. A general theme among the faculty interviewed for this analysis was that more time should be devoted to highway safety, and some programs are making strides in that direction. As resources permit and increasing attention is given to highway safety among state DOTs and at the national level, further incorporation of modern, rigorous approaches to highway safety can be incorporated into the curriculum.

Regular offerings of highway safety courses at state universities would provide further opportunities for both civil engineering students and practicing highway safety professionals to improve their knowledge and skills pertaining to highway safety. Such a course could include, but not be limited to, use of the *HSM*. Materials for such a course already exist in many forms. For example, USA already

offers a full-semester course twice every three years. Many pieces of a course exist in other forms, such as one-day courses offered through the Alabama LTAP Center, modules on highway safety in existing transportation courses in civil engineering programs at Alabama's universities, and *HSM* training materials developed through NCHRP. It appears the greatest constraint on regular offerings at the various programs across the state is resources. However, if demand for such courses were more apparent and requests for such offerings more frequent, support for such offerings (such as moving long-term goals into action) could be increased.

The lack of sufficient resources might be overcome if the demand were greater. Potential opportunities for increasing demands could include:

- The universities collectively could develop a highway safety engineering certificate program. The certificate program could offer a flexible curriculum, e.g. in-class, blended learning, online, etc., including practical experience;

The universities, in cooperation with ALDOT, could create traffic safety labs where the students address "real world" problems; and ALDOT and regional transportation planning and engineering agencies could establish eligibility requirements that require highway safety training for specific position descriptions and consultants/contractors working on safety projects.

9.0 Summary and Recommendations

Some general themes became apparent during the interviews. Following is a synopsis of the major points along with recommendations for future action by ALDOT.

9.1 Safety Training

A coordinated program of safety training opportunities does not exist within ALDOT. The procedure for accessing training generally is reactive, e.g. someone must request the training. However, little seems to be known about what training individual employees need or what is available. The typical employee interviewed reported if they receive any safety training, it occurs on the job and is delivered by a supervisor or a mentor.

Recommendation: Several interviewees suggested ALDOT needs additional enhancements in Division Office safety and operations. This could occur initially through additional resources being made available to the Safety Section, OSO, the LTAP Center or some other entity. Ultimately, every Division should be staffed with a well-trained highway safety engineer, who has continuing access to the expertise being made available through national committees and organizations. The Alabama T^2 Center (LTAP) also could be expanded, if additional resources were identified, to

offer continuous safety training at the Division, county, and local levels. Having this resource at the Division level could make the required expertise more accessible and better distribute the safety analysis workload throughout the State. This would increase the likelihood that safety analyses are conducted and safety issues are addressed when it would be most helpful.

Recommendation: The Location Section of the Design Bureau has some personnel for which additional safety-related training is recommended. Field surveying personnel should be trained in temporary traffic control. Generally they have little to no formal training on this topic. Office-based personnel who establish project location and roadway alignment should be trained in use of the HSM specific to their needs, such as how project alignment decisions may affect safety performance.

Recommendation: The design-oriented sections of the Design Bureau have some personnel for which additional safety-related training is recommended. Personnel involved in roadway design should be trained in use of the HSM specific to their needs, such as how design decisions may affect safety performance. Additionally, these engineers would benefit from specific guidance on how to use the HSM in their work. This guidance could range from simple recommendations about use of some specific procedures found in the HSM to ALDOT-specific goals regarding desired safety performance of roadway facilities.

Recommendation: The Maintenance Bureau personnel would benefit from safety-related training specific to their areas of responsibility. Road maintenance engineers involved in setting priorities for resurfacing and other maintenance activities should be trained in HSM tools, such as crash modification factors, that address resurfacing activities. Traffic engineers should be trained in HSM tools pertaining to traffic operational and safety-driven improvements. These recommendations apply both to personnel in the Maintenance Bureau at the Central Office as well as maintenance engineers and their engineering staff at the divisions.

9.2 Strategic Highway Safety Plan

Most of the interviewees did not participate in the most recent SHSP update (2011), were not familiar with the document, and none of them had actually read it.

Recommendation: Prepare briefing materials and roll out a DOT-wide campaign to encourage all employees to become “ambassadors” for safety and participate in SHSP implementation activities. Review the strategies and actions in the SHSP, and where appropriate, assign specific individuals responsibility for SHSP implementation. These activities would become the beginning stage for creating a safety culture within ALDOT.

9.3 Highway Safety Manual

Several of the interviews reported they had received either a briefing or a "crash course" on the HSM. ALDOT employees expected to use the HSM in their work need additional, hands-on training. Although CARE training is available, most have not accessed it enough to actually use it.

Recommendation: Assess which employees need CARE and/or HSM training; provide the training; and develop an incentive program to encourage engineers to use the training.

Recommendation: Provide ALDOT guidance or a policy on how and when to use the HSM.

9.4 Hiring and Succession Planning

Succession planning is somewhat limited because of state personnel requirements, but several alternatives exist for ensuring safety personnel are trained to do the job. ALDOT might want to consider hiring the State Safety Operations Engineer's replacement in advance of his retirement, to ensure someone has the requisite safety skills to accomplish the job. This would require diligence in learning from peers and the literature to acquire in-depth knowledge on the science of safety. Furthermore, a list of basic training requirements could be established for safety engineers to ensure once on the job, the employees know they must acquire the knowledge and skills.

10.0 Phase 1 Implementation

Several steps can be taken immediately to "jump start" safety education and training within ALDOT, such as those outlined above. The first step might be to review the Training and Education Plan developed during this study and prepare a briefing presentation for use with management and other ALDOT employees. The purpose would be to ascertain and prioritize the training opportunities agreed to and supported by management and to identify the resources necessary for implementing the prioritized Training and Education Plan.

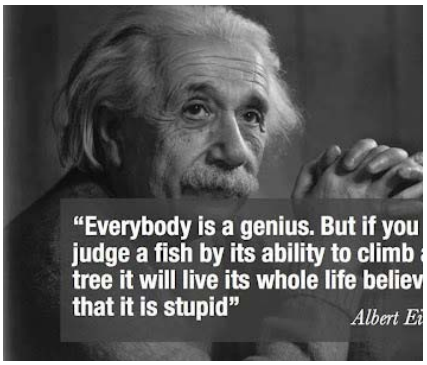
In some cases, new or revised policies would need to precede implementation. The proposed training needs can be addressed in three broad categories:

10.1 Available Courses

Some of the proposed courses are available through FHWA, National Highway Institute (NHI), and other sources. Examples include training that provides a basic

introduction to the HSM, road safety assessments, and low-cost safety improvements. These could be delivered to appropriate audiences through the ALDOT Training Bureau, LTAP, and/or consultant services.

10.2 Tailored and Adapted Training



The action plan shows a large number of currently available materials; however, to be effective and efficient, much of it would need to be tailored to specific positions. One obvious example is the HSM, which many believe could have a profound and positive effect on roadway safety. The manual is complex and not easily understood without thorough training, but it is not necessary for all positions. Most highway safety managers and practitioners do not need to know the analytic methods contained in the HSM; yet, they do need to be familiar with the general content and importance of implementing the techniques. Some ALDOT employees are familiar with the HSM, but not well enough schooled to apply the methods. In some other cases, the current materials need to be updated and dissemination methods explored to find efficient delivery methods that do not require travel or even, in some cases, classroom presentations.

10.3 Training Development

In a few instances, the training may need to be developed, such as a workshop focused on the use of the SHSP to provide support for decision-making on policy and project development and prioritization. An obvious example is SHSP awareness training for all employees.

As SHSP implementation expands, persons with little or no road safety experience will be encouraged to join the effort. ALDOT is working toward establishing regional safety coalitions and programs. The coalition members may need to know about not only the SHSP and the benefits and opportunities it provides, but they also may need instruction on coalition building, grant writing, and other areas. In many cases, with some investigation, these materials can be found. For example, the Louisiana Department of Transportation and Development recently developed and presented a workshop to introduce regional coalition directors to effective methods for coalition building, facilitation, and presentation. These materials could be adapted to the Alabama environment. Other DOTs, metropolitan planning organizations (MPO), etc. also may have such resources available.

10.4 Framework for Phase 2

Several projects can be developed from the work documented in Phase 1 to meet the overarching goal of identifying road safety needs and requirements for key ALDOT positions. Possible means to identify and develop training needs and materials include:

- Host a peer exchange among selected state and local safety engineers to continue to build out the training and education plan by developing tables showing the knowledge, skills, and abilities (KSA) required for any topic and the associated required training resources. Table 10.1 demonstrates this approach using intersection design as an example topic.

Table 10.1 Example of a Topic-Specific Table: Intersection Design

	Required KSA	Training Resources
Basic	Concepts of alignment, design vehicles, turning radii, turn lanes	A module in an existing roadway design course such as those available through LTAP centers, NHI, etc.
Intermediate	Application of vehicle traffic data and pedestrian data to determine need for auxiliary lanes and specific dimensions; evaluation of intersection sight distance	One-day course on intersection design, e.g., NHI Course 380074 “Designing and Operating Intersections for Safety”
Advanced	Consideration of innovative/unconventional design options; comprehensive evaluation of alternative designs to meet different objectives; evaluations of complex geometric conditions	A series of one-day courses on specific aspects or types of intersections, e.g., NHI Course 380109 “Alternative Intersections and Interchanges” and 380096 “Modern Roundabouts: Intersections Designed for Safety”

- Create training videos on Part A and Part B of the HSM (highway safety fundamentals and network screening methods)
- Outline a training and education curriculum that allows engineers and planners to acquire basic and intermediate safety knowledge and experience.
- Develop a video demonstrating potential roadway safety hazards and low cost improvements to educate law enforcement, county and local traffic engineers, and other interested parties.
- Develop a course curriculum for immediate and advanced training for regional safety engineers.

- Produce one or more training videos to demonstrate basic roadway engineering concepts to educate law enforcement to help them identify potential hazards and report them to ALDOT. Examples might include sight distance, pavement friction, correct signage, etc.

In the long-term, execution of all of the above projects is recommended to adequately prepare ALDOT employees and law enforcement officers in Alabama for their roles and responsibilities pertaining to highway safety. For the second phase of the current work, the research team and ALDOT elected to focus on a more thorough development of a training and education plan. The key information gathering step in this process is to hold a peer exchange; the input obtained from a range of traffic safety professionals would be then synthesized into a training needs matrix.

11.0 Phase 2 Development

Phase 1 of the Alabama Safety Workforce Development research program was designed to develop a detailed education and training framework by reviewing the relevant literature, e.g., RRD 302, etc.; conducting numerous interviews with DOT employees across the functional areas relevant to DOTs; and identifying the current "state of practice" to learn about road safety training and education opportunities available in the U.S.

Phase 2 of the research program involves seeking confirmation and expansion of the training and education matrix or framework from a qualified group of experts with experience in road safety workforce development, as well as a widespread vetting process. The first step was to recruit an expert working group to participate in a peer exchange. Once accomplished, the group met for two days to further develop the education and training matrix resulting from Phase 1.

11.1 Phase 2 Objectives

The objectives of the Phase 2 Study were to develop training guidance for ALDOT safety workforce development by accomplishing the following tasks:

- Conduct a peer exchange program to enhance the education and training matrix;
- Develop a curriculum outline for highway traffic and safety engineers in ALDOT's Regions;
- Develop training materials on safety engineering skills and traffic safety engineering issues for law enforcement officers; and
- Develop tailored road safety training materials for ALDOT employees.

Phase 2 of the research program began with a peer exchange held in September 2016 among road safety experts with interest and experience addressing road safety workforce development. The participants represented state DOT safety engineers,

university professors, FHWA road safety managers, and consultants. The purpose of the peer exchange was to build on previous efforts to create an education and training matrix for all functional areas within a department of transportation, as well as other safety agencies, to enhance the overall capacity of the agencies to effectively address safety. The specific peer exchange objectives were to:

- Construct an outline of training and other strategies to help new road safety employees become effectively and efficiently productive and successful;
- Develop safety capacity building performance measures;
- Create implementation plans for each of the previous three objectives; and
- Generate activities to vet the effort broadly for additional input and inform other capacity building efforts.

The peer exchange members began by providing additional detail to the draft Workforce Development Education and Training Matrix from Phase I. While the work is not complete, the group was productive. Initially, the group identified the primary challenges to be overcome and reviewed the functional areas addressed in Phase 1 and expanded the list of DOT functional areas with safety training needs.

11.2 Challenges

The following challenges were identified as pertinent to some degree in all state DOTs.

- Lack of structured safety training and education opportunities.
    - Inadequate understanding of how safety training fits into overall DOT training;
    - Lack of qualified people and expertise to apply for safety positions, specifically a lack of safety analysis skills;
    - Lack of a national program to fill the gap;
    - Little research into safety training needs; and
    - Lack of safety training ownership. The NHI, LTAPs, and the FHWA Resource Centers provide some training but a coherent and comprehensive approach to road safety training does not exist.
- Lack of methods for addressing the multidisciplinary nature of safety.
    - Current training opportunities tend to be siloed like the agencies they serve; and
    - The development of SHSPs and the HSM only partially address the need to bring more emphasis on quantification and tying the results into the design function.
- The low-level status of safety in DOT operations and decision-making.

  - Many DOTs consider safety engineering as incorporated into traffic engineering, maintenance, or a design function;
  - The growing trend to place safety in operations, traffic, design, etc., threatens to reduce the status of safety throughout the DOTs;
  - Leadership and decision-makers prioritize safety publicly, but follow up actions are lacking; and
  - Safety funding is a small part of a DOT budget.
- Insufficient university-based training at undergraduate and graduate levels.
- Weak relationships with other agencies.
  - Determine how safety on the infrastructure side works with behavioral safety. SHSPs have a behavioral focus, but training is lacking on that side of safety as well. NHTSA has a training course but it focuses on project and grant management.
  - Federal Motor Carrier Safety Administration (FMCSA) and Federal Transit Administration (FTA) also provide safety training related to their missions. It is not clear whether cross training among agencies is an option.
- Workforce reductions and the lack of succession planning.

11.3 DOT Positions with Safety Training Needs

Table 3 shows the enhanced list of positions.

• Data collection, management, and analysis • Planning • Programming • Design • Traffic Operations • Transportation Systems Safety	• Construction • Maintenance • Performance Management • Local Programs • Research • Communications • Leadership/Executive

Table 3. DOT Positions with Safety Training Needs

11.4 Enhanced Training Matrices

The peer exchange participants determined the need to create further detail in the training matrices by categorizing which job functions require basic, moderate, or advanced knowledge. The categories were defined as follows:

- Basic – A practitioner has basic awareness and can remember the information.
- Moderate – A practitioner understands and uses the information and can effectively explain it to others.
- Advanced – A road safety practitioner acquires in-depth knowledge and has the ability to create additional information, analyze, and apply the knowledge, and is able to evaluate the results of using the information.
- Briefing – A practitioner or manager has a high-level understanding of the knowledge and knows where to obtain additional information.

11.5 Training Matrix for Safety Engineers and other Safety Personnel

The peer exchange participants focused on detailing the capacity building requirements for safety engineers and other "systems safety" practitioners and outlined the knowledge, skills, and abilities required for these positions. Table 4 demonstrates their findings.

Highway Safety Management Process	Projects Delivery Functions	Information Needs/Activity	Data	Planning	Programming	Design	Traffic Operations	Transportation Systems Safety	Construction	Maintenance	Performance Management	Local Programs	Research	Communications	Leadership/Executive	Available Training & Resources
Leverage & Manage Data	Data Acquisition	Data Needs														FHWA is developing a safety data and analysis training Traffic Records 101
		Data Collection														Traffic Records 101 (NHTSA)
		Data Integration to perform safety analysis														Traffic Records 101 (NHTSA)
Incorporate federal program rules	Federal rules	Federal Planning and Safety Performance Requirements														Federal Aid 101 (would need to be adapted to safety and planning); FHWA final rule webinars

Table 4. Training Needs, Opportunities, and Level of Accomplishment by Functional Area

The members identified specific training needs within broad categories, determined which DOT functions required the specific training needed, assigned a level of importance, and identified current opportunities for accessing the information and training.

The system follows a framework established by the Washington State DOT. It includes the functions and information needs. The flow of information from left to right are:

- The far left column is the highway safety management process components. In this case, the first is leverage and manage data.

- The next column is the corresponding project delivery function, which is data acquisition.
- Next, for these two processes, the information needs or activities are listed. Examples are data needs, collection, and integration.
- The next group of 13 columns represent functional areas within a DOT, such as data management, planning, design, traffic operations, and transportation systems safety.
- Finally, the last column on the right, as identified by the participants, is the training and resources currently available to address the information needs or activities within the two processes.

For example, in the broad area of "Leverage and Manage Data," the functional areas need to know what data are needed and how to collect and integrate or manage the data to support accurate road safety decision-making. The colors reflect the level at which each function needs to know and understand data processes, e.g., basic (green), moderate (yellow), advanced (red), and briefing (blue). The group quickly determined that systems safety practitioners need advanced knowledge in each of the identified training needs areas. This position would be the DOT's traffic safety engineer and other personnel with primarily safety responsibilities.

After identifying and documenting the training needs, opportunities, and level of accomplishment by functional area, the group turned to the task of providing more detail on matrices for the basic (green) and moderate (yellow) safety information needs, learning objectives, and currently available or needed resources, such as available courseware, courseware in need of updating and/or tailoring to a specific state or local environment, and courseware development needs. The key exercise was to develop the learning objectives for each of the functional components. The more detailed approach remains to be developed for advanced safety information needs. After the peer exchange, a partner in this effort, the Louisiana Department of Transportation and Development with the Louisiana Center for Transportation Safety provided additional input to the matrix. The Appendix contains the Safety Workforce Development Education and Training matrix.

11.6 Summary

The peer exchange accomplished work beyond the original expectations. The members were able to fine tune the work of Phase 1 and develop an approach for determining which functions within a DOT are important to safety improvement, and the specific information and level of required knowledge or skill each function needs to perform effectively. While the peer exchange was productive, the work is not finished. The group agreed to continue to work via conference calls and webinars. To date, one two-hour webinar has been completed. The members readily see that meeting in person to accomplish this difficult work is far more fruitful and productive.

Therefore, leadership within the group is seeking additional funds to continue the journey.

12.0 Next Steps and Conclusions

The expert working group is seeking funding to support additional peer exchanges and consultant support. A proposal has been submitted to conduct a domestic scan to identify information from other states working on road safety workforce development issues and concerns, and work has begun to develop a mechanism to pool funds from states interested in advancing the current work. The additional funds would be used to:

- Advance and finish the basic and moderate training information matrices;
- Develop a matrix for advanced training information;
- Complete the Transportation Systems Safety Training Guide;
- Develop training guides for remaining the functional areas;
- Determine measures and methods for assessing training effectiveness; and
- Create the training materials and courseware where gaps appear in safety training and education opportunities.

Documenting and presenting progress at this stage of the research will not only support funding requests, but also provide opportunities for vetting the findings and seeking additional input on the process and content of the effort.

References

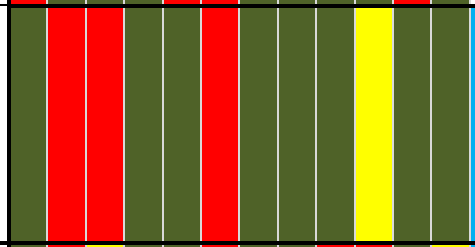
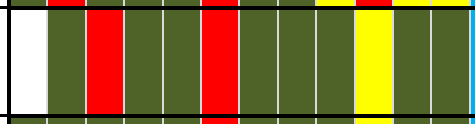
- [1-2] Transportation Research Board, Washington, D.C. *Special Report 289: Building the Road Safety Profession in the Public Sector*, p. vii, Washington, D.C. 2007. (See http://safety.fhwa.dot.gov/media/pdf/proc_hswpw.pdf.).
- [3] National Cooperative Highway Research Program. Research Results Digest 302: *Core Competencies for Highway Safety Professionals*. May 2006.
- [4] AASHTO Standing Committee on Highway Traffic Safety. Strategic Plan, Washington, D.C. June 2011.

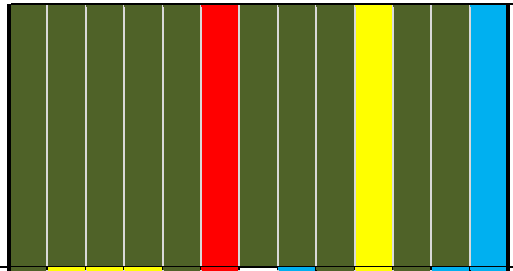
Appendix:

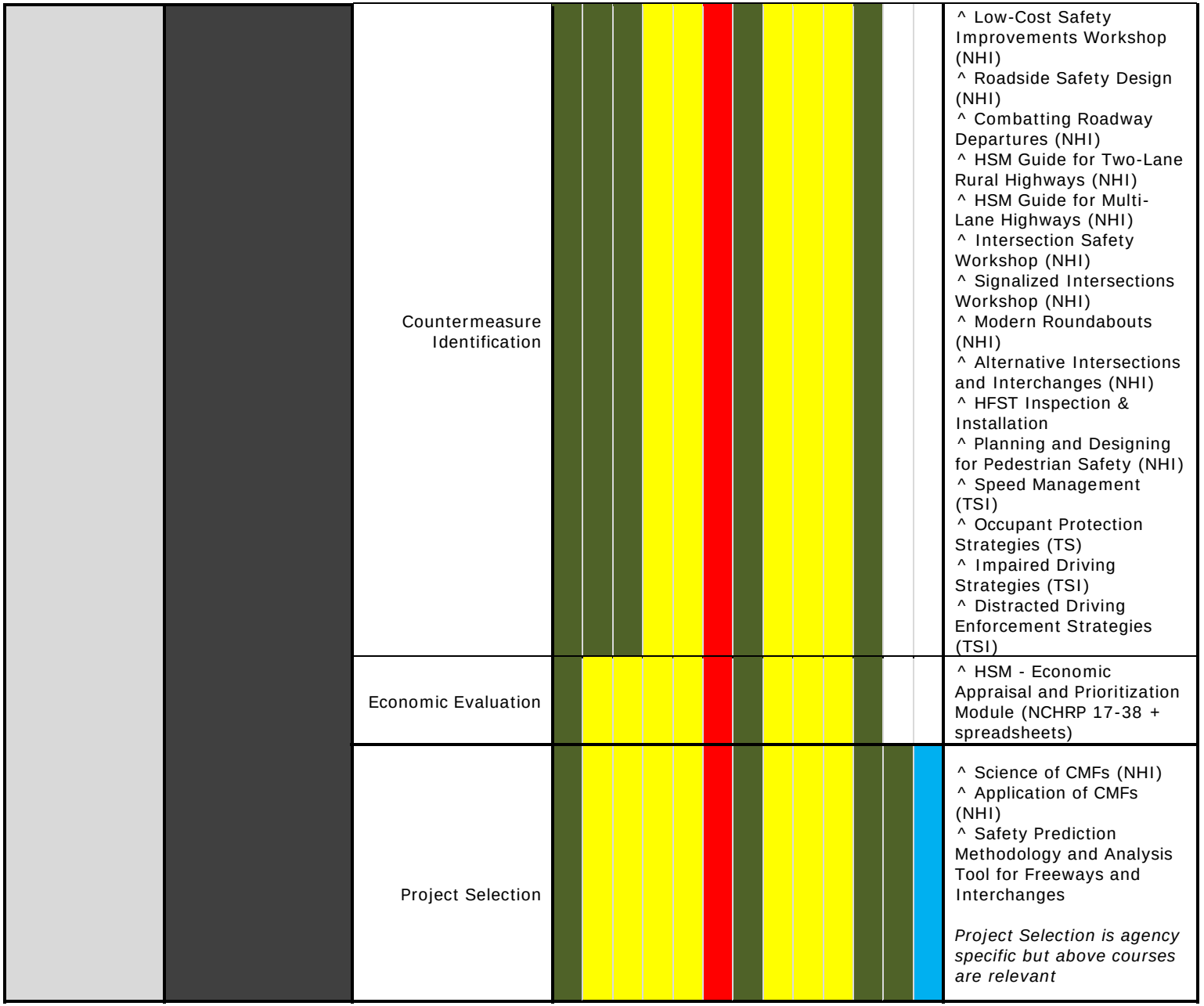
Safety Workforce Development Education and Training Matrix

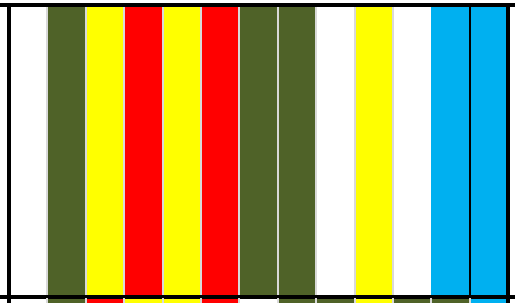
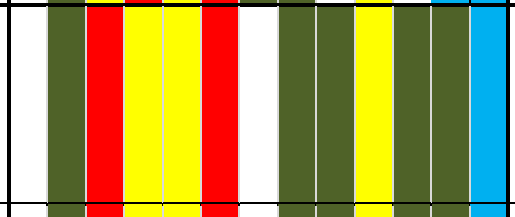
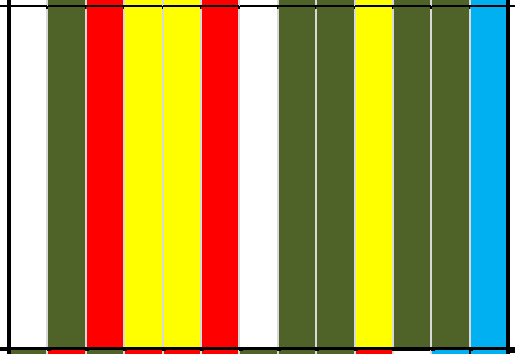
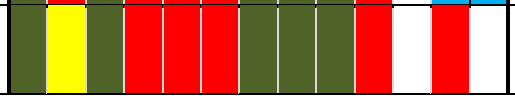
Safety Workforce Development Education and Training Matrix

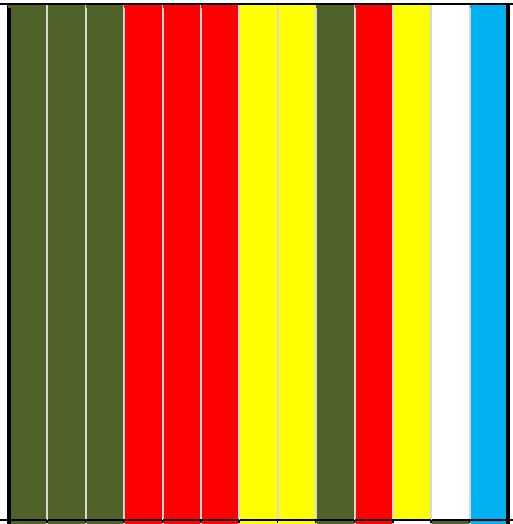
			DOT Positions with Safety Training Needs												
Highway Safety Management Process	**Projects Delivery Functions**	**Information Needs / Activity**	Data	Planning	Programming	Design	Traffic Operations	Transportation Systems Safety	Construction	Maintenance	Performance Management	Local Programs	Research	Communications	Leadership/Executive	**Available Training & Resources**
Leverage & Manage Data	**Data Acquisition**	Data Needs														^ FHWA developing a safety data & analysis training ^ Traffic Records 101 (NHTSA) ^ Traffic Records Training for State Highway Safety Office Leadership ^ DOT|TRCC's Training & TA page ^ FHWA Roadway Safety Data Program, Primer on Safety Data and Analysis Toolbox
		Data Collection														^ Traffic Records 101 (NHTSA) ^ LA's crash report presentation as template for other states

		Data Integration to perform safety analysis		^ Traffic Records 101 (NHTSA) ^ 2016 FHWA DDSA webinars ^ 2012 AASTHO pub: Integrating the HSM into the Highway Project Development Process ^ 2015 FHWA pub: Applying Safety Data and Analysis to Performance Based Transportation Planning
Incorporate federal program rules	**Federal rules**	Federal Planning and Safety Performance Requirements		^ Federal-Aid Highway 101 (NHI) ^ HSIP and Safety Performance Measures Final Rules Webinar ^ FHWA Safety Perf Mgmt webinars ^ FHWA Office of Safety Fact Sheets
Develop Short, Medium & Long-term Vision, & Performance Goals/Objectives	**Strategic Highway Safety Planning**	Goal, Measurable Objectives/Performance Targets, Emphasis Areas		^ HSIP Overview (NHI) ^ SHSP Development (NHI) ^ State Specific Presentations on SHSP ^ FHWA HSIP Manual ^ FHWA Office of Safety, Communities of Practice
		Implementation Plan		^ SHSP Implementation (NHI)
		Eligibility/screening policy criteria		^ HSIP Project Identification (NHI)
Budget	**Setting budget expectations**	Budget		^ State Specific Core Module Highway Program Funding (NHI)
Screen/scan network and corridors to	**Scenario Planning**	Screening Criteria/ Identification		^ HSIP Project Identification (NHI) ^ HSM Overview (NHI)

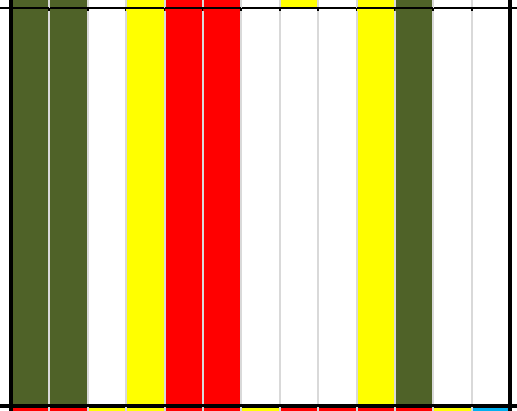
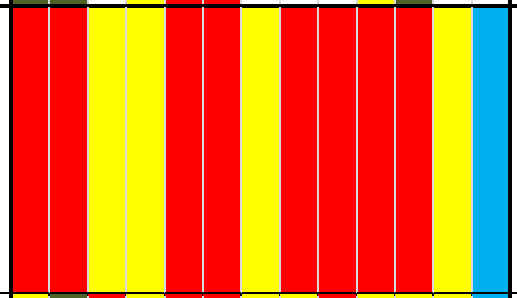
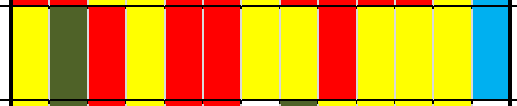
identify opportunities	**Corridor and System Safety Planning**	Screening		^ HSM Roadway Safety Management Process (FHWA RC) ^ New Approaches to Highway Safety Analysis (NHI) ^ Network screening based on level of service of safety (LOSS)
		Ranking		^ Systemic Tool
		Safety incorporation into system plan		^ Systemic Safety Webinar Series (FHWA)
		Safety incorporation into corridor plans		^ Safety Guidance for Corridor Planning Studies (WA State) ^ Synthesis Study: Effectiveness of Safety Corridor Programs (IA State U.)
Evaluate Benefits and Tradeoffs	**Pre-design and scoping**	Safety countermeasure policy, procedure and evaluation		^ Improving Highway Safety: An Overview of 9 Proven Crash Countermeasures (ASCE)
		Diagnosis (Road Safety Audits, Human Factors etc.)		^ Road Safety Audit/Assessment (NHI) ^ HSM Online Overview (NHI) HSM - Diagnosis and Countermeasure Selection Module (NCHRP 17-38) ^ IHSDM - Interactive Highway Safety Design Model (NHI) ^ Introducing Human Factors in Roadway Design and Operations (NHI)

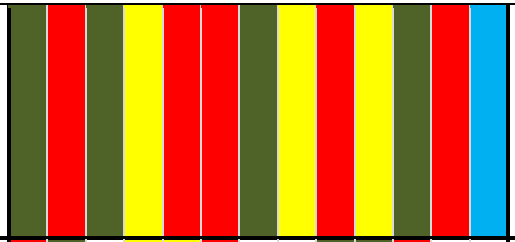
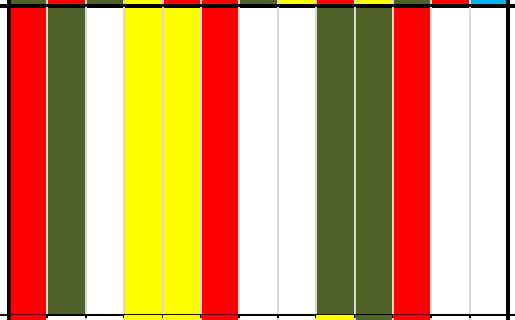
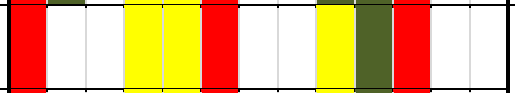
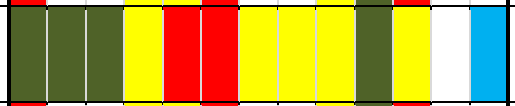
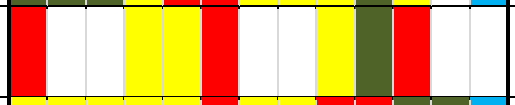
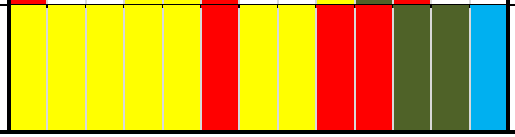

Countermeasure Identification
^ Low-Cost Safety Improvements Workshop (NHI)
^ Roadside Safety Design (NHI)
^ Combatting Roadway Departures (NHI)
^ HSM Guide for Two-Lane Rural Highways (NHI)
^ HSM Guide for Multi-Lane Highways (NHI)
^ Intersection Safety Workshop (NHI)
^ Signalized Intersections Workshop (NHI)
^ Modern Roundabouts (NHI)
^ Alternative Intersections and Interchanges (NHI)
^ HFST Inspection & Installation
^ Planning and Designing for Pedestrian Safety (NHI)
^ Speed Management (TSI)
^ Occupant Protection Strategies (TS)
^ Impaired Driving Strategies (TSI)
^ Distracted Driving Enforcement Strategies (TSI)
Economic Evaluation
^ HSM - Economic Appraisal and Prioritization Module (NCHRP 17-38 + spreadsheets)
Project Selection
^ Science of CMFs (NHI)
^ Application of CMFs (NHI)
^ Safety Prediction Methodology and Analysis Tool for Freeways and Interchanges
Project Selection is agency specific but above courses are relevant

Final Scoping	**Fit the design to the site**	Project Defined		^ Context Sensitive Design (KY Transportation Center) ^ Workshop on Performance Based Practical Design (FHWA RC) ^ Complete Streets (Assoc of Ped & Bicycle Prof) ^ Access Management, Location, and Design (NHI)
Prioritize and program projects	**Programs developed**	Prioritization		^ HSM Part B, Chapter 8 - Prioritize Projects ^ Developing Methodology for Identifying, Evaluating, and Prioritizing Systemic Improvements
		Program Created (6 yr STIP, etc.)		^ Basics of Transportation Planning (NHI) ^ Transportation Planning Process (NHI) ^ NCHRP 08-76 - Institutionalizing Safety in Transport Planning Process ^ Nov 2016 FHWA e-guide: Building Links to Improve Safety: How Safety and Transportation Planning Practitioners Work Together
Design Projects and Procure Assets	**Pre-Design**	Environmental Planning		^ Integrating Road Safety into NEPA Analysis: Practitioner's Primer
		Public Involvement		^ Public Involvement in the Decision Making Process

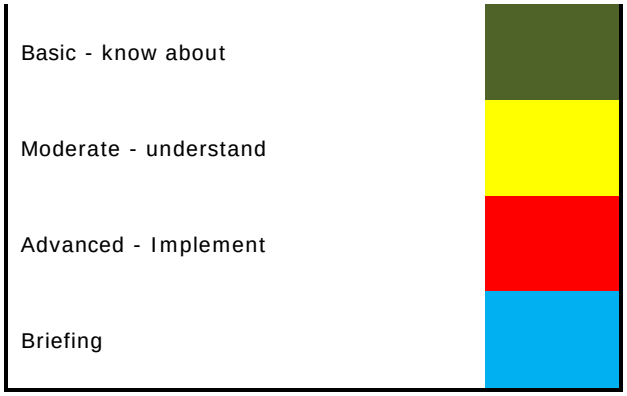
	Design	Safety Related Design Policy and Requirements		^ Access Management, Location and Design (NHI) ^ HSM Guide for Geometric Design Features (NHI) ^ Design, Construction, and Maintenance of Highway Safety Appurtenances and Features (NHI) ^ Integrating Geometric Design & Traffic Control for Improved Safety (NHI) ^ Introduction to MUTCD (ATSSA) ^ NACTO Design Guides - urban street, global street, urban bikeway, transit street
		Context Sensitive Design		^ Context Sensitive Design (KY Transportation Center)
		Practical Solutions		^ FHWA Performance Based Practical Design
		Design Evaluations		^ IHSDM ^ HSM
		Design Analysis and Exceptions		^ IHSDM ^ HSM ^ Geometric Design: Applying Flexibility and Risk Management (NHI)
		Corridor Analysis		^ IHSDM ^ HSM ^ Geometric Design: Applying Flexibility and Risk Management (NHI)

Construct Projects & Place Assets into Service (Implementation)	**Construction**	Advertisement		
		Construct Project		^ Work Zone Management Training (NHI & ATSSA) ^ Business Process Framework for TSMO
		Change Orders		^ TSMO Training ^ Basic Level Safety Training
		Complete and Document Project		^ HSIP Project Evaluation (NHI) ^ HSM Vol. 1 (Part B) Chapter 9, Module 11 - Safety Effectiveness Evaluation ^ Reliability of Safety Management Methods in Safety Effectiveness Evaluation guide (FHWA)
		Public Relations		^ Communication Strategies for Bridge Preservation (NHI)
Optimize System Performance and Efficiency	**Evaluation**	Operational and Safety Assessments		^ HSIP Improvement Program Project Evaluation (NHI)
		Crash Evaluations		^ RSA Training
		Crash Diagramming		^ Application of CMFs ^ Intersection Safety Course (NHI) ^ Crash Investigation 1 (NUCPS) ^ Crash Investigation 2 (NUCPS) ^ Traffic Crash Reconstruction-Vehicle Dynamics (NUPCS)
		Crash and Non-Crash Studies		^ FHWA HSIP Self-Assessment Guide

		Crash Investigation & Reconstruction		^ Traffic Crash Reconstruction 1 (NUCPS) ^ Traffic Crash Reconstruction 2 (NUCPS)
		CMF Use		^ Application of CMFs
		SPF Use		^ Data Driven Safety Analysis Webinar material ^ CMF Clearinghouse-How to develop and use SPFs ^ NCHRP 20-7 (332) User's Guide to Develop HSM SPF Calibration Factors ^ NCHRP 17-38 (spreadsheets to apply to SPFs - HSM training)
Operate Facilities and Monitor Performance	**Performance Measures**	Performance management and measures		^ HSIP Project Evaluation (NHI) ^ Let's Talk Performance: Safety Target Setting and Coordination Webinar (FHWA) ^ Transportation Performance Management for Safety (NHI) ^ Target Setting Resources (FHWA)
		Program Assessment		^ HSIP Manual
		Project Studies		^ Application of CMFs

		Market Safety		^ Communication Skills for the Highway Safety Professional (TSI) ^ Highway Safety Manual-Online Overview (NHI)
Leverage and manage existing and new data	**Research**	Safety Research		^ Application of CMFs ^ DDSA Training ^ Development of SPF (already listed in earlier sections) ^ Traffic Safety Culture
		CMF Development		^ Application of CMFs
		SPF Development		^ Calibration courses
	Update Process	Review and modify safety processes and procedures		^ FHWA HSIP Self-assessment Guide
		Modify CMFs and SPFs		^ Development of CMFs ^ Development of SPFs
		Review and modify, as needed, safety programs and strategies		^ Don't exist

Legend


Basic - know about
Moderate - understand
Advanced - Implement
Briefing