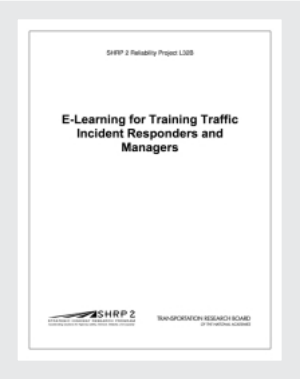

E-Learning for Training Traffic Incident Responders and Managers

DETAILS

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SHRP 2 Reliability Project L32B

E-Learning for Training Traffic Incident Responders and Managers

SHRP 2
STRATEGIC HIGHWAY RESEARCH PROGRAM
Accelerating solutions for highway safety, renewal, reliability, and capacity

TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES

SHRP 2 Reliability Project L32B

E-Learning for Training Traffic Incident Responders and Managers

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Executive Summary

The second Strategic Highway Research Program's (SHRP 2's) Reliability Project L32B, e-Learning for Training Traffic Incident Responders and Managers, was designed to establish the foundation for and promote certification of responders to achieve the three objectives of the Traffic Incident Management (TIM) National Unified Goal (NUG). The purpose of the project was to develop and implement an e-learning system that was primarily an electronic version of the classroom training curriculum material previously developed in the L12 project and further refined in project L32A. The overall focus of the training is to motivate different stakeholder groups—law enforcement, fire and rescue, emergency medical services (EMS), transportation agencies, towing and recovery, and notification and dispatch—to acquire a common set of core competencies to promote a shared understanding of the requirements for achieving the safety of responders and motorists, quick response, and effective communications at traffic incident scenes.

Through this project, this classroom curriculum was transformed into a complete interactive e-learning training course. The existing classroom curriculum was broken down into modules consisting of two to three lessons each. To meet the needs of the stakeholders, each of the lessons was designed to take no longer than 10 to 15 minutes to complete. The intention was for the target audience to be able to complete an individual lesson during roll call or during a break. The entire course was not intended to be completed all at once, but instead taken in small segments over several days or weeks.

The project consisted of three phases:

Phase A: Transforming the Original Classroom Curriculum into an Interactive e-Learning Format;
Phase B: Development of Performance Support Tools; and
Phase C: Development of an Additional e-Learning Module Specifically for Dispatchers.

The final e-learning course, which includes the additional module for dispatchers, will be delivered to the target audience through the National Highway Institute (NHI) and its web-based training program. NHI will market, deliver, and maintain the course in cooperation with the Federal Highway Administration's (FHWA's) Office of Operations. The performance support tools developed will be available through the FHWA's Office of Operations website as well as a resource through the e-learning course.

The research team made suggestions for the development of additional training modules geared toward specific target audiences and a virtual "tabletop" training simulation module.

CHAPTER 1
Background

Problem Statement

The L12 TIM train-the-trainer program is a product of the SHRP 2 Reliability Research Project. The training program consists of state-of-the-art TIM training and course curriculum material and is geared to meet critical training needs of traffic incident responders and managers from many disciplines. Based on the results from the core research on the L12 projects, the L32B e-Learning for Training Traffic Incident Responders and Managers was recommended.

The research team was previously familiar with the subject matter of the L12 training, specifically incident and emergency management, safety, standards development, and traffic management. This knowledge and experience proved invaluable in terms of understanding what the SHRP 2 was looking for, reviewing the pertinent literature, studying the comparable training programs, and reviewing and testing the e-learning system at all points in the development process.

Objective

The objective of this project was to develop and implement an e-learning training course that was primarily an electronic interactive version of the classroom training course curriculum material previously developed in the L12 project and further refined in project L32A.

CHAPTER 2
Research Approach

Introduction

The research team's approach to the research on this project was based on the ADDIE model of instructional systems design and program development. ADDIE is an acronym that stands for Analysis, Design, Development, Implementation, and Evaluation. It is possibly the best-known instructional design model providing a solid framework for designing e-learning environments. Consistency is a crucial concern whether developing a single course or a set of courses. This approach ensures both consistency and repeatability of the e-learning solution.

Course development as envisioned by the research team follows the five steps of the ADDIE model as illustrated in Figure 2.1. The research team integrated the phases of this process within the tasks and subtasks defined in its proposal. Detailed information about the ADDIE model is included in Appendix A.

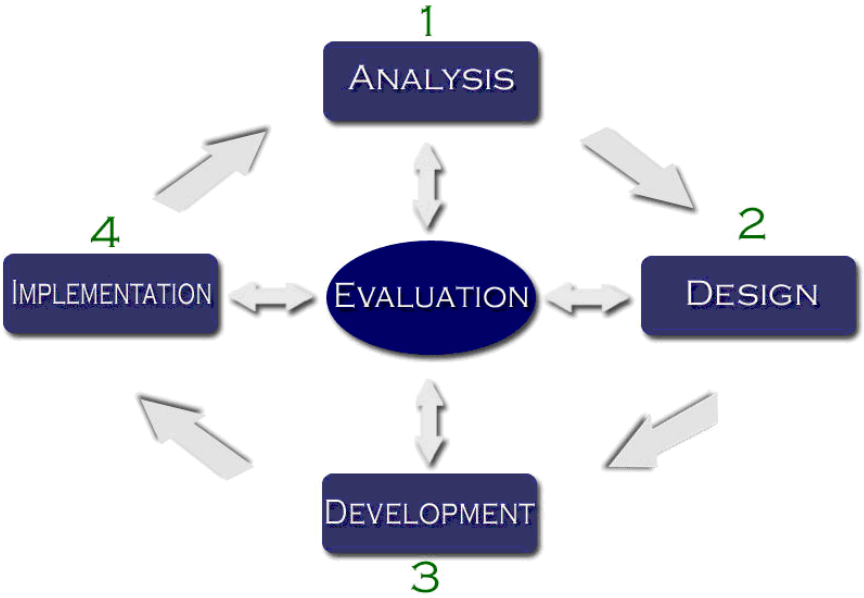

Figure 2.1. ADDIE model.

The research team's instructional philosophy is based on the theory that there are three basic methods of learning: passive, inactive ("by the way" or demonstration), and active ("by doing"). Each phase of the model is described briefly below.

Analysis Phase of the ADDIE Model

The first step of the course development process is the analysis phase of the ADDIE model. During this phase, the research team examined three areas, virtually in parallel: the audience, the

task, and the environment. As instructional designers of a learner-centered course, the research team began by assessing:

- **The Audience**: This phase of the project focused on evaluating the learners' needs, assessing how to fill the gap between the current level of knowledge and the knowledge to be mastered, and determining the limits (if any) of the learning environment.
- **The Task**: The subject matter to be mastered was analyzed carefully to determine the most effective way to adapt the course material to an e-learning format to best meet the needs of the audience.
- **The Environment**: Any physical and/or technical constraints bearing on the learner's environment were considered, such as bandwidth, user access, or audio equipment.

A thorough analysis of these three broad areas allowed the research team to plan the e-learning system/course development process with accuracy and formulate a sound project plan.

Design Phase of the ADDIE Model

During the design phase, the research team specified the treatment of the course content, practice, and assessment activities as follows:

- Developed a set of instructional strategies to ensure knowledge acquisition/retention;
- Developed an array of assessment tools utilized to test the knowledge gained and elicit further knowledge;
- Outlined and developed exercises or simulations that served as hands-on practice tools; and
- Incorporated resources for added instructional value.

Development Phase of the ADDIE Model

During the development phase of the ADDIE model, the instructional designers fleshed out the course by applying the instructional strategies and developed the interactive elements determined in the design phase.

Implementation and Evaluation Phases

There is a great deal of back and forth during the implementation and evaluation phases. Once the course was developed, it was imperative that the project stakeholders [SHRP 2, Technical Expert Task Group (TETG), FHWA, NHI] review the materials before finalizing them for the pilot. This process took several iterations before the implementation phase could begin. Once implementation began, it was also imperative to continue the evaluation process.

CHAPTER 3
Findings and Applications

Phase A: Transforming the Original Classroom Content into an Interactive e-Learning Format

Coordination with L32 TETG and L32A and L32C Project Contractors

The research team coordinated with a large group of stakeholders for this project. They included the SHRP 2 L12 project team, the L32A project team, the SHRP 2 L32C project team, SHRP 2 staff, the L32 Technical Expert Group (TEG), FHWA, and NHI.

To become intimately familiar with the content, learning environment, and audience for the course, members of the L32B project design team attended one of the L32A train-the-trainer in-person courses. The research team also coordinated with the L32A National TIM train-the-trainer project to ensure that the web-based e-learning tool was thoroughly consistent with the L32A course curriculum and material, thus meeting the critical needs of multidisciplinary traffic incident responders.

The research team worked with the L32C project team to ensure that they were able to utilize the Post-Course Assessment Tool to ensure consistency and to allow agencies to assess the effectiveness of lessons learned from L32A and L32B.

Literature Review

A review of the current literature on the topic of using e-learning to train incident and emergency responders and managers in TIM confirmed the need for cross-discipline, standardized training that is widely available across the nation.
Literature was reviewed from the following organizations:

- SHRP 2 Reliability Research;
- U.S. Fire Administration's Traffic Incident Management Systems (TIMS);
- National Traffic Incident Management Coalition (NTIMC);
- International Association of Fire Fighters (IAFF);
- I-95 Corridor Coalition;
- Ohio DOT Quick Clear; and
- Towing and Recovery Association of America (TRAA).

There are many examples of TIM training within specific disciplines, but very few across disciplines. In addition, there are no training efforts existing or in development that match the depth and scope of the SHRP 2 traffic incident responders and managers training. The individual literature and training programs that are currently available are summarized in Appendix B.

A review of literature on the topic of incident responder training showed the core competencies and the approach of the SHRP 2 National Traffic Incident Management Responder Training curriculum to be both accurate and appropriate.

Other Pertinent e-Learning Systems

The research team developed a comparison matrix of selected TIM programs with their corresponding applications, tools, audiences, and resources. By comparing previous efforts to provide quality TIM training, the research team sought to benefit from lessons learned on these projects. In addition, the research team examined emerging tools and techniques for effective e-learning.

Each training program was evaluated in terms of its management of events, content, assessment tools, learning environment, mobile apps (if any), social learning (if any), type of registration, security level, accessibility (508 compliance), e-mail notifications, and system specifications. In addition, an attempt was made to determine whether or not they met the perceived expectations of the stakeholders and the long-term viability of these tools and applications.

A review of e-learning programs with similar topics showed that there are no existing incident responder training programs in an e-learning format with the depth and breadth of the SHRP 2 traffic incident responder training, especially in terms of its multidisciplinary focus. The programs were diverse in their range of capabilities and curricula.

The detailed comparison matrix that was developed is presented in Appendix C.

SHRP 2 Project Workshop

The research team developed, coordinated, and facilitated a workshop held on February 19, 2013, which served as a means to address several in-depth instructional and content-related topics as outlined below:

- Discussed the findings and reports associated with Tasks 1, 2, and 3;
- Ensured that the overall objectives of the e-learning system corresponded to those of the L12 and L32A projects;
- Ensured that the specific objectives of each module in the e-learning system corresponded to those of the instructor-led modules of the L12 and L32A projects;
- Worked together to analyze and assess the primary and secondary target audiences;
- Identified e-learning tools that will best benefit specific target audiences;
- Discussed the potential of packaging learning modules to target specific audiences;
- Explored the possibility for establishing tiers or prerequisites for the learning modules;

- Presented common and suggested innovative e-learning methods for TIM training and brainstormed approaches to be included in subsequent tasks;
- Coordinated with L32C contractor regarding assessment methods/technologies to be included in the e-learning system;
- Explored potential for using social media to enhance and extend (not replace) the learning experience; and
- Discussed the possibility of incorporating mobile learning in terms of how it could make the TIM training more widely available.

The results of the meeting were as follows:

- The course will be offered for continuing education units (CEUs) or professional development hours (PDHs):
  - Must have a final exam—keep track of questions missed;
  - Must have an evaluation survey (coordinate questions with L32C); and
  - Individual login required.
- Student login
  - Must gather enough data to have a rich profile of students, but no more data than needed; and
  - Must request e-mail, discipline, agency, state, volunteer versus paid, and description of role.
- Course will be free:
  - There could be a fee-based blended version offered as optional training. The research team would need to develop the course so it can be offered as blended. (It should be noted that this option was not added as part of the project.)
- There will be a self-registration process by the students.
- The course will be designed in modules by topic. Each topic will have submodules that will be 10 to 15 minutes in length.
- Course must be accessible via desktop and laptop computers. It would be a “nice to have” if the students could access the material via a tablet. The committee recognized that flash and some other software programs are not readable on a tablet or smartphone.
- Course would incorporate discussion boards and forums but only if they encourage participation and don’t require a lot of monitoring (need to watch maintenance costs).
- Bookmarking is a must.
- Must include a downloadable workbook/study guide.

- Under the Phase B additional scope, the research team will try to develop an app that could be used as a stand-alone resource. [University of Maryland (UMD) did not develop an app; they developed other types of resources instead.]
- Want an executive summary version for senior management/executives (this was not possible).
- Course should contain feedback from L32C project as it becomes available.
- Student tracking:
    - Need to be able to determine who has taken course from particular agencies.

Develop e-Learning System Functional Requirements and Architecture

The needs assessment and analysis was completed during the project workshop, and the results were discussed above. This section will discuss the results of the in-depth analysis of learning management systems (LMSs) and the technical architecture, system software requirements, and modules.

The research team identified and analyzed a series of candidate LMSs based on the functional requirements identified by the needs assessment/analysis and technical requirements for software that were provided by the SHRP 2 project manager/FHWA. An examination of over 70 LMSs produced no candidates that were in full compliance. Many of the LMSs examined met the functional requirements from the TETG (results of the needs assessment/analysis). However, the research team determined that the full range of technical requirements for software could not be met among the pool of potential professional-grade open-source LMS applications. In addition, all hosted LMS solutions were rejected since they use proprietary codebases and do not provide source code. However, a few select LMSs stood out in the ability to meet the functional requirements determined from the needs assessment/analysis. The detailed comparison matrix that was developed is presented in Appendix D. The research team selected the top three in terms of the following features and/or criteria:

- Course authoring;
- Assessment tools;
- Learning environment;
- Mobile app availability;
- Social learning;
- Registration process;
- Security (login);
- Customer support, training;
- Sharable Content Object Reference Model (SCORM) compliance; and
- Accessibility.

The top three LMS choices based on the above-listed criteria were Moodle, Canvas, and Adobe Connect. Based on the research into the LMSs and experience in LMS tools, the research team recommended the use of Moodle. Although the research team performed an in-depth evaluation of LMSs and made a recommendation for an open-source LMS (Moodle), the decision was made to host the TIM training course on the LMS used by the NHI (Adobe Connect) since the final e-learning course would be delivered and maintained by NHI.

Develop Test Plan for e-Learning System

Since the research team did not have to set up an LMS to deliver the course, the test plan for the e-learning system was limited to testing the modules developed.

The original classroom course was broken down into nine modules consisting of two to three lessons each. Each of the lessons was intended to take 10 to 15 minutes to complete. Each module was reviewed at several stages of the development process by various stakeholders.

Table 3.1 features the development stages and review responsibilities.

Table 3.1. Development Review Stages

Development Stage	Reviewer
Research team breaks down original classroom course into modules and lessons. Research team develops storyboards detailing learning objectives, content per page including any narration, and knowledge checks.	FHWA L32A project team NHI instructional designers
Research team puts course material into Adobe Captivate.	1. Research team reviews first and makes edits. 2. The TETG and FHWA review and provide feedback. 3. Research team edits files. 4. NHI reviews and provides edits. 5. Research team finalizes course files.
Functional Testing	Completed by NHI when the modules were published into Adobe Connect.
Course Pilot	Selected reviewers take the entire course. Feedback is provided to NHI. Any major items edited by research team.

Below is a list of major items that were reviewed at each step in the development process:

- Verification that course/module content meets the needs of intended audience;
- Logical flow of course/module content;
- Ensure all links, videos, and file downloads were working properly;
- Spell check and grammar check all pages;
- Multimedia content including images were properly sized for web viewing;
- Knowledge checks were graded properly and included the correct review feedback;
- Verify that the closed captioning was working properly;
- Adherence to NHI style guidance; and
- Ensure the modules were meeting 508 compliance standards.

Build and Test the e-Learning System

As stated above, the original classroom course was broken down into nine modules consisting of two to three lessons each. Each of the lessons was intended to take 10 to 15 minutes to complete. The learning outcomes are clearly and precisely outlined at the beginning of every lesson. Interactive summaries tying these learning outcomes back to the material covered are provided at the end of each lesson. Attainment of the learning outcomes is evaluated through a combination of knowledge checks, thought-provoking exercises, and student assessments to ascertain the students' understanding and knowledge of the material presented in the lesson.

Review of the material by the stakeholders was described above (including the pilot test). Figure 3.1 shows a screenshot of one of the pages in the course.

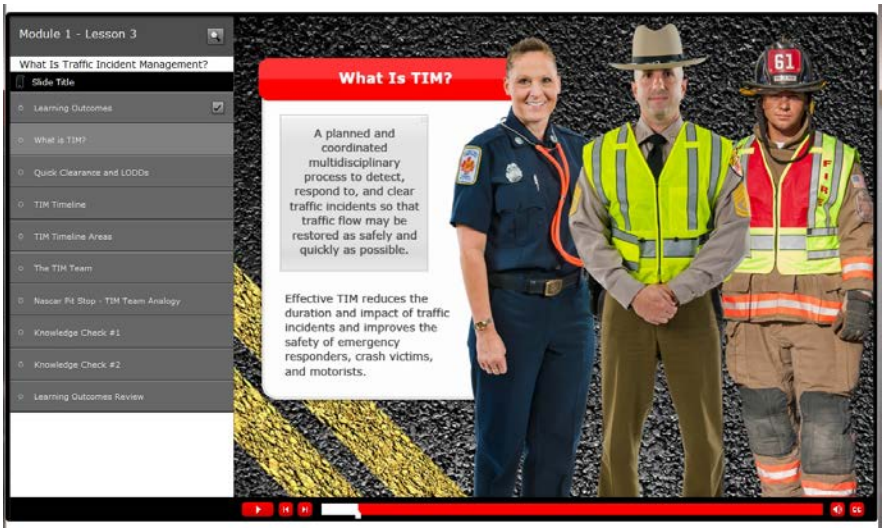

Figure 3.1. Sample course page.

The NHI piloted the completed e-learning course the week of May 19–23, 2014. A total of 42 individuals, representing all target audiences, were sent information to review the course. Out of that number, 19 registered for the course, and a total of 12 submitted feedback on the course. The research team edited the course based on the feedback received. Following the pilot, the course was made available free of charge through NHI's web-based training program. NHI will continue to market, deliver, and maintain the course in cooperation with the FHWA's Office of Operations.

Revise, Operate, and Maintain

This task was originally set up to have the research team provide a variety of services once the course was completed and was being offered to the target audience. These activities included:

- Making any corrections/revisions to the system based on information provided by the testing team;
- Providing student and instructor support for the LMS as needed;
- Making editorial and functional content changes as necessary; and
- Assisting L32C project team with assessment tool evaluation and implementation as necessary.

Since the NHI will be delivering and maintaining the completed course instead of the research team, the only item under this task that was conducted by the research team was the first bullet.

Final Report

The final report was submitted to the TETG as required.

Phase B: Development of Performance Support Tools

UMD developed performance support tools to enhance the learning experience for the target audience. This type of segmented, targeted learning provides a flexible and efficient tool for in-service or on-the-job training.

A description of the performance support tools developed is detailed in Table 3.2.

Table 3.2. Performance Support Tools

Performance Support Tool	Description
Small Videos on Vehicle Positioning	The small videos were created and embedded into the TIM e-learning course to enhance the learning experience by utilizing animation to depict various vehicle positioning maneuvers. The short clips demonstrate how a first responder would initiate linear, angle, lane plus 1, opposite direction, and ambulance vehicle positioning to provide a level of safety from passing motorists for responders and others at the scene of an incident.
Large Video on Vehicle Positioning	This video was assembled from the short vehicle positioning animated video clips and is narrated by a fire department official. The intent of this video is to stress the importance of safety, which is realized by proper vehicle positioning by the first arriving responders in preventing errant vehicles from entering into an incident scene. This video is made to be short enough in length to be delivered at safety briefings or roll calls for all agencies, both public and private, which respond to roadway incidents.
D Driver Scribble Video	“D Drivers” is a term that has been coined for drivers who are drunk, drugged, drowsy, distracted, or just plain dangerous. These types of drivers are a hazard on the roadways and are one of the worst dangers to responders working an incident along a roadway. This video is meant to be delivered to responders from all disciplines as a reminder to always keep an eye on traffic and use caution when working in or around moving vehicles.

Taper Video	This video was created to demonstrate to responders the proper, safe way to deploy traffic cones when setting up a taper to further protect the incident scene. This video has been inserted into the training curriculum and is also constructed to be a stand-alone video for display to all responder disciplines as a training and awareness tool.
Converted Tabletop Exercise	In the classroom version of the training, tabletop exercises are conducted using matchbox-scale vehicles to demonstrate how various disciplines position their vehicles at the scene of a roadway incident. This could not be done for the e-learning course, so the research team instead developed an animated tabletop exercise as an addition to the training course. It allows students to experience a hands-on exercise in positioning response vehicles at the scene of an incident to demonstrate what they have learned in the e-learning course. This tool begins with a scenario of the incident scene and description of the order in which the response vehicles will arrive. The student moves response vehicles one by one to the appropriate locations and then places them in the proper position (angled versus linear). The student is allowed two tries with each vehicle before it is automatically placed.

Phase C: Development of an Additional e-Learning Module for Dispatchers

The FHWA Office of Operations provided content for an additional module for dispatchers. The module was developed into three lessons and added as Module 10 to the e-learning course. The research team developed additional content to the material provided, which was not the case for the other nine modules of the course. The same stakeholders reviewed the dispatcher module as the other modules.

CHAPTER 4
Conclusions and Suggested Research

Conclusions

Through this project, the existing classroom curriculum for training traffic incident responders and managers was transformed into an interactive e-learning training course. The completed e-learning course meets the overall focus of the training to motivate different stakeholder groups—law enforcement, fire and rescue, EMS, transportation agencies, towing and recovery, and notification and dispatch—to acquire a common set of core competencies to promote a shared understanding of the requirements for achieving the safety of responders and motorists, quick response, and effective communications at traffic incident scenes.

The project consisted of three phases:

Phase A: Transforming the Original Classroom Curriculum into an Interactive e-Learning Format;
Phase B: Development of Performance Support Tools; and
Phase C: Development of an Additional e-Learning Module Specifically for Dispatchers.

The final e-learning course, which includes the additional module for dispatchers, will be delivered to the target audience through the NHI and its web-based training program. NHI will market, deliver, and maintain the course in cooperation with the FHWA's Office of Operations. The performance support tools developed will be available through the FHWA's Office of Operations website as well as a resource through the e-learning course.

Suggested Research

Additional Modules

The research team suggests that in-depth research be conducted to develop methods and technologies to improve incident response and safety for each primary discipline. Research also should be conducted as to the possibility of developing other modules that are targeted specifically to other segments of the primary audience such as

- Accident investigators, reconstructionists;
- Hazmat/environmental response teams;
- Roadway service patrols;
- Public works personnel; and
- Towing and recovery personnel, supervisors.

In addition, similar “mini-modules” could easily be developed for members of the secondary audience of the TIM training course including

- Coroners/medical examiners;
- Municipal government: mayors; city, town, or village officials; city managers; traffic engineers;
- New media: television, radio, traffic reporting organizations; and
- Federal agencies: National Transportation Safety Board (NTSB), Environmental Protection Agency (EPA).

The research team suggests that the information contained in these mini-modules be developed at an introductory, more general level.

Tabletop Simulation

The research team has developed online exercises based on the group tabletop exercises that take place in the in-person TIM workshop. Neither funding nor time allowed for the complex development required for a true virtual incident management training module. The research team strongly suggests that research be conducted into developing a virtual tabletop training simulation module.

APPENDIX A
ADDIE Instructional Design Methodology

Consistency is a crucial concern whether developing a single course or a set of courses. The team's approach to instructional design follows the widely used Instructional Systems Design (ISD) method, based on the ADDIE model of program development. This approach is a prevalent model in distance learning theory and ensures both consistency and repeatability of the e-learning solution. ADDIE is an acronym that stands for **A**nalysis, **D**esign, **D**evelopment, **I**mplementation, and **E**valuation.

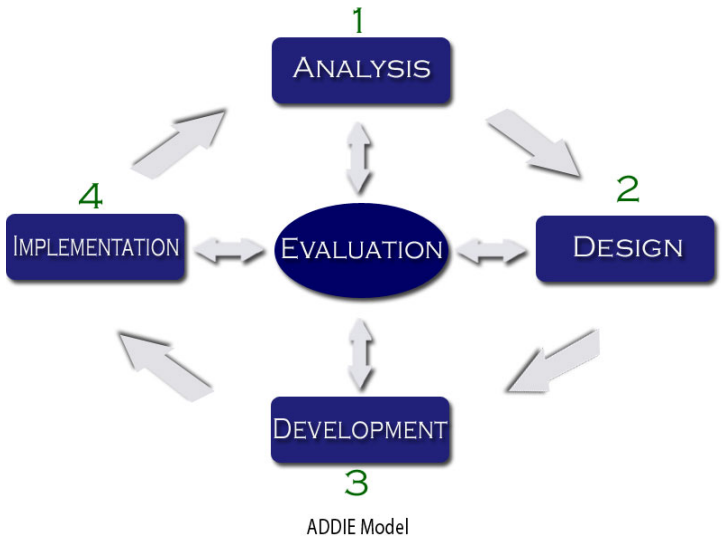

Figure A.1. ADDIE Model

Course development as envisioned by the University of Maryland (UMD) follows the five model steps as described below:

Analysis

In this phase of the development process, there are three areas to examine in parallel: the audience, the task, and the environment.

As instructional designers of a learner-centered course, the team will begin by assessing the following:

- What are the user's existing knowledge and skills?
- What is the level of knowledge or skills to be mastered?
- What is the most effective way to adapt the course material to e-learning?

- What, if any, are the technical constraints bearing on the user's environment? For example, there may be issues associated with bandwidth or user access to audio sound cards and headsets.

Thus, this phase of the project will be focused on evaluating the users' needs, assessing how to fill the gap between the current level of knowledge and the knowledge to be mastered, and determining the limits (if any) of the learning environment.

Design

Fundamental Elements of the Design

The design phase of the ADDIE model essentially involves planning what the course should look like when it is complete.

Using the course learning objectives as a starting point, UMD's instructional designers establish the cornerstones of the course:

- Most effective way in which the interactive electronic medium environment can serve the instructional objectives and activities of the curriculum;
- Organization of the instructional material (outline modules and lessons);
- Selection of a set of instructional strategies to ensure knowledge acquisition/retention;
- Array of assessment tools to be utilized to test the knowledge gained and elicit further knowledge;
- Selection of formats for the exercises or simulations that will serve as hands-on practice tools; and
- Investigation of resources to be brought in for added instructional value to the course.

Selection of Instructional Theories

A variety of instructional strategies are used in UMD's Consortium for ITS Training and Education (CITE) courses. The particular strategy applied depends greatly on the content it addresses and on the educational objectives for that content. UMD instructional strategies draw from the three major learning theories briefly described below:

- **Behaviorist theory** emphasizes the importance of the external environment as the principal factor in learning behavior. Individuals learn when given the appropriate blend of stimuli and rewards. Behaviorist instructional strategies include repetition; small, concrete tasks; consistency; and immediate or intermittent reinforcement.
- **Cognitivist theory** starts with the premise that good teaching techniques have an impact on the way in which the brain processes and stores information. For instance, lower-level facts must be known before higher-level concepts are taught. Cognitivist strategies include specifying clear objectives, advanced organizers, displaying the contents with distinctive features, asking the learner for additional performance, and providing varied and interactive practice.

- **Constructivist theory** assumes that learners are responsible for their learning. Learning is seen as an active, social, and contextual process. Constructivist strategies include hands-on involvement, collaborative learning, problem-based learning, and modeling.

Evaluation of the Design Phase

Evaluation is part of the standard quality assurance process put into practice throughout course development. In this phase of the ISD process, UMD evaluates to ensure that the results of the original analysis are still accurate and that the design facilitates successful learning outcomes.

Output of the Design Phase

The output of this phase will be a program design document (three hard copies) describing all aspects of the course contents, practice, and assessment activities through the following:

- Detailed outline of the course contents;
- Set of instructional strategies used;
- Media treatment for each screen;
- Broad characteristics of the user interface and navigational tools;
- Flow diagrams illustrating the functions of the application;
- Characteristics of student log-in and tracking processes; and
- Testing/quality assurance at various points of course development.

Development

The development phase entails the actual production of learning materials based on their conception during the prior design phase. In other words, the designer fleshes out the canvas created in the design phase and constructs a detailed "blueprint" of the presentation on a screen-by-screen basis.

The activities that take place during this phase are extensive:

- Application of the instructional strategies most effective to accomplish specific educational objectives—particularly as they apply to the design of interactions and assessment screens;
- Determination of the appropriate interactions to elicit interest and knowledge-seeking behavior in as creative a manner as possible;
- Creation of the required media; and
- Evaluation of the develop phase.

These activities are described in further detail below.

Application of the Instructional Strategies

UMD instructional strategies use a variety of elements drawn from the behaviorist, cognitive, and constructivist theories. These elements are listed below.

Learning Theory	Instructional Strategies
Behaviorist Theory	• Instructional cues to elicit correct response • Practice paired with target stimuli • Reinforcement for correct responses • Multiple opportunities/trials (drill and practice) • Discrimination (recalling facts) • Generalization (defining and illustrating concepts) • Association (applying explanations) • Chaining (automatically performing a specified procedure)
Cognitivist Theory	• Explanation • Illustrative example • Demonstration • Matched nonexample • Corrective feedback • Outlining • Mnemonics • Information chunking • Repetition • Concept mapping (a technique for visually representing the structure of information) • Advanced organizer (preview of content; overview) • Analogy • Summary • Dual coding (presenting illustrations in text) • Interactivity • Synthesis • Generative learning (active integration of new ideas with the learner's existing knowledge) • Organizational strategy • Links to prior knowledge
Constructivist Theory	• Modeling • Coaching • Authentic learning (learners construct their own understanding and apply it to complex real-world problems) • Collaborative learning (workshops; group work; discussion forum) • Object-based learning (allow for hands-on or experience-based learning opportunities; workshops; field visits) • Anchored instruction (placing learning within a meaningful, problem-solving context; case study) • Problem-based learning (learning centered around a problem) • Cognitive flexibility hypertext (fosters development of knowledge-transfer skills by presenting learners with multiple representations of case events)

The strategies used by UMD are selected based on the material to be learned.

Creation of the Required Media

Online courses are heavily dependent on the authoring tools and delivery environment. UMD's development team is well acquainted with multimedia development software. UMD uses various multimedia development tools such as Adobe Flash, Captivate, Photoshop, Fireworks, QuickTime, muvee autoProducer, and so forth, to produce appropriate, innovative, and creative screens.

Evaluation of the Development Phase

Evaluation is part of the standard quality assurance process put into practice throughout course development. In this phase, UMD will ensure that the developed storyboards fully reflect the design and that the development process is still consistent with the program goals and objectives.

Output of the Development Phase

The output of this phase will consist of the following deliverables:

- A detailed description of the user interface (navigation scheme, colors and screen conventions, menu and link styles);
- Six sets of storyboards (five hard-copy, one electronic) providing a thorough description of each frame/screen of the course in all respects, including
    - Descriptions of graphics, animations, and photos,
    - Specifics of video segments,
    - Exhaustive programming notes, and
    - Transcription of all narration;
- A prototype version of the online course(s) (contingent upon approval of the storyboards);
- A beta version of the online course(s) (contingent upon approval of the draft version); and
- Corrections/modifications to the online course(s).

Implementation

The implementation phase involves the delivery or distribution of material to the student group. At this point, UMD deploys a pilot offering of the course to be taken by pilot students, to be followed by the definitive version of the course upon completion of all necessary modifications. The activities included in this phase are the following:

- Establishing the timetable for the course rollout;
- Ensuring the availability of Internet access to the online course (pilot and definitive versions); and
- Distribution of Installation and User's Guide to be printed and distributed with the program. The guide will include the program's goals and objectives, topics covered/outline installation instructions, hardware requirements, administrative and tracking features, and troubleshooting tips.

Evaluation

As mentioned previously, evaluation occurs at a number of points in the development process. In fact, each previous phase of the ISD process includes a review checkpoint to ensure the results of the original analysis are still accurate, the design is still appropriate, and the development process is still consistent with the program goals and objectives.

After delivery, the effectiveness of the training materials is evaluated through testing and surveying. The final evaluation phase uses the data gathered from the pilot offering. Pilot students complete an end-of-course assessment (graded final exam) in which attainment of the learning outcomes is measured through the users' grades.

Additionally, pilot students complete an end-of-course evaluation. The data address many aspects of the course design and content in an attempt to answer these broad but essential questions:

- Did the users like the course?
- Did the users achieve the learning objectives at the end of the course?
- Did the users change their behaviors in the workplace?
- Will the knowledge gained have an impact on the users' careers?
- Sample course evaluation questions appear in Figure A.2.

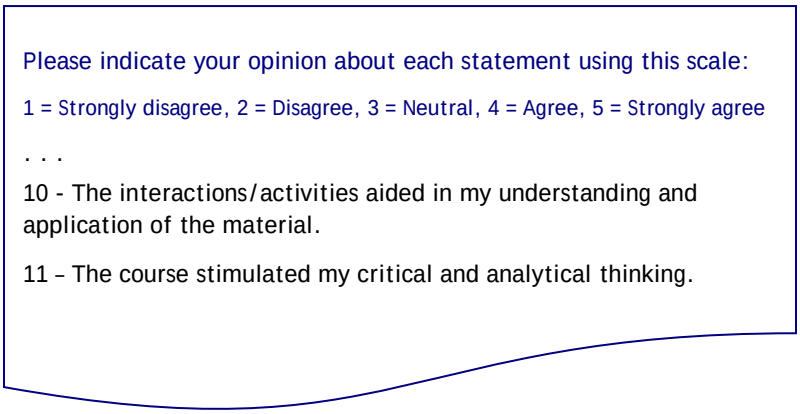

Figure A.2. Sample evaluation questions.

APPENDIX B
Literature Review

The individual literature and training programs that are currently available are summarized below.

The U.S. Fire Administration's Traffic Incident Management Systems (TIMS) (April 2008)

The U.S. Fire Administration (USFA) is an entity of the Federal Emergency Management Agency (FEMA), whose mission is to reduce life and economic losses due to fire and related emergencies. The USFA worked in cooperation with the Cumberland Valley Volunteer Fireman's Association (CVVFA) and its Emergency Responder Safety Institute (ERSI) to identify methods to protect emergency responders who are operating at roadway incidents.

In partnership with the U.S. Department of Transportation (U.S. DOT), USFA initiated the Emergency Vehicle Safety Initiative in 2002. The initiative identified the major issues related to firefighter fatalities that occur while operating on roadway emergency scenes and developed and obtained consensus among major national-level fire and emergency service trade associations on draft best practices, guidelines, mitigation techniques, and technologies to reduce roadway scene fatalities. The results were published in *Emergency Vehicle Safety Initiative* (August 2004). The report identified several recommendations to improve safety related to response and highway operations.

The USFA developed the Emergency Vehicle Safe Operations for Volunteer and Small Combination Emergency Service Organization Program. This web-based educational program included an emergency vehicle safety best practice self-assessment, standard operating guideline examples, and behavioral motivation techniques. The USFA developed a similar web- and computer-based training and educational program, Improving Apparatus Response and Roadway Operations Safety in the Career Fire Service. This program discussed critical emergency vehicle safety issues such as roadway operations safety on crowded interstates and local roads.

The original edition of the *Traffic Incident Management Systems* (TIMS) report was released in 2008. The 2011 latest edition of TIMS was developed in response to the release of the 2009 edition of the *Manual of Uniform Traffic Control Devices* (MUTCD), which included updated content. The current edition of TIMS offers a comprehensive document, which cites Incident Case Studies and chapters including Equipment to Improve Highway Safety, Setting Up Safe Traffic Incident Management Areas, and Preincident Planning and Incident Command for Roadway Incidents, as well as Best Practices and Other Sources of Information for Effective Highway Incident Operations.

A review of the content of the TIMS publication found the guidelines and procedures to be consistent with the core competencies outlined in the SHRP 2 L32A train-the-trainer instruction.

http://www.usfa.fema.gov/downloads/pdf/publications/tims_0408.pdf

National Traffic Incident Management Coalition (NTIMC) (2004)

The National Traffic Incident Management Coalition (NTIMC) is a coalition launched in 2004 to promote the safe and efficient management of traffic incidents. The vision of NTIMC is the safe and efficient management of all incidents that occur on the nation's roadways. The mission is to provide multidisciplinary partnership forum spanning public safety and transportation communities to enhance safety for responders and motorists and to reduce incident delays. Through NTIMC, public safety and transportation organizations join together to advocate for policies to promote responder safety (such as move-over laws) and to promote and improve safety procedures and safety training of responders.

One of the partnership initiatives to increase responder safety and reduce traffic congestion was the development of the National Unified Goal (NUG). The NUG is a unified national policy developed by major national transportation and other public safety organizations representing traffic incident responders. The NUG will encourage state and local transportation and public safety agencies to adopt multidisciplinary policies, procedures, and practices. The NUG is organized around three themes of broad common concerns: responder safety; safe, quick clearance; and prompt, reliable incident communications. The NTIMC also issued several publications, one of which is the *Benefits of Traffic Incident Management*. The publication lists the benefits of TIM such as economic savings, secondary crash reductions, and increased responder safety by stakeholder groups such as firefighters, law enforcement, and transportation agencies as well as other agencies that respond to roadway incidents, and highway users.

A review of the content of the NUG found the guidelines and procedures to be consistent with the core competencies outlined in the SHRP 2 L32A train-the-trainer instruction.
http://ntimc.transportation.org/Pages/default.aspx

International Association of Fire Fighters (IAFF)

The IAFF was formed in 1918 to unite firefighters for better wages, improved safety, and greater service for their communities. The IAFF represents more than 300,000 full-time professional firefighters and paramedics. IAFF history is a legacy of safety achievement and has become the voice of the firefighter.

The IAFF encourages its members to continuously build their skills and knowledge in their roles as firefighters, paramedics, and union leaders. Members have access to IAFF education and training opportunities on a wide array of topics from their online learning resource as well as information about hands-on training, classroom education, self-paced study, and instructional conferences.

One of the training publications is *Best Practices for Emergency Vehicle and Roadway Operations Safety in the Emergency Services*. The publication was developed in cooperation with the Department of Homeland Security and the USFA. It focuses on the hazards faced by law enforcement officers and firefighters while operating at or around the scene of roadway incidents. The publication covers numerous case studies, organizational and personal

responsibilities, emergency vehicle lighting and markings, and roadway scene safety.

A review of the content of the IAFF training publication found the guidelines and procedures to be consistent with the core competencies outlined in the SHRP 2 L32A train-the-trainer instruction. http://www.iaff.org/

I-95 Corridor Coalition

The I-95 Corridor Coalition is a partnership of 16 states from Maine to Florida. The Coalition provides a forum for key decision and policy makers to address transportation management and operations issues of common interest. This volunteer, consensus-driven multiagency organization enables its member agencies to work together to improve transportation system performance.

The Coalition offers numerous traffic incident related studies and training programs. Some of the Coalition's feature products are the Quick Clearance Toolkit and Responder Workshops, which provide guidance for implementing and enhancing quick clearance practices. Another is the 3-D Virtual Incident Management Training for First Responders. The 3-D training is an intensive program that uses three-dimensional, multiplayer computer gaming simulation technology to test, validate, and reinforce TIM best practices. To accompany the virtual training, the Coalition offers the Quick Clearance Core Competencies Online Training that focuses on the Coalition's Quick Clearance principles for roadway incidents.

The Coalition has developed the *Traffic Incident Management Teams Best Practice Report*, which identifies and describes best practices regarding incident management team programs, including communications, response, safety, incident command, and towing. From this report, *How to Establish Traffic Incident Management Teams Pocket Guide* was developed.

A review of the content of the I-95 Coalition training publications found the guidelines and procedures to be consistent with the core competencies outlined in the SHRP 2 L32A train-the-trainer instruction.

www.i95coalition.org

Ohio DOT QuickClear

The QuickClear program is outlined as a way for multiple agencies [transportation, law enforcement, fire, emergency medical services (EMS), etc.] to coordinate their individual efforts at an incident scene to effectively provide the public and rescue personnel with as safe an environment as possible while rescue work is ongoing. The goal of QuickClear is to keep traffic flowing as normally as possible while reducing the instances of injury to the public or rescue personnel as well as additional property damage at incident scenes from secondary crashes or collisions.

A review of the content of the QuickClear program publications found the guidelines and procedures to be consistent with the core competencies outlined in the SHRP 2 L32A train-the-trainer instruction.

http://www.dot.state.oh.us/Divisions/Operations/EmergencyOperations/Ohioquickclear/Pages/default.aspx

Towing and Recovery Association of America

The Towing and Recovery Association of America (TRAA) was founded in 1979 and is the umbrella trade group and national voice of the towing and recovery industry in the United States. TRAA works to improve the towing industry with legislation, education, and communication. TRAA offers training with the TIM Training Program for Entry-Level Towers. This training course covers What Is a Traffic Incident? Who Are Emergency Responders, and Who Is in Charge at the Scene? The PowerPoint presentation CD written by TRAA also covers What Are Towing and Recovery Responsibilities? and What Should Towers Do When Arriving at the Scene? The training offers comprehensive information to educate entry-level towers on TIM. To accompany the training, TRAA developed a Vehicle Identification Quick Reference Guide card in a vehicle visor format, which is a guide giving useful information to law enforcement, towers, and dispatchers on the class of vehicle based on weight and the corresponding type of recovery vehicle that is needed. This visor card is intended to increase standardized communication and accurate vehicle and incident information, which will ensure quick and efficient clearing of incident scenes. TRAA also offers the National Drivers Certification Program and a roadside safety DVD (Everyone Goes Home) and an approved apparel DVD (Dress for Success).

A review of the content of the TRAA materials found the guidelines and procedures to be consistent with the core competencies outlined in the SHRP 2 L32A train-the-trainer instruction. http://traaonline.com/

TRAA Vehicle Identification Guide (2009)

This reference guide is a two-sided card developed by the TRAA to educate first-responder agencies, as well as their dispatchers, on information the towing industry needs in responding to and clearing incidents involving vehicles in a more efficient manner. The front of the card lists eight types of vehicle classes with a silhouette of each vehicle type shown in each class. The classes range from a car or minivan as a Class 1 to tractor trailer or over-the-road bus as a Class 8. Each class of vehicles also corresponds to a weight classification listed in gross vehicle weight in pounds and the class of tow truck to request. There is also a list of information that towing companies need when receiving a call for their services that a dispatcher could use as a checklist when receiving information from the field.

The flip side of the card shows a silhouette of each kind of tow truck in its respective category, which corresponds to the other side of the card to assist responders in asking in correct terms which type of tow truck they may need. This side of the card also shows which part of the vehicle identification number identifies the year of the vehicle, which is a critical piece of information for the tower in determining the correct towing procedures for that type of vehicle.

A review of the content of the TRAA *Vehicle Identification Guide* found the guidelines and procedures to be consistent with the core competencies outlined in the SHRP 2 L32A train-the-trainer instruction.
http://ops.fhwa.dot.gov/publications/fhwahop10014/s5.htm

Ten Cones of Highway Safety

This 18-minute video highlights highway safety for emergency services using an actual case study and interviews with Lionville Pennsylvania Fire Company members who were on the scene of a minor motor vehicle incident when a tractor trailer went out of control and slammed into the incident scene killing one firefighter and severely injuring nine others. As in the title, "The Ten Cones of Highway Safety," each cone represents an important safety practice that pertains to every agency and individual who responds to highway incidents. These very same 10 tips also make up the basis for many safe quick clearance practices being taught today in many different programs and in many different ways.

1. There is no substitute for training.
2. Multiagency coordination and communication are a must.
3. Limit your exposure . . . limit your time.
4. Give traffic plenty of warning.
5. Protect the scene with apparatus.
6. Always work away from the traffic.
7. Be prepared to shut down the roadway.
8. Be seen and not hurt.
9. Dress for the occasion.
10. Accountability matters.

This video discusses the dangers for fire, EMS, police, and traffic control personnel when responding to highway incidents. The video discusses the numbers of rescue personnel who are injured or killed every year due to secondary incidents at or around roadway incident scenes. The video gives 10 strategies (training, multiagency coordination and communication, limited exposure at the scene, traffic warning and diversion, scene protection with apparatus, distance between traffic and rescue personnel, shutting down the roadway, visibility, safety and reflective gear, and scene accountability) to better prepare and manage incident scenes to prevent injuries or the deaths of rescue personnel.

A review of the content of the video found the guidelines and procedures to be consistent with the core competencies outlined in the SHRP 2 L32A train-the-trainer instruction.
http://www.respondersafety.com/TenCones.aspx

Your Vest Won't Stop This Bullet (2005)

This video focuses on the dangers associated with law enforcement officers making traffic stops

along local roads and highways. The video highlights through dash-cam video the many accidents that occur as officers are going through their enforcement action procedures. The National Highway Traffic Safety Administration (NHTSA) suggests a strategy of Stop Safe, which takes into account the stop location, awareness of traffic, finding an escape route away from all vehicles, and reentering traffic safely once the enforcement action is concluded. This video highlights the need for officers to be aware of the locations where they are stopping vehicles and the unpredictability of traffic around them. The NHTSA is encouraging the strategy of Stop Safe to help reduce officer injuries and deaths.

The review of the content of the video found the guidelines and procedures to be consistent with the core competencies outlined in the SHRP 2 L32A train-the-trainer instruction. http://www.floridatim.com/documents/Training/Your%20Vest%20Wont%20Stop%20This%20Bullet.wmv

The Many Hats of Highway Incident Management (2007)

This 18-minute video is a comedy spoof on the age-old question of who is in charge at the scene of a highway incident and promotes coordination, cooperation, and communication of all parties involved with highway incidents. Tom Martin, who was a lieutenant with the Virginia State Police, plays a speaker at an incident management conference in which he is leading a panel discussion of the various entities and agency representatives that respond to or feel the effects of highway incidents. As Tom introduces each speaker, he becomes that person, using various props to represent each of the disciplines and taking on their role as they explain what their role would be at the scene of an incident and why they feel they should be in charge.

Throughout the mock conference, Tom transforms and represents folks such as Pete from VDOT, the EMT, Larry the Tower, Bob the Traffic Reporter, Jerry the Fire Chief, Trooper Bad Ass, Bob the Commuter, and Gary the Congressman as they give their opinions as to why they are in charge. Tom wraps up as the moderator following the speakers. He sums up their presentations by stating that it is all about the hats that distinguish each person's role but that the important thing is not who is in charge, but who is in charge of what. Through the comedy of Tom Martin, this video sends a very valuable message, which has been very well received throughout the first-responder community, of communication, cooperation, coordination, and the importance of working together as a team. People who view this video see and remember, through the comedic delivery, how simple working together can be and, at the end of the day, when we take off our hats, that we are all just people.

A review of the content of the video found the guidelines and procedures to be consistent with the core competencies outlined in the SHRP 2 L32A train-the-trainer instruction. http://vimeo.com/29673244

Summary

A review of literature on the topic of incident responder training showed the core competencies and the approach of the SHRP 2 National Traffic Incident Management Responder Training

curriculum to be both accurate and appropriate.

The agencies and organizations that have developed their own policies, procedures, and training materials are widely varied. Each has conducted its own research and developed its own materials. As stated previously, there are a great many resources available, but all are lacking in that they are (1) not comprehensive, (2) not unified or standardized, (3) not multidisciplinary, or (4) not widely available. It is believed that the content developed under L12 and L32A, combined with the e-learning delivery mechanism of SHRP 2 L32B e-Learning for Training Traffic Incident Responders and Managers effort will address these insufficiencies. It would be beneficial to SHRP 2 Reliability Research and to the incident management community at large to take advantage of the best of these resources, incorporating them as references and/or resources as part of the National Traffic Incident Management Responder Training curriculum.

References

Best Practices in Traffic Incident Management, U.S. Department of Transportation, Federal Highway Administration, Office of Operations, September 2010 (FHWA-HOP-10-050x).

Everyone Goes Home, Towing and Recovery Association of America (TRAA).

Ohio QuickClear, Professional Responders Guide for Safe and Effective Highway Incident Management, Ohio DOT.

Proposed National Unified Goal for Traffic Incident Management: Working Together for Improved Safety, Clearance, and Communications, National Traffic Incident Management Coalition, March 2007.

Ten Cones of Highway Safety, Emergency Responder Safety Institute (ERSI), March 2008.

The Many HATS of Highway Incident Management, I-95 Corridor Coalition, November 2007.

TIM Training Program for Entry-Level Towers, Towing and Recovery Association of America (TRAA).

Vehicle Identification Guide, Towing and Recovery Association of America (TRAA).

Your Vest Won't Stop This Bullet, International Association of Chiefs of Police, 2005.

APPENDIX C
Incident Management Training Tool Comparison

A comparison matrix of selected traffic incident management (TIM) programs with their corresponding applications, tools, audiences, and resources is presented here. The benefits of lessons learned on these projects were sought by comparing previous efforts to provide quality TIM training. Each training program was evaluated in terms of its management of events, content, assessment tools, learning environment, mobile apps (if any), social learning (if any), type of registration, security level, accessibility (508 compliance), e-mail notifications, and system specifications. In addition, an attempt was made to determine whether or not they met the perceived expectations of the stakeholders and the long-term viability of these tools and applications.

A review of e-learning programs with similar topics showed that there are no existing incident responder training programs in an e-learning format with the depth and breadth of the SHRP 2 National Traffic Incident Management Responder Training, especially in terms of its multidisciplinary focus. The programs were diverse in their range of capabilities and curricula. On the leading edge was the Virginia Department of Transportation's (VDOT's) TIM training. The reviewers agreed that it was engaging and nicely presented in short segments, making it easy for presentation at roll call or during downtime.

Reviewers were pleased with the Federal Emergency Management Agency (FEMA)–based courses for the registration and the storing of the courses passed in a database showing certification at each level. Since the SHRP 2 program is striving to promote the traffic incident response management training to becoming a national certification for responders, this is a good method to follow for tracking the certifications.

The Emergency Responder Safety Institute (ERSI) courses include the ability to achieve continuing education credits upon course completion. This is a good way of enticing personnel from certain agencies to complete training courses, as they are required to obtain credits for promotions or to keep their current levels. This site also uses actual case studies, which help to add real-life situational awareness to the courses.

Consortium for ITS Training and Education (CITE) courses were also popular with reviewers due to their combination of interactivity, use of real-life case studies, award of continuing education units (CEUs), and the offering of independent study, blended learning, and certificate programs.

The detailed comparison matrix is presented on the following pages. (We suggest you magnify your screen to 150% to 200% to view the matrix.)

Incident Management Training Tool Comparison Matrix

Event Management	Course Content	Assessment Tools	Learning Environment	Mobile Apps	Social Learning	Registration	Security	Accessibility	E-mail Notifications	System Specifications	Link (if applicable)
VDOT Traffic Incident Management											
10-15 minute topic segments VDOT employees can take course through their LMS system Non VDOT employees can also access the course without passwords	Video Audio Hot buttons/hot spots/hot text Random knowledge checks Time given to complete each topic	Knowledge checks Multiple choice 2 opportunities to take final review exam Final Review must score 70% or better No pretest	Engaging to student Reference material which can be downloaded or printed VDOT LMS students can stop and restart the training where they left off Non students cannot On-line Independent study Bookmarking	Web-based VDOTs Virtural campus (LMS) May work on mobile browsers that support Flash	None	Free Self-registration	No login required	Not accessible	No	Requires Flash Player	http://www.virginiadot.org/info/TIM_Course/VDOT_CS_Interface.swf
FEMA Emergency Management Institute Professional Development											
Independent study Expected course duration indicated Interactive Web-based courses	Provides reference Web sites in text A lot of text/reading Uses Video (Flash) with captions Mostly text based without audio Independent study	Random questions Download sample final exam questions CEUs given for completion Multiple choice and true/false questions Scored final exams pass/fail @ 75%	No prerequisites 180 pages of text Structured path thru material Has accessible glossary Ungraded quiz after each module ungraded Must complete each section before leaving training or start over	Web-based Can only be used on mobile devices with Flash; not iPad No apps available	Facebook, Twitter, and YouTube Blogs	Self-paced No signup; Free Personal information entered prior to final exam	Personal information entered prior to final exam Encrypted sample test and final test questions Student information entered at end of course	508 compliant	Notified as to pass or fail grade and cerificate	Requires Flash Player	http://training.fema.gov/emiweb/pds/
FEMA Emergency Management Institute National Incident											
Self-paced; No sign-up Expected course duration indicated Interactive Web-based courses	Progress bar Uses video (flash), audio Download sample final exam questions CEUs given for completion Independent study Interactive	Final exam No pretest Scored final exams pass/fail Randomized test questions 26 questions Multiple choice and true/false questions	Self-paced Lesson summary at end of each chapter Structured path thru material Has accessible glossary Ungraded quiz after each module ungraded Must complete each section before leaving training or start over	Web-based Can only be used on mobile devices with Flash; not iPad No apps available	Facebook, Twitter, and YouTube Blogs	Free Self login Personal information entered prior to final exam	Encrypted sample test and final test questions Student information entered at end of course Personal information entered prior to final exam	508 compliant	Notified as to pass or fail grade and cerificate	Requires Flash Player	http://training.fema.gov/is/nims.asp
Florida DOT's Maintenance for Traffic Incident Management (TIM)											
8 modules Self-paced; no sign-up Interactive, Web-based courses	Voice over Powerpoint One full video - "Hats" Uses video (Flash) Flash interaction and animation Uses actual case studies Audio with closed caption	No pretest Final exam Certificate issued Student may select answers until he/she gets it right Quiz at the end not graded Multiple choice questions	Self-paced Structured path through material Video slide show moderated with closed captioning available	Web-based Can only be used on mobile devices with Flash; not iPad No apps available	None	Open Free	No login required	508 compliant	No	Requires Flash Player	http://wbt.dot.state.fl.us/ois/IMOTTIRCBT/index.htm
Responder Safety Learning Network											
3 standalone training modules: NUG/Advanced Warning/Blocking Expected course duration indicated Topic-specific	Uses in-person interviews Uses video (Flash), animations, and audio Uses actual case studies Bookmarking Approx. 30-minute segments Knowledge checks between modules	Knowledge self-checks Scored final exam Multiple choice Certificate provided	Knowledge reference section Self-paced Transcripts by student available Earn Credit hours Certificate of completion given Structured path through material	Web-based Can only be used on mobile devices with Flash; not iPad No apps available	Poll to ascertain how many folks have Apple or Android for further customization of site	Self-registration Free	Unique student password Login required	Internet based	No	Requires IE 7 or later or Firefox 3.0 or later Adobe Flash (10.0 or later or Adobe Acrobat 6.0 or later Flash and Acrobat available for download from site Computer compatibility test	learning.respondersafety.com/
Consortium for ITS Training and Education (CITE)											
Independent study Blended learning Some audio, video Interactive	Some video, audio Provides reference to web sites in text Flash animations Bookmarking Very interactive Knowledge checks within lessons	Random questions Fill in the blank, mult choice, T/F, matching Workshops Case studies Final scored exam Quiz at end of lessons Self assessments - Knowledge Checks	Some courses have prerequisites Independent study courses are self-paced; Blended study courses have a schedule Very interactive CEUs awarded Accessible glossary Downloadable study guide	Web-based Can only be used on mobile devices with Flash; not iPad No apps available	Blogs Discussion Forums RSS Feeds Wiki	Log in required Free	Unique student password	Internet based 508 compliant	Registration required	Requires IE 7 or later or Firefox 3.0 or later Requires Adobe Flash Player Requires Shockwave Player Requires Adobe Acrobat Reader	http://www.citeconsortium.org

Event Management	Course Content	Assessment Tools	Learning Environment	Mobile Apps	Social Learning	Registration	Security	Accessibility	E-mail Notifications	System Specifications	Link (if applicable)
National Highway Institute (NHI) /FHWA											
Basic-level training Web-based; classroom	Interactive Variety	Final exam No pretest	7 hours in length CEU's available	Web-based		Self login Free	No login required	Unknown	None		http://www.nhi.fhwa.dot.gov/
New Mexico Department of Public Safety Training											
Extensive curriculm Confirmations normally will be mailed, faxed, or e-mailed one week prior to the start of the class for all NMDPS courses ; Phone confirmations will be made on short notice. Not e-learning			Must meet certain criteria to take courses	Web-based		Various fees for training			Registration required		nmlea.dps.state.nm.us/wp-content/uploads/2012/08/LEA-90.pdf
International Association of Chiefs of Police (IACP) TIM Video											
Video training Office safety Topic-specific	Use actual footage Informative style Actual case studies Audio Approx. 30-minute segments Facts and figures	No exam	Allows for single viewing or classroom group viewing Short enough for roll call or shift change briefings Good for single or multiple agency viewing Available on-line Might not pass through some agencies firewalls	You Tube app for mobile devices Internet browser for mobile devices supported	Can be used in a group setting to spark discussion				None	Can be viewed on any computer or mobile device with internet access but may have some issues passing through some agencies firewalls	http://beaubienengineering.com/2012/10/iacp-tim-video/
American Association of State Highways and Transportation Offices (AASHTO) Winter Maintenance											
Courses are delivered on a CD and not online so not reviewed Log in with the ability to resume where last left off Self-paced	2D and 3D animation Animated speaking guide Audio controls Digital video Scenarios presented in simulated maintenance facility Printing of screen shots and various documents Website links Notepad	Intermittent review questions and interactive exercises Pre and post assessment Separate reporting and tracking tool for administrators Progress indicators Certificate of completion	Bookmarking Employee performance support system Fun facts Facts on demand knowledge base Glossary Hot terms	None	Mentions instructional dialog available as narration or text	None mentioned	Log in	On a disk	None	Adobe Acrobat PDF document viewer	http://scop.transportation.org/Documents/CBT_Flyer_v2b[1].pdf
US DOT Outreach Modules											
Made for an instructor in a classroom enviornment No registration	Powerpoint, HTML or PDF formats	None	Classroom with instructor	None	Classroom	None	None	Internet accessible or can be downloaded for off-line	None	Requires Acrobat Reader Microsoft power point	http://ops.fhwa.dot.gov/eto_tim_pse/timtoolbox/index.htm

APPENDIX D
LMS Evaluation

Analysis

The project team identified and analyzed a series of candidate learning management systems (LMSs) based on the functional requirements identified under Subtask 5A and technical requirements for software that were provided by the SHRP 2 project manager/Federal Highway Administration (FHWA). An examination of over 70 LMSs produced no candidates that were in full compliance. Many of the LMSs that were examined met the functional requirements from the Technical Expert Task Group (TETG). However, the project team determined that the full range of technical requirements for software could not be met among the pool of potential professional-grade open-source LMS applications. In addition, all hosted LMS solutions were rejected since they use proprietary codebases and do not provide source code. (The top three candidate LMSs appear in bold.)

Candidate LMS	Description	URL	Status	Comments
Accord LMS	ASP.NET DotNetNuke-based solution.	http://www.accordlms.com/	Rejected	Fails server requirements. Meets some NET standards but does not provide full source code or entity framework and is not written in C#.
AJ LMS	Java- and Tomcat-based LMS.	http://www.ajsquare.com/products/lms/index.php	Rejected	Fails server requirements. Not NET based.
Amvonet	Moodle-based LMS.	http://www.amvonet.com/	Rejected	Fails server requirements. PHP/MySQL based.
WebMentor LMS	Windows/ColdFusion based.	http://www.avilar.com	Rejected	Fails server requirements. ColdFusion based.
Dokeos	Well-known open-source and professional PHP–based LMS.	http://www.dokeos.com/	Rejected	Fails server requirements.
SharePoint LMS	MS SharePoint based.	http://www.sharepointlms.com	Rejected	Fails server requirements. Requires SharePoint install.
eFront LMS	Robust LMS with many useful features. PHP/Apache based.	http://www.efrontlearning.net	Rejected	Fails server requirements. PHP/Apache based.
Joomla LMS	Popular LMS built on Joomla CMS platform	http://www.joomlalms.com/	Rejected	Fails server requirements. PHP/MySQL based.
CLIX Learning Suite	Component-driven LMS.	http://www.im-c.com/australia/en/start/	Rejected	Fails server requirements. WebSphere/Java based.

Candidate LMS	Description	URL	Status	Comments
Canvas	Feature-rich LMS used by several major universities.	http://www.instructure.com/	Rejected	Fails server requirements. Runs on Ruby and requires POSIX compliance operating system.
WBT Manager	Somewhat dated but ASP.NET-based application.	http://www.ielearning.com	Rejected	Fails server requirements. Not MVC or Entity framework based.
DotNetSCORM	ASP.NET based. Project may no longer be active.	http://dotnetscorm.codeplex.com	Rejected	Fails server requirements. Written in VB.
ATutor	Popular open-source LMS platform.	http://atutor.ca/	Rejected	Fails server requirements. Requires Apache and PHP.
Caucus	Open-source platform with optional commercial support.	http://caucuscare.com	Rejected	Fails server requirements. Requires Apache and MySQL.
Chamilo	Open-source platform written by former members of Dokeos development team.	http://www.chamilo.org	Rejected	Fails server requirements. Requires Linux-based environment.
Moodle	Very popular open-source LMS.	https://moodle.org	Rejected	Fails server requirements. Requires PHP and MySQL.
OLAT	Open-source platform funded by the University of Zurich.	http://www.olat.org	Rejected	Fails server requirements. Java based.
Sakai	Feature-rich LMS available in two	http://www.sakaiproject.org	Rejected	Fails server requirements. Java based.

Candidate LMS	Description	URL	Status	Comments
	versions.			
Open Elms	Open-source ASP/JavaScript based. Restricted redistribution.	http://www.openelms.org/	Rejected	Fails server requirements. ASP and JavaScript based.
Claroline	Claroline is an open-source platform for collaborative e-learning and working online.	http://www.claroline.net/?lang=en	Rejected	Fails server requirements. PHP based.
Adobe Connect	Robust LCMS from Adobe.	http://www.adobe.com/products/adobeconnect/elearning.edu.html	Rejected	Fails server requirements. Not NET based.