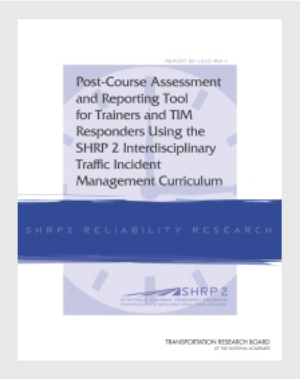

Post-Course Assessment and Reporting Tool for Trainers and TIM Responders Using the SHRP 2 Interdisciplinary Traffic Incident Management Curriculum

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The Second
STRATEGIC HIGHWAY RESEARCH PROGRAM

SHRP 2 REPORT S2-L32C-RW-1

Post-Course Assessment and Reporting Tool for Trainers and TIM Responders Using the SHRP 2 Interdisciplinary Traffic Incident Management Curriculum

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Weris, Inc.
Reston, Virginia

TRANSPORTATION RESEARCH BOARD

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Subject Areas

Highways
Operations and Traffic Management

The Second Strategic Highway Research Program

America's highway system is critical to meeting the mobility and economic needs of local communities, regions, and the nation. Developments in research and technology—such as advanced materials, communications technology, new data collection technologies, and human factors science—offer a new opportunity to improve the safety and reliability of this important national resource. Breakthrough resolution of significant transportation problems, however, requires concentrated resources over a short time frame. Reflecting this need, the second Strategic Highway Research Program (SHRP 2) has an intense, large-scale focus, integrates multiple fields of research and technology, and is fundamentally different from the broad, mission-oriented, discipline-based research programs that have been the mainstay of the highway research industry for half a century.

The need for SHRP 2 was identified in *TRB Special Report 260: Strategic Highway Research: Saving Lives, Reducing Congestion, Improving Quality of Life,* published in 2001 and based on a study sponsored by Congress through the Transportation Equity Act for the 21st Century (TEA-21). SHRP 2, modeled after the first Strategic Highway Research Program, is a focused, time-constrained, management-driven program designed to complement existing highway research programs. SHRP 2 focuses on applied research in four areas: Safety, to prevent or reduce the severity of highway crashes by understanding driver behavior; Renewal, to address the aging infrastructure through rapid design and construction methods that cause minimal disruptions and produce lasting facilities; Reliability, to reduce congestion through incident reduction, management, response, and mitigation; and Capacity, to integrate mobility, economic, environmental, and community needs in the planning and designing of new transportation capacity.

SHRP 2 was authorized in August 2005 as part of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU). The program is managed by the Transportation Research Board (TRB) on behalf of the National Research Council (NRC). SHRP 2 is conducted under a memorandum of understanding among the American Association of State Highway and Transportation Officials (AASHTO), the Federal Highway Administration (FHWA), and the National Academy of Sciences, parent organization of TRB and NRC. The program provides for competitive, merit-based selection of research contractors; independent research project oversight; and dissemination of research results.

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The members of the technical committee selected to monitor this project and review this report were chosen for their special competencies and with regard for appropriate balance. The report was reviewed by the technical committee and accepted for publication according to procedures established and overseen by the Transportation Research Board and approved by the Governing Board of the National Research Council.

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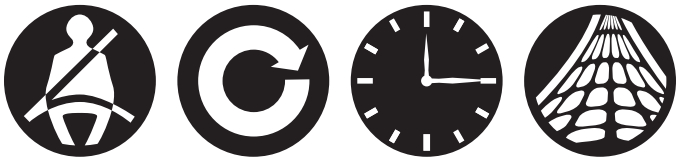

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Zongwei Tao, Founder and President of Weris, Inc., was the principal investigator. Other contributors were Elizabeth Hess and Jeffrey Spotts, also from Weris, Inc.

FOREWORD

Reena Mathews, *SHRP 2 Senior Program Officer, Capacity and Reliability*

This report will be of interest to agencies and responders—from transportation, police, fire, towing, and dispatch—charged with managing highway incidents. It supports three SHRP 2 projects developed to broaden responders' understanding of their roles and responsibilities for faster and safer clearance. Project L12, Training for Traffic Incident Responders, developed a classroom-training curriculum for traffic incident management (TIM). Train-the-Trainer Pilot Courses for Incident Responders and Managers (L32A) and e-Learning for Training Traffic Incident Responders and Managers (L32B) were also developed. This research project designed a process and developed a tool to assess the effectiveness of the SHRP 2 TIM training. Needs were analyzed, business requirements were established, and a TIM assessment tool was specified, designed, developed, and tested.

Agencies invest time and money in an effort to train their staff, and they want to understand the impact of their investment. In the short term, organizations conduct and receive feedback on training materials from attendees and work to improve the content delivered. However, the long-term effectiveness of training on the individual and organization is often not evaluated. Long-term evaluation requires a mechanism to contact students after their training, elicit feedback from their supervisors, and compare selected performance measures to see if improvements have occurred.

This report addresses how agencies can evaluate the effectiveness of the SHRP 2 TIM training. This training was designed to help decrease the impacts of crashes on both responders and travelers. It helps responders understand and implement the national unified goal for traffic incident management: responder safety; safe, quick clearance; and prompt, reliable, and interoperable communications.

To develop a TIM assessment tool, the research team and an advisory panel of subject matter experts selected the Kirkpatrick Model evaluation methodology, conducted literature reviews, and synthesized best practices. The findings of the research established the business and technical feasibility of developing a TIM assessment tool, using readily available, cost-effective technologies focusing on customer management, survey management, and reporting and analysis. The final product is a scalable tool that agencies can use in evaluating a variety of trainings beyond traffic incident management.

CONTENTS

Executive Summary

The second Strategic Highway Research Program's Reliability Project L32C, Post-Course Assessment and Reporting Tool for Trainers and TIM Responders Using the SHRP 2 Interdisciplinary Traffic Incident Management Curriculum, was designed to build on the foundation of earlier projects that created a body of multidisciplinary, multiagency traffic incident management (TIM) training materials. Specific goals of the project were to design a training evaluation process and then to develop a TIM assessment tool that would become the baseline assessment tool by which TIM agencies determine the effectiveness of TIM training materials developed in the SHRP 2 program. The project required that the tool apply across multiple target groups within incident response agencies and organizations at all organizational levels, that it be applicable to a variety of training delivery mechanisms, and that it support national and state-level training programs.

The research team began its work by conducting a literature review and needs analysis, which established business requirements and a recommended business model. This work informed the ensuing specification, design, development, and testing of the product of the L32C research, a TIM assessment tool. The tool demonstrates the business and technical feasibility of developing such a system, which could evolve and eventually operate as a full production system.

The research team drew several conclusions from the research:

- A full, four-level "Kirkpatrick Model" evaluation methodology (Reaction and Learning measured immediately following training, and Behavior and Results measured over the longer term) is applicable and implementable for a nationwide rollout of the Interdisciplinary TIM Training Curriculum.
- Implementing a TIM assessment tool that meets the requirements set forth in the original project request for proposal (RFP) is feasible and practical, using readily available, cost-effective technology.
- The effectiveness of any training program can only be measured over time and with many inputs. Doing this requires a sustained organizational commitment to an assessment process. The TIM assessment tool is a means to that end but is not an end in and of itself.
- The successful implementation of a TIM assessment program requires clear business ownership, leadership, committed staffing, and other resources.

CHAPTER 1

Background

The goal of the SHRP 2 Reliability focus area is to reduce congestion through incident reduction, management, response, and mitigation. SHRP 2 Reliability Project L12 delivered a coordinated, multidisciplinary training program for traffic incident responders and managers through interactive seminars, tabletop role-play, and field practicum.

To facilitate the implementation of this traffic incident management (TIM) program, SHRP 2 initiated two projects:

- L32A: Conduct train-the-trainer pilot courses for incident responders and managers, and
- L32B: Develop an e-learning tool for training traffic incident responders and managers.

The ultimate goal of the national TIM training program is to create a safer future for both incident responders and motorists in which traffic backups from crashes are cleared quickly and efficiently, responders are never injured or killed at the scene, and interagency incident communications are prompt, reliable, and coordinated.

To help agencies assess the return on their training investment and to uncover what additional steps they can take to meet their goals for incident response, SHRP 2 initiated Project L32C: Post-Course Assessment and Reporting Tool for Trainers and TIM Responders Using the SHRP 2 Interdisciplinary Traffic Incident Management Curriculum.

As stated in the project's original RFP, the goal of Project L32C was to "develop a tool that agencies can use to ensure student achievement of the TIM training learning objectives and to identify additional resources TIM responders and managers might need to meet their goals for incident response."

The project RFP stipulated a number of requirements, as follows:

- The tool should apply across multiple target groups within incident response agencies and organizations at all organizational levels, including executives, mid-level program managers, field responders, and trainers conducting the subject training.
- The tool must be multifaceted, sustainable, and scalable to a variety of applications (e.g., classes, online and e-mail-based training, executive briefings).
- The tool should be based as much as possible on off-the-shelf software and equipment that is readily available to state and other public-sector agencies through existing contracts or standard bidding procedures.

As a research project, L32C was expected to demonstrate the business and technical feasibility of developing the desired TIM assessment tool. Following the completion of the project, the tool would evolve into a full production system, as shown in Figure 1.1:

1. Demonstrating initial functionality and maturity by the end of the L32C project (the scope and subject of this report).
2. Continuing to mature and become close to production-ready during a transition period before takeover by an "owning" agency.
3. Operating as a full production system after formal takeover by an agency.

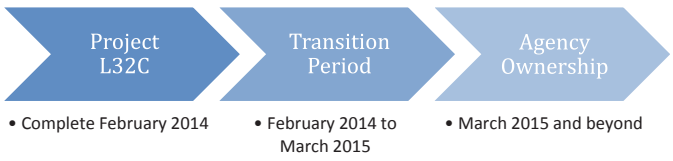


Figure 1.1. Evolution of TIM assessment tool over time.

CHAPTER 2

Research Approach

The work for this project was roughly divided into four stages, as shown in Figure 2.1.

The initial task was to develop and describe a full-range assessment process for the TIM training program that would address what would be assessed, how the assessment would be done, and when each assessment step would take place. A parallel and related task was to perform a literature review, including an assessment of other relevant training initiatives, and develop a business model that specified how best to develop, implement, and sustain the TIM assessment tool. The research team then developed a set of use cases that served as a framework for the development of functional requirements; that framework guided subsequent system architectural design, development, and testing. Finally, the research team demonstrated the TIM assessment tool to SHRP 2 program staff, Federal Highway Administration (FHWA) personnel, and the Technical Expert Task Group (TETG).

Key aspects of the research approach are discussed in the followed sections.

Collaborative Nature of Project L32C

The L32C project is tightly coupled with Projects L12, L32A, L32B, and other TIM training programs nationwide and requires support from many federal, state, and local agencies. That made L32C a highly collaborative effort. Figure 2.2 shows the interactions and communications between L32C and other projects and organizations.

During the course of the work, the L32C team

- Attended project meetings with L32B, SHRP 2, and FHWA staff to review tasks, milestones, and timelines for Projects L32B and L32C and to discuss dependencies between the two projects;
- Engaged with National Highway Institute (NHI) regarding its e-learning platform and mechanisms for integrating with it;
- Reviewed the L12 and L32A projects' final reports and course materials;
- Reviewed Project L32A course evaluation questionnaires and student exam;
- Reviewed Project L32B results and initial system requirements and design approaches;
- Reviewed NHI's registration survey and questions for course evaluation;
- Attended an FHWA-run TIM train-the-trainer class held in Rhode Island; and
- Interviewed responder agency managers and training professionals.

Conceptual Model for Training Evaluation

Early in the project the research team decided to use the widely used and popular "Kirkpatrick Model" as a conceptual reference for the TIM assessment tool. Donald L. Kirkpatrick's four-level evaluation model first appeared in a series of articles published in 1959 and became popular with his 1994 book, *Evaluating Training Programs* (Kirkpatrick 1959; Kirkpatrick 1994).

The idea behind the Kirkpatrick Model is to provide organizations with meaningful ways to evaluate training programs or learning in the organization. The four levels of evaluation described by the model are depicted in Figure 2.3.

Level 1. This level tries to ascertain how students feel about the training; it is a measure of student motivation and satisfaction. Students are typically asked to fill out evaluation or feedback forms immediately after the training ends. These forms usually include questions to evaluate instructors, training materials, and training logistics.

Level 2. This level measures how much the students have learned by attending the training. The measurements aim to find out what knowledge was learned, what skills were developed or improved, and what attitudes were changed. Students

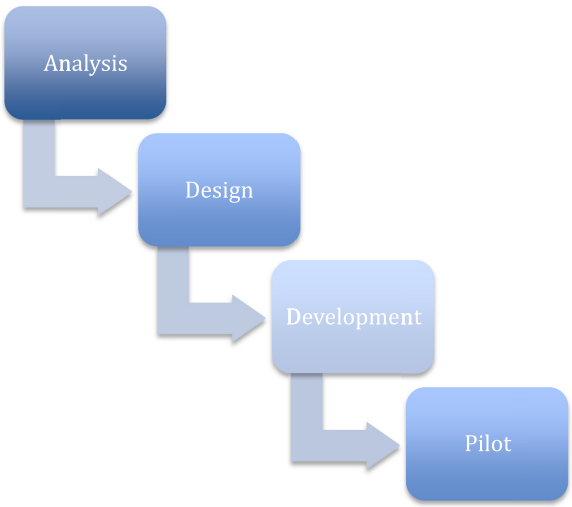


Figure 2.1. SHRP 2 L32C project stages.

typically need to complete evaluation forms or perform some type of tests both before and after the training.

Level 3. This level measures whether on-the-job behavioral changes have occurred as a result of students attending the training, and if so, to what extent. Trainees, their immediate supervisors, and their subordinates or peers who often observe their behaviors may be asked to participate in this level of evaluation. The degree of assessment difficulty is increased at this level because behavioral changes often take time, and the right environment must be provided for the students to implement their behavioral changes. Additionally, those who participate in this evaluation need to be observant to note the behavioral changes that took place.

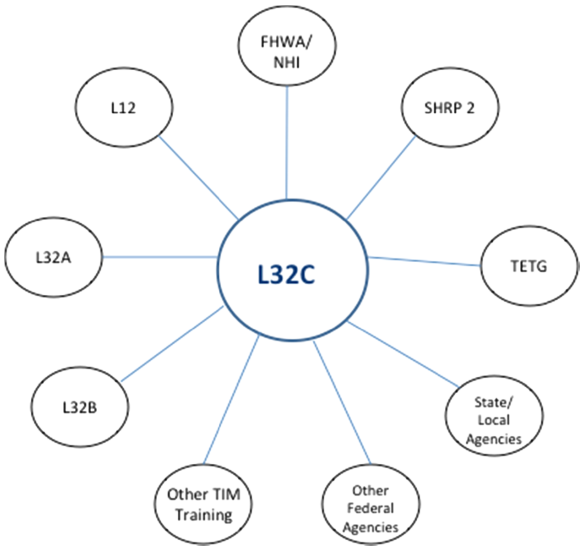


Figure 2.2. Collaboration between the SHRP 2 L32C project and other projects and organizations.

Level 4. This level measures the impact on the business as a result of students attending the training and their subsequent on-the-job behavioral changes. The impact may be determined in terms of improved safety, increased productivity and efficiency, and reduced staff turnover. This level of assessment is usually the most difficult because results take time to achieve; measurements are needed both before and after the training. The evaluation also needs to determine what business results have been achieved as a result of student participation in the training, as opposed to other organizational initiatives.

The research team applied this four-level evaluation model when designing the TIM assessment process and tool.

System Development Methodology and Approach

The research team followed a typical systems development life cycle (SDLC) approach to designing and developing the TIM assessment tool. The analysis stage of the project provided an understanding the business requirements, an essential first step in any SDLC methodology. From there the team

- Documented a set of use cases;
- Developed a concept of operations and initial meta-architecture for the system;
- Translated this foundational information into functional requirements;
- Established the systems architecture, developed functional specifications, and documented test cases; and
- Developed the software and performed unit testing.

The high-level concept for the system which the team envisioned is shown in Figure 2.4. It consists of three major blocks of functionality:

- Survey Management—functionality to execute a particular kind of assessment, from a Level 1 (Reaction) survey at the conclusion of a training event to a Level 4 (Results) survey long after a training event or series of events.
- Constituent Management—functionality to manage relationships and communications with all key constituents (e.g., individual students, agency training officers and/or management, and trainers).
- Analysis and Reporting—functionality that enables program staff as well as participating agencies to analyze and report on training participation, needs, effectiveness, and so on.

Custom software development is almost always the least desirable approach to system implementation, and that was certainly the case for this project. Controlling costs, ensuring

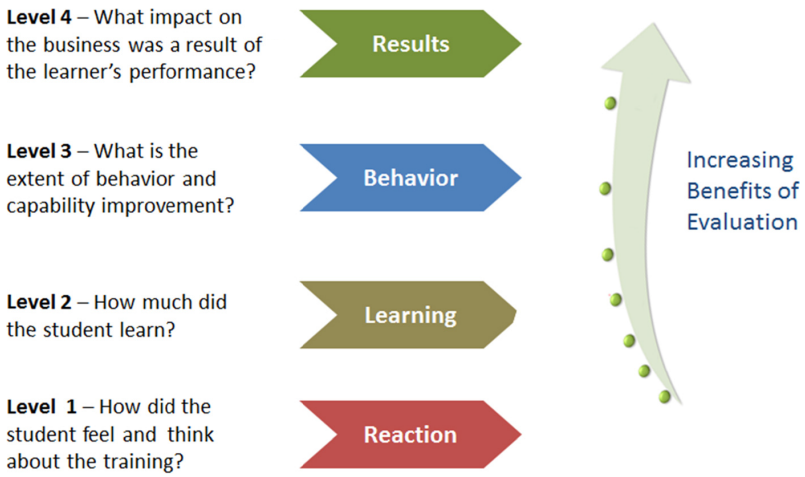


Figure 2.3. Kirkpatrick's four levels of learning evaluation.

sustainability, and preserving long-term flexibility are always important considerations, particularly in a research project with limited scope and funding.

All of these factors pointed to the use of off-the-shelf technology, with a focus on integration and customization via configuration, as opposed to writing code from scratch. Fortunately, the major functional elements of the envisioned system were all available in various cost-effective forms:

- Highly capable and popular survey management and constituent relationship management packages (which evolved from customer relationship management, or CRM) are available as software-as-a-service (SaaS) subscriptions. In this model, an organization pays a monthly or annual usage fee, and the vendor hosts and manages the entire application environment in the cloud.
- Cloud computing services allow an organization to subscribe to a cloud-based, virtual computing, storage, and network environment and pay for usage on a time-, capacity-, and bandwidth-used basis. In this case the organization is responsible for licensing, installing, and maintaining the application that runs in this virtual environment.

As described in more detail in Chapter 3 of this report, the team's approach was to use SaaS subscriptions for survey management and CRM functions and to base the analysis and reporting functions on desktop products that integrate with a cloud computing platform.

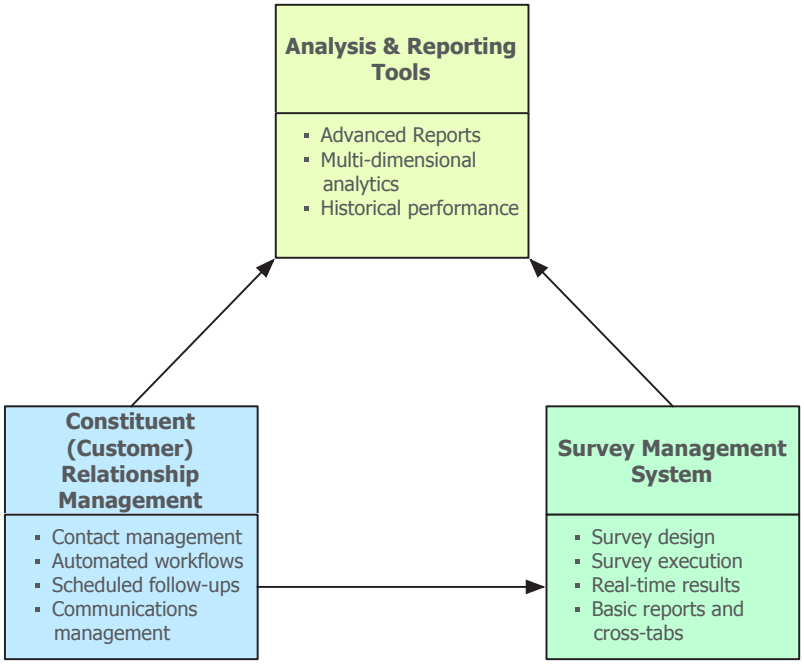


Figure 2.4. High-level system concept.

CHAPTER 3

Findings

This section of the report presents major findings from the research efforts. The team began with an analysis of business needs and continued with the specification, design, development, and testing of the TIM assessment tool.

Needs Analysis

Figure 3.1 provides a visual overview of the assessment needs and the assessment process.

Assessment Needs: What to Assess

The research team believes that the TIM training courses should bring about two aspects of learning: knowledge transfer and on-the-job behavioral changes. Both types of learning have the potential to positively affect performance results for responder agencies in terms of safety and efficiency.

This section describes assessment needs in terms of Kirkpatrick's four-level evaluation model.

Level 1 Assessment: Reaction

A reaction evaluation measures students' personal reactions to a training experience. Questions explore whether

- The content was relevant to the student's job;
- The course was perceived to be helpful in terms of improving the student's job performance;
- The subject matter was well organized;
- Training materials were effectively presented;
- The training session provided the student opportunities to participate; and
- The training was a satisfactory learning experience.

Since these types of assessments are rather general, the research team decided to use the National Highway Institute (NHI) course evaluation form as the basis for the Level 1 questions.

Level 2 Assessment: Learning

Learning evaluation measures the increase in knowledge or intellectual capability from before to after the training experience. It aims to determine the following:

- Did the students learn what was intended to be taught?
- Did the students experience what they were intended to experience?
- What is the extent of advancement or change in the students after the training, in the direction or area that was intended?

Questions for students might include these:

- According to the TIM phases of incident response, which of the following is the next responder duty after incident arrival?
  A. Initial size-up
  B. Traffic management
  C. Investigation
  D. Clearance
- Why it is important for the Communications Center personnel to provide the geographic location of an incident using mile markers or the nearest intersection?
  A. To provide the most accurate description for later-arriving responders
  B. To track which intersections see the greatest occurrence of incidents
  C. To identify the type of incident
  D. To more accurately identify the specific location of the incident
- Why should responders approach a burning vehicle from a vantage point other than the front or rear of the vehicle?
  A. Items may violently explode, propelling loose parts off the vehicle
  B. To avoid smoke inhalation

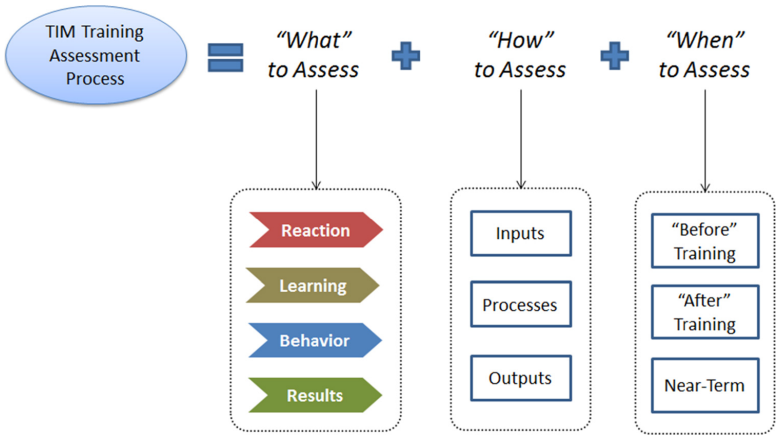


Figure 3.1. SHRP 2 Project L32C TIM training assessment process.

C. So as not to interfere with other firefighting activities
D. To mitigate the dangers of passing traffic

Level 2 assessment questions are typically created by the subject experts who develop a training program, since they are the most familiar with the course material. The Project L32A final report included a 92-question student exam, which the research team decided to use as the basis for this project's Level 2 assessment (Transportation Research Board 2013).

Level 3 Assessment: Behavior

Behavior evaluation measures the extent to which the trainees applied the learning and changed their behaviors; this may occur immediately or several months after the training, depending on the situation. The goal of this evaluation is to determine

- Did the trainees put their learning into effect when back on the job?
- Were the relevant skills and knowledge used?
- Was there noticeable and measurable change in the activity and performance of the trainees when back in their roles?
- Was the change in behavior and/or new level of knowledge sustained?
- Would the trainee be able to transfer his/her learning to another person?

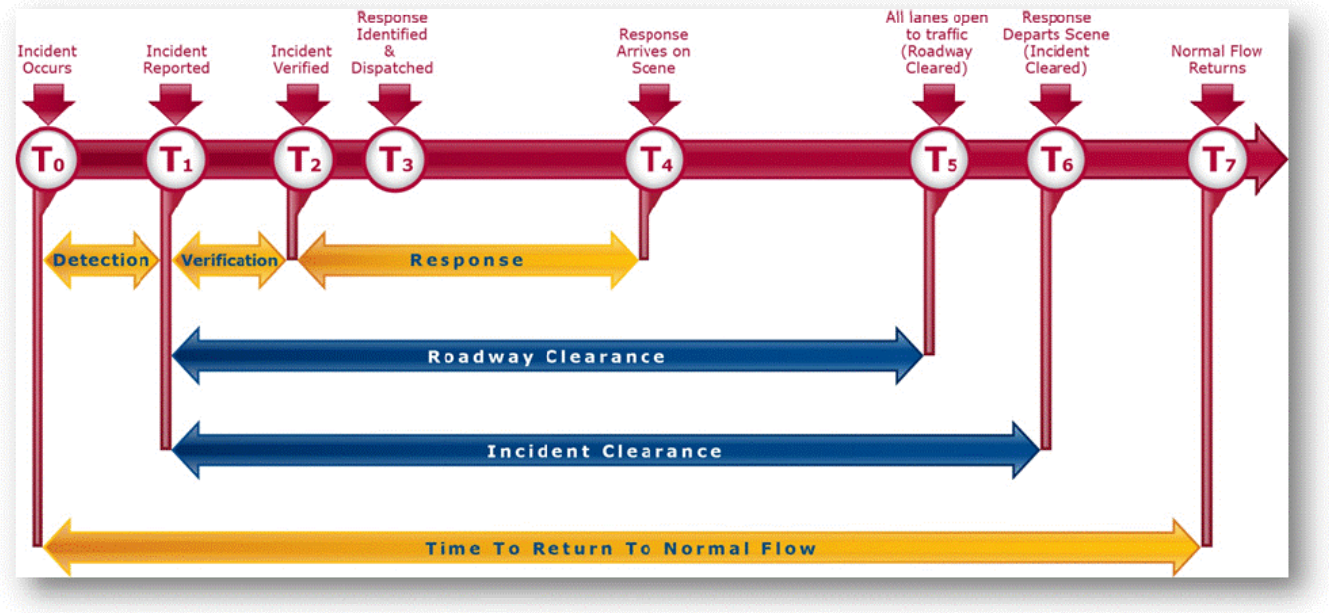
Questions at this level are designed for trainees, their peers, and their immediate supervisors who observe the trainees' on-the-job behaviors on a regular basis. Sample behavior-oriented questions based on the TIM training material from Projects L12 and L32A include the following:

- Using the definition of a TIM timeline in Figure 3.2, what student behavioral changes were implemented or observed to shorten the duration of each phase?
- Were student behavioral changes implemented or observed to
  - Better communicate locations of incidents?
  - Better describe the nature of incidents?
- Were student behavioral changes implemented or observed to better ensure the response contains the appropriate resources?
- Were student behavioral changes implemented or observed in terms of responder vehicle positioning?
- Were student behavioral changes implemented or observed in terms of lane blocking?
- Were student behavioral changes implemented or observed to ensure that TIM responders wear appropriate safety apparel?
- Were student behavioral changes implemented or observed to better coordinate multiagency TIM operations?
- Were student behavioral changes implemented or observed to better anticipate and prepare the necessary TIM resources?

Level 4 Assessment: Results

Results evaluation measures the effect on the organization or environment resulting from the improved performance of trainees. Measures typically involve business or organizational key performance indicators, such as volumes, values, percentages, timescales, return on investment, and other quantifiable aspects of organizational performance. For example,

- Reduction in number of TIM responder deaths and injuries;



Source: FHWA.

Figure 3.2. TIM timeline.

- Improved incident and roadway clearance time;
- Reduction in number of secondary incidents;
- Equipment and resource readiness; and
- Reduction in TIM responder turnover.

Level 4 questions are generally directed toward senior management. Example results-oriented questions for post-TIM training evaluation include the following:

- How many TIM responder injuries occurred on average in a 6-month period before TIM training? How many TIM responder injuries occurred in the most recent 6 months after TIM training?
- How many secondary incidents occurred on average in a 6-month period before TIM training in your state? How many secondary incidents occurred in the most recent 6 months after TIM training?
- What was the average time needed to clear a major incident before TIM training? What was the average time needed to clear a major incident during the most recent 6 months after the TIM training?
- How many times was incident clearance delayed due to lack of equipment and/or resource readiness in a 6-month period before TIM training? How many times was incident clearance delayed due to lack of equipment and/or resource readiness in the most recent 6 months after TIM training?
- What was the TIM responder turnover rate before TIM training? What was the TIM responder turnover rate during the most recent 6 months after the TIM training?

To achieve optimal assessment results, the following may need to be adjusted:

- Duration of the evaluation period (the research team used a 6-month period to obtain assessment data within the project's time frame); and
- When the evaluation period starts—as stated previously, behavioral changes take time, and those changes need to be observed before evaluating organizational results.

Assessment Process: How and When to Assess

This section describes the assessment process in terms of how and when to conduct an assessment. Figure 3.3 is a concept-of-operations diagram for the overall assessment process.

Essential Student Information

A clear requirement for the tool is the ability to perform multi-dimensional analysis. Certain essential student information must be collected at course registration, or when the student completes an assessment form, to enable this level of analysis with the L32C assessment tool. This includes information about the student's agency and the nature of the student's affiliation with it, his/her responder discipline, and so on. The type of data that is required is discussed in more detail in a subsequent section of this chapter, Database Design. Note that some data administration is required to enter survey results, test scores, and other input data into the assessment tool.

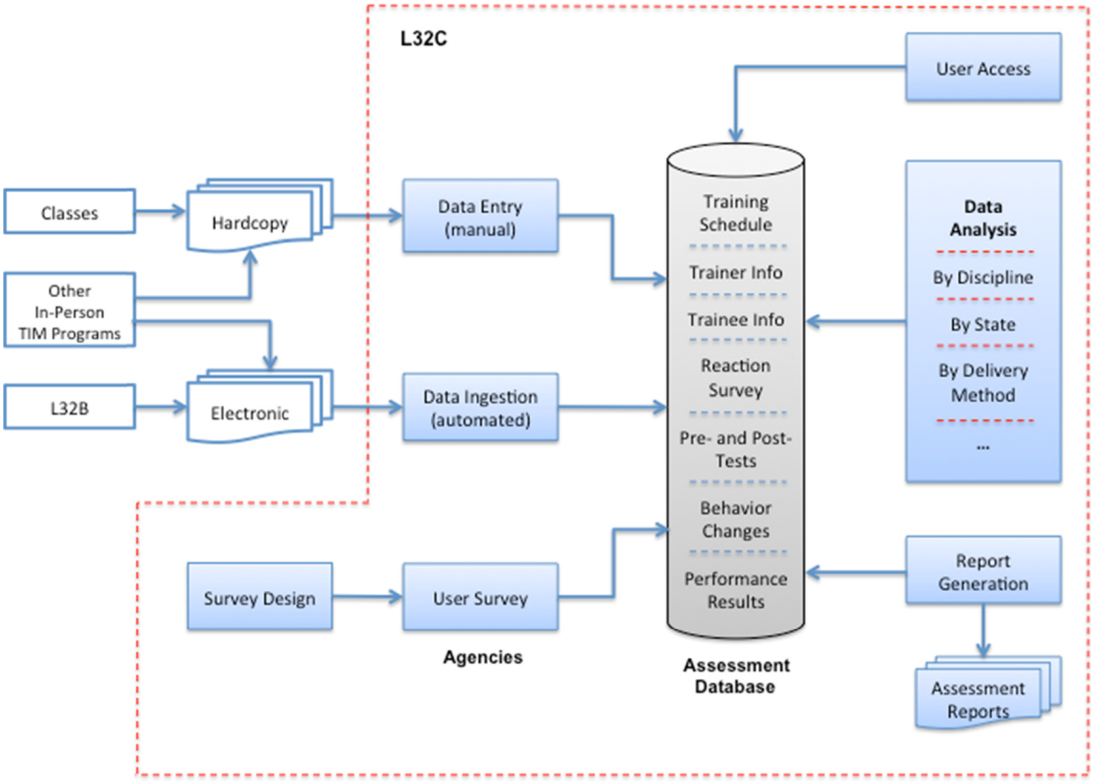


Figure 3.3. Concept of operations for assessment process.

The research team believes there is a two-fold aspect to TIM training assessment based on the Kirkpatrick evaluation model. In one aspect, at each of the four levels, data must be collected from the intended sources and then analyzed using the assessment tool to generate the output. Another aspect of the assessment involves cross-level examination to determine what positive outcome from each level gets propelled to the next level. For example, of the many things that students learned in the classroom, what was retained and turned into behavioral changes on the job which, in turn, translated to TIM safety and efficiency improvements on a regional or national level? This type of assessment can provide additional feedback on training materials as well as training environment and methodology.

The output of the data analysis is presented in the form of statistical analysis results and their graphical representations when appropriate. The output can be stored in some type of electronic format such as Excel spreadsheet, XML file, and/or PDF file, which can be downloaded or e-mailed to interested parties. Additionally, the assessment tool will have the capability for registered users to review input data and to perform their own analysis.

To achieve the desired evaluation goal at each of the four evaluation levels, it is imperative not only that the proper questions are asked, but also that the evaluations are done at the right time, using the most appropriate methods, and followed by relevant data analysis.

Table 3.1 provides a summary of critical success factors and input data sources at each evaluation level.

The balance of this section provides further discussion on when and how to assess the TIM training programs based on Kirkpatrick's four-level evaluation model.

Level 1 Assessment: Reaction

When to Assess

To get an accurate gauge of the students' reactions to the training, this evaluation is best carried out immediately following the completion of the TIM training, preferably before students leave the classroom.

Inputs

Table 3.2 contains the origin and format of the expected Level 1 input data.

Analysis

The research team expects that data analysis at this level will evaluate the following:

- Student enthusiasm by state or region;
- Perceived relevance by students based on course modules; and
- Perceived effectiveness of in-person training versus online training.

Table 3.1. Critical Success Factors and Data Sources for Evaluations

Evaluation Level	Critical Success Factors	Data Source
1. Reaction	• Evaluation must be done immediately after training ends.	• Trainees
2. Learning	• Evaluation must be done before and after training.	• Trainees
3. Behavior	• Evaluators must allow time for behavioral changes to be observed. • Trainees must be allowed the right work environment to implement behavioral changes. • Peers and/or immediate supervisors must be able to observe the behavioral changes.	• Supervisors • Peers • Trainees
4. Results	• More time will likely be needed to obtain organizational results. • Management support is a must. • Pretraining and posttraining results are needed for comparison. • Evaluation must be able to determine what improvements are due to training efforts as opposed to other organizational initiatives.	• Management • TIM performance measures

Level 2 Assessment: Learning

When to Assess

To obtain an accurate measure of the knowledge and skills learned this evaluation is ideally performed both before and after the training. Students can fill out the pretraining survey any time after registering for the TIM training and before training class commences. The same survey can be completed again immediately or shortly following the completion of the TIM training.

Inputs

Table 3.3 contains the origin and format of the expected Level 2 input data.

Analysis

The research teams expect that data analysis at this level will evaluate the TIM training in terms of the following:

- The effectiveness of each trainer;
- The effectiveness of each module taught; and
- Whether or not students consistently miss certain questions.

Level 3 Assessment: Behavior

When to Assess

Changes in behavior take time. Therefore, observation and evaluation of behavior over time are required to assess change, relevance of change, and sustainability of change brought about by the TIM training.

The research team suggests that Level 3 behavior evaluation be performed at least 1 to 2 months after the completion of a TIM training course. The research team also believes that repeating this evaluation over a longer period of time is beneficial, if feasible. Repeated evaluation gives insight into the sustainability of the behavioral changes, and additional changes that take longer to implement may be discovered.

Inputs

The research team developed an initial set of Level 3 survey questions. The survey is hosted on the L32C assessment platform; the target survey responders are the trainees' supervisors and peers, or the trainees themselves. Ideally, input data will be captured electronically, but paper-based surveys can be input by manual data entry.

Table 3.2. Level 1 Input Data Origin and Format

Input Data Origin	Input Data Format
Participant feedback for the national TIM responder train-the-trainer course	Hardcopies
L32B—participant feedback for the e-learning TIM training course	Electronic
L12-based TIM training programs—participant feedback for the training courses	Hardcopies
NHI TIM training courses—Level 1 evaluation form	Electronic

Table 3.3. Level 2 Input Data Origin and Format

Input Data Origin	Input Data Format
Student exam scores for the national TIM responder train-the-trainer course	Hardcopies
L32B—student exam scores for the e-learning TIM training course	Electronic
L12-based TIM training programs—student exam scores for the training courses	Hardcopies
NHI TIM training courses—Level 2 test scores	Electronic

Analysis

The research team expects that data analysis at this level will provide information such as the following:

- What areas of learning tend to be retained over time?
- What areas of learning lead to the most positive behavioral changes on the job?

Level 4 Assessment: Results

When to Assess

Measurement of organizational results may take many months. The time needed to measure the results of the TIM training may be even longer given the multidisciplinary and multiagency nature of the training programs.

The research team suggests that Level 4 evaluation be performed at least 3 months after the completion of a TIM training course. Repeating this evaluation over a longer period of time will also be beneficial. The repeated evaluation may uncover not only organizational results that take longer to realize but also improvements that result from more cross-disciplinary participation on a regional and/or national level.

Inputs

The research team developed an initial set of Level 4 survey questions. The survey is hosted on the L32C assessment platform; the target survey responders are agencies' senior management. Ideally, input data will be captured electronically, but paper-based surveys can be input by manual data entry.

Analysis

The research team expects that data analysis at this level will give insight into the following:

- What behavioral changes translate into TIM performance improvement?
- What measurable improvements have been achieved in terms of TIM safety and efficiency as a result of the TIM training?
- What TIM resources are missing that may hinder safety or performance?

Literature Review

The research team began this review by examining pertinent sources from the transportation realm that were available in the public domain. Because such sources usually provide limited visibility into process, governance, technology, and best practices, the team eventually pursued additional avenues to gain insight into these critical matters.

Through the auspices of the TETG, the research team was able to gain access to contacts involved in training and knowledge transfer activities at other agencies and organizations. The team also interviewed professionals from various aspects of the responder community with supervisory and management experience; these individuals provided useful input into training assessment.

Finally, because the Kirkpatrick Model is used across many domains, the team sought best practice lessons and recommendations that could apply to any significant training initiative.

Table 3.4 summarizes the sources the team examined in the literature review and the lessons they offer for Project L32C, if any.

Synthesis of Best Practices

After casting a fairly wide net in search of insights into how organizations assess the effectiveness of their training programs, the research team did not find anything close to a perfect model that could be emulated when developing the TIM assessment processes and tool for this project. In fact, when talking with others about SHRP 2's aspirations for Project L32C, the team was frequently asked about the project's progress, because it was exactly what was needed.

The research team did, however, find many discrete current practice examples that can be mapped against the requirements outlined in the RFP, which provides a framework for synthesizing best practices that the team believes are applicable to the project. These are summarized in Table 3.5.

Recommended Business Model

The research team concluded that no single training assessment program provides a complete pattern for the long-term implementation of the TIM assessment program, in terms of either process or business model. The team's approach to developing a recommended business model was to map a synthesis of best practices to the known set of requirements for Project L32C.

The research team believes that the TIM training tool cannot be thought as a single, stand-alone software program. Consistent with the objectives for the tool outlined in the RFP (e.g., multifaceted, sustainable, scalable to a variety of applications, providing a framework for coordination at the local program level, suitable for integration into FHWA and other national program efforts), the tool needs to be viewed as a system, whose success will be highly dependent on a sustainable business model.

While a government-funded national training initiative differs from a private-sector product or service venture, many of the fundamental building blocks of a traditional business plan apply. Figure 3.4 shows how these fit together conceptually.

Table 3.4. Sources of SHRP 2 Project L32C Literature Review and Lessons Learned

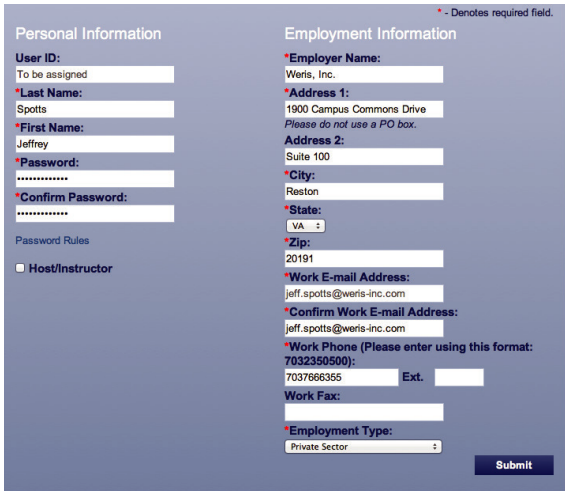
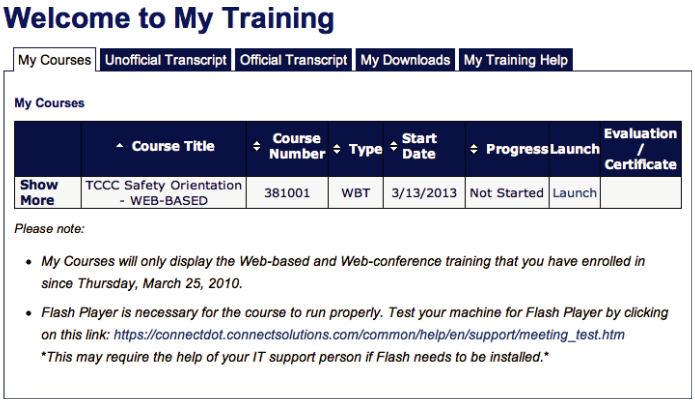
Source	Description
AASHTO	American Association of State Highway and Transportation Officials (AASHTO) does not directly offer any training, but related entities provide information about or access to training resources.
NTIMC	The National Traffic Incident Management Coalition (NTIMC) has a presence on the AASHTO website, which provides a link to training resources at http://ntimc.transportation.org/Pages/TRAININGRESOURCES.aspx. This is a compendium of links to materials that can be ordered or, in some cases, downloaded. It also references training courses at other sites, which the research team investigated as part of the literature search and covers when discussing that source.
Emergency Transportation Operations, FHWA	This arm of FHWA provides a link to training at http://www.ops.fhwa.dot.gov/eto_tim_pse/training/index.htm. At the time of the literature review, the only available reference was to an August 2012 webinar related to SHRP 2 national TIM responder training.
National Highway Institute	This FHWA entity offers an array of classroom and web-based courses. NHI's online training platform is expected to be used to deliver the training modules being developed in Project L32B. Basic contact information is required to register and subsequently purchase access to NHI's online courses (some are free):  * - Denotes required field. Personal Information User ID: To be assigned *Last Name: Spotts *First Name: Jeffrey *Password: •••••••••••• *Confirm Password: •••••••••••• Password Rules Host/Instructor Employment Information *Employer Name: Weris, Inc. *Address 1: 1900 Campus Commons Drive Please do not use a PO box. Address 2: Suite 100 *City: Reston *State: VA *Zip: 20191 *Work E-mail Address: jeff.spotts@weris-inc.com *Confirm Work E-mail Address: jeff.spotts@weris-inc.com *Work Phone (Please enter using this format: 7032350500): 7037666355 Ext. Work Fax: *Employment Type: Private Sector Submit Similar information is captured on paper-based registration forms for classroom training. Once a course has been purchased it is accessible by logging into a personalized My Training page:  Welcome to My Training My Courses | Unofficial Transcript | Official Transcript | My Downloads | My Training Help My Courses Show More | TCCC Safety Orientation - WEB-BASED | 381001 | WBT | 3/13/2013 | Not Started | Launch Please note: • My Courses will only display the Web-based and Web-conference training that you have enrolled in since Thursday, March 25, 2010. • Flash Player is necessary for the course to run properly. Test your machine for Flash Player by clicking on this link: https://connectdot.connectsolutions.com/common/help/en/support/meeting_test.htm *This may require the help of your IT support person if Flash needs to be installed.* A typical Level 1 assessment captures a student's reaction to training. Learning assessment (Level 2) is based on the particular course's subject. NHI's online platform has the ability to capture high-level test results. It is not clear that any analysis is performed. The research team did not identify any Level 3 or 4 assessment program.

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Table 3.4. Sources of SHRP 2 Project L32C Literature Review and Lessons Learned (continued)

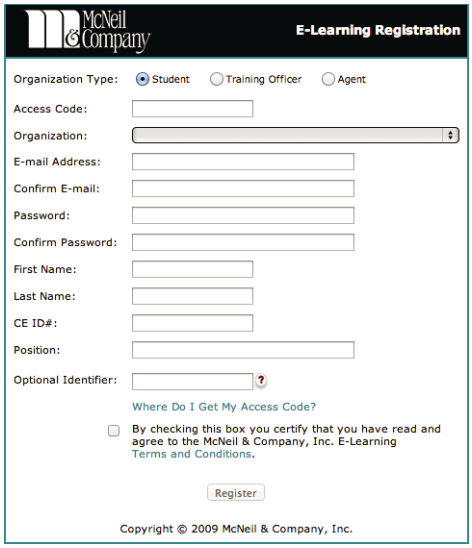
Source	Description
National Volunteer Fire Council	This organization offers a range of training focused on health and safety subjects at http://www.nvfc.org/training/education/health-and-safety-training. Most of the webinars offered are simply YouTube videos, which means that no registration is required, anyone can watch them, and no assessment seems feasible. A few of the webinars are actually online training modules hosted by the insurer McNeil & Company at http://www.mcneilandcompany.com/risk-management/e-learning/. The online training is free, but an individual learner cannot enroll for a course until his/her training officer registers the organization in the program. This can be seen in the registration screen: a specific access code is required, and the student's organizational affiliation is chosen from a dropdown list. Since a continuing education (CE) identification number (ID) is required, it can be inferred that some Level 2 assessment is done to ensure course completion.  The team's research suggests that no systematic Level 3 or 4 follow-up assessments are done.
I-95 Corridor Coalition	This organization provides a number of online courses accessible via http://www.i95coalition.org/i95/Training/tabid/87/Default.aspx. Some of the courses, including ones related to incident management, are self-hosted. Registration is required but only involves providing an e-mail address, which is validated by clicking through on an e-mailed link. Courses of this type consist of a sequence of video modules, each followed by a quiz. A multiple-choice exam concludes the course. This approach provides the basis for a basic Level 2 (Learning) assessment, albeit limited, since the learner is given multiple tries to get the correct answer; and feedback given following an incorrect answer steers the student to the correct one. Other courses are actually hosted by CITE (discussed separately), and those that are fee-based require registration with that organization.
ERSI	The Emergency Responder Safety Institute (ERSI) has a Learning Network accessible at https://learning.responder-safety.com. It currently offers five online training modules relevant to TIM. The content is available only to registered users, but anyone can register. Only basic contact information is required. An organization name is required but it can be entered arbitrarily. Organization type is selected from a dropdown list. A unique e-mail per registrant is required so that a unique training record can be maintained. Adobe Flash is a technical prerequisite for taking a course, and the content is video-heavy. Modules must be completed end-to-end and built-in Knowledge Check and Skills Challenge steps provide a basic Level 2 (Learning) assessment. For example, the Intro to Fire Service Traffic Control Professional course skills challenge consists of 12 multiple-choice questions. Correctly answering 75% or more of the questions generates a course completion certificate in PDF format that automatically downloads. The team's research suggests that no systematic Level 3 or 4 follow-up assessments are done.
International Association of Chiefs of Police (IACP)	This association's Center for Police Leadership and Training (CPLT) provides information and registration services for training offerings at http://www.theiacp.org/LeadershipandTraining/tabid/68/Default.aspx. A close inspection of the offerings shows that the courses are mostly leadership-oriented and classroom-based. Online courses are mostly links to downloadable, previously recorded webinars. The IACP does not seem to offer anything instructive for Project L32C.
Towing and Recovery Association of America (TRAA)	This organization operates the National Driver Certification Program (NDCP), which involves a paper-based application process, self-study (only the first-level study guide is downloadable), and either pencil-and-paper-based testing at a local community college or computer-based testing in certain states. As currently constituted, this program does not seem to be instructive for Project L32C. TRAA also offers other training materials on the Products page on its website. The TIM Training Program for Entry Level Towers is a new, featured product that consists of a CD and one paper copy for $20.

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Table 3.4. Sources of SHRP 2 Project L32C Literature Review and Lessons Learned (continued)

Source	Description
NTED	The Federal Emergency Management Agency (FEMA) National Training and Education Division (NTED) offers over 200 courses to first responders. The majority of the courses are delivered on or near the requesting agency's site or at a training partner site (e.g., a university). Some courses are offered online. Registration requires chain-of-command approval and facilitation by designated training points of contact. Because of the restricted nature of access to this entity's offerings, the research team was only able to gain insight into the assessment process through a TETG-facilitated introduction to an agency employee. In summary, the research team learned that • There is a centralized registration function for all courses. • A standard form is used for Level 1 (Reaction) assessment. • Any immediate Level 2 assessment (Learning) is done on a course-by-course basis, and the team's contact was not certain that it was done in a manner that facilitated meaningful analysis. • Kirkpatrick-style Level 3 and 4 assessments (Behavior and Results) are at the discussion stage inside the agency, but no concrete plan is in place to implement them. • The current long-term assessment strategy involves mailing a cover letter and standard survey posing three broad, open-ended questions to students 6 months after they have attended a course. • Survey responses are manually entered into an Access database and analyzed qualitatively.
CITE	The Consortium for ITS Training and Education (CITE) offers a range of certificate programs, blended courses, and online training. The latter is available at http://www.i95coalition.org/i95/Training/tabid/87/Default.aspx. Registration is required for all courses, and all but two involve fees of $50 to $200. The free courses require between 2 and 8 hours to complete, so the research team did not examine them. The registration process collects basic contact information. Organization type and the registrant's role in the organization are selected via checkboxes.
National Fire Academy (NFA)	This arm of the U.S. Fire Administration, which is part of FEMA, provides a wide range of courses in on-campus and off-campus classroom settings; it also offers a subset of courses online via NFA Online at http://www.usfa.fema.gov/nfa/nfaonline/browse/index.shtm. Offerings include National Incident Management System (NIMS) Incident Command System (ICS)-series courses familiar to many responders, especially those in supervisory positions or higher. An introduction facilitated by the TETG was essential to get a broad overview of process from an agency employee. However, the insights gained from one person—while useful—cannot be considered comprehensive given the vast scope of the organization and its mission. Nonetheless, the research team believes the NFA model is the one most relevant to L32C. In summary, the research team learned that • There is a centralized admissions function for the NFA and also an organization responsible for long-term evaluation. • Level 1 and 2 assessments (Reaction, Learning) are done at course completion. Pretesting is only done (a potentially useful strategy for deeper Level 2 assessment) in a Hazmat-oriented chemistry course (so that the instructor can determine students' baseline level). • In an online setting, mandating completion of a survey and exam can be easily done, thus accomplishing Level 1 and 2 assessments. When asked how NFA gets students to comply in classroom settings, the team's source said an unspoken rule stipulates that students have to complete an evaluation to receive a certificate. • In classroom settings, the Level 1 assessment input has moved from paper forms that were optically scanned, to an online system. Students are handed a business-card-sized form with a unique ID, which is entered when the student accesses the evaluation system. • Similar to NTED, 6 months after a student has completed a course, the student's supervisor is e-mailed a survey, which is designed to address Level 3 and 4 (Behavior, Results) assessments. The admissions/registration process requires chain-of-command approval or sponsorship, and it always captures the student's then-current supervisor information. • NFA publishes an annual evaluation report. The most recent one available is for 2009 (National Fire Academy 2009).
Law enforcement training professional	The team's discussion with this senior professional focused mainly on issues related to participation, governance, and sustainability: • He stressed the critical importance of the supervisor in obtaining feedback on training effectiveness with respect to long-term changes in individual behavior and organizational change (i.e., Kirkpatrick Levels 3 and 4). • He emphasized the need for programmatic incentives or mandates to drive participation, at both the individual learner and supervisor/management level. He used the term *carrot and stick.* In eras of tight budgets, allotting officer and management time to training and assessment is difficult. • He felt that online delivery of training was essential to the long-term success of the program, for all the expected reasons. He also made the point that online training should be available "where cops go all the time" and cited NLEARN (discussed next) as an example of online venues that are very familiar in law enforcement circles.
NLEARN	The National Law Enforcement Academy Resource Network (NLEARN) is part of the International Association of Directors of Law Enforcement Standards and Training (IADLEST). This source was suggested by the law enforcement training professional the research team interviewed as part of the literature search effort. NLEARN offers over 200 online courses. Access is restricted to official law enforcement use only, and content is not for public release; so the team was ultimately unable to get any insights from this source.

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Table 3.4. Sources of SHRP 2 Project L32C Literature Review and Lessons Learned (continued)

Source	Description
Fire service professional	This senior professional is experienced with managing and training fire and rescue personnel. During his discussion with the team, • He stressed the vital importance of supervisor and management participation in any Level 3 or 4 assessment process and ensuring that individuals responding to any survey that measures strategic outcomes (i.e., Level 4, Results) have the authority to do so. • He focused on the interdisciplinary nature of the TIM training curriculum and suggested that assessment of behavioral changes (Level 3) attempt to measure what students learned about other disciplines and responder roles, as well as any changes they made in how they communicate with other disciplines. • In terms of Level 4 (Results) assessment, he felt that incident clearance time was an important measure.
Kirkpatrick community	Donald Kirkpatrick and family have established an online community that provides members with access to training evaluation resources that build on the conceptual model he created. The team engaged this community to identify best practices that might be applicable to Project L32C. The information the research team garnered is general in nature and not specific to the transportation sector; it is cited—where applicable—in the Synthesis of Best Practices section of this chapter.

The four key elements of this business model are the following:

1. *Value proposition.* This is the most important element. Like any other product or service, the long-term success of the TIM assessment tool depends on its ability to help customers achieve demonstrable results. Value to customers will be delivered in multiple forms, including classroom, online, and hybrid courses; train-the-trainer events and webinars; plus automated follow-up evaluations and self-assessment capabilities.
   a) *Customers* are the responder agencies nationwide that will train their personnel using the new TIM curriculum. These personnel will come from law enforcement,

Table 3.5. Synthesis of Best Practices

Category	Best Practice
General	• The assessment program should be driven by the desired end result (strategic goals) and how the training will specifically affect it.
Level 1 Assessment—Reaction	• The assessment should be done immediately after the training ends. • Level 1 typically should use the least resources. • The scope should be limited to identifying opportunities to improve the program, instruction, support, and administration.
Level 2 Assessment—Learning	• This assessment can precede Level 1. Learning can be measured in steps throughout the learning event. • The results of quizzes and exams can be used to provide insight into gaps in instruction and student materials, or deficiencies in test-item construction.
Level 3 Assessment—Behavior	• Most resources/effort should be devoted to Level 3. • This is arguably the most important assessment as there is little point in a good reaction and increase in knowledge if nothing changes once the learner is back on the job. • Input from both graduates and their supervisors are necessary to evaluate the effectiveness of the program. • Involving line management in this level of assessment is critically important, since observation over time is required to assess change, relevance of change, and its sustainability. • The trainee's opinion is relevant but tends to be more subjective and less reliable.
Level 4 Assessment—Results	• Effective Level 4 assessment requires senior management participation, as they are most attuned to their agency's key performance indicators. • As with Level 3, results must be measured over time.
Organizational/ Institutional	• There must be a long-term commitment to collecting necessary data and conducting systematic assessment over time. • Incentives (in the form of either mandates or value in exchange) can be created to drive program participation over time.
Process/ Technology	• A centralized, consistent registration function should be used for all levels of training and types of delivery methods. • The recipient agency should be involved in the enrollment process, even though individual trainees may self-register. • Organizational affiliation, role, supervisor, and so on should be captured for subsequent follow-up assessment, data aggregation, and analysis.

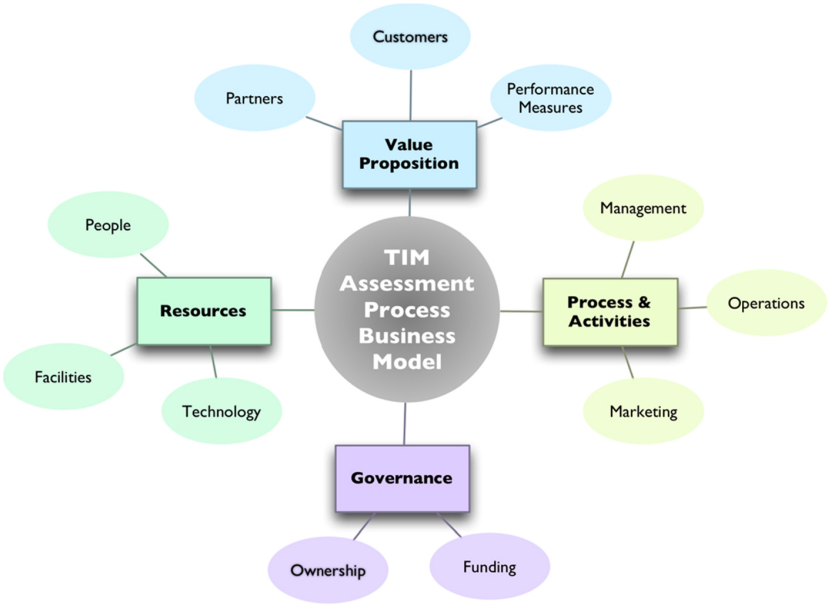

Figure 3.4. Conceptual business model.

fire and rescue, departments of transportation (DOTs), towing and recovery, hazmat, and other disciplines.

b) *Partners* may be needed to engage the wide range of responder disciplines that the TIM training curriculum is designed to reach, particularly in terms of promotion and shaping customers' perceptions of value. Examples of potential partners include AASHTO, CITE, ERSI, various FEMA divisions, and IADLEST.

c) *Performance measurement* will be based on measures of strategic significance to FHWA, participating agencies, and other partners. Examples of these performance measures are roadway clearance time, incident clearance time, and secondary crashes. Example performance measurement categories that the TIM assessment business model can be aligned with include
   - FHWA's Focus States Initiative: TIM Performance Measures, and
   - The National Unified Goal for Traffic Incident Management from the National Traffic Incident Management Coalition.

2. *Governance.* Postimplementation success of Project L32C will also depend on sustained funding, leadership, policies, leadership and decision making.

3. *Process and activities.* A number of key operational processes and activities must be planned and managed over the TIM assessment tool's life cycle.

a) *Management.* The research team expects that management activities will involve how and when the four levels of assessment will be planned, initiated, executed, tracked, and analyzed. These activities include
   - Program management—administering, executing, and enhancing the overall assessment program; and
   - Analysis and reporting—assessing various dimensions of performance from a programwide perspective.

b) *Operations.* These processes will cover day-to-day activities in support of operating, administrating, and maintaining the assessment tool. These include
   - Systems management—including administration, backup/recovery, monitoring, security, and troubleshooting of the computing, network, and storage environment that supports the assessment tool;
   - Application maintenance—implementing bug fixes and functional enhancements to the tool; and
   - Help desk—providing a contact point for end-user assistance and troubleshooting.

c) *Marketing.* These activities will promote initial agency uptake and ongoing use of the assessment tool.

4. *Resources.* Human resources, facilities, and technology will be required to operate and sustain the assessment tool.

a) *People.* Although it is too early to forecast exact headcounts, operation and management of the overall assessment program will require human resources to cover all of the management, operations, and marketing activities described above.

b) *Facilities.* Facilities requirements and costs should be commensurate with final staffing numbers. No unusual facility requirements are foreseen.

c) *Technology.* There will be technology-related costs for operating the TIM assessment program. The research team advocates the use of cloud computing services, open source software, and/or commercial, off-the-shelf software to minimize hardware and software acquisition costs and maintenance fees.

Requirements Analysis

Users of the Assessment and Reporting Tool

Based on the concept of operations, the research team identified the following groups of users who will access the assessment and reporting tool.

- *Participating agency points of contact (POCs).* These are agency-designated staff responsible for the overall administration and day-to-day management of the TIM training program. For example, the POCs ensure that trainees from the agency are properly registered and their pertinent information is updated properly and promptly in the assessment and reporting tool.
- *Trainers.* In addition to teaching the TIM training courses, the trainers will likely create or assist the application administrators in creating pre- and posttraining tests and surveys.
- *Trainees.* These are students of the TIM training program. They will use the assessment tool to take the pretraining tests, posttraining Level 1 reaction surveys, and posttraining Level 2 learning tests.
- *Agency managers.* Agency managers and/or their designated staff will use the assessment and reporting tool to take Level 3 behavior surveys and Level 4 results surveys. They will also be interested in performing various data analyses and generating performance reports.
- *Application administrators.* Application administrators are responsible for the proper setup of all constituents of the assessment and reporting tool, as well as for the creation and maintenance of tests and surveys. Additionally, they will create, maintain, or assist in creating and maintaining assessment reports.

Use Cases

Based on the concept of operations and the assessment and reporting tool's target user groups, the research team developed a set of primary use cases. These use cases define the high-level business requirements and were used as a framework for the subsequent development of the system functional requirements. Table 3.6 summarizes these use cases.

These use cases can be mapped to the three functional areas of the tool introduced previously:

- Survey management—used to execute a particular kind of assessment, from a pretraining assessment survey to a Level 4 (Results) survey long after a training event;
- Constituent relationship management (CRM)—used to manage relationships and communications with all key constituents (e.g., individual students, agency training officers and/or management, and trainers); and
- Analysis and reporting—used to enable program staff as well as participating agencies to analyze and report on training participation, needs, effectiveness, and so on.

Table 3.6. High-Level Use Cases

Use Case	Description
UC01	Administrator captures/modifies a participating agency
UC02	Administrator captures/modifies a contact
UC03	Student takes pretraining assessment test
UC04	Student takes posttraining Reaction survey (Level 1)
UC05	Student takes posttraining Learning test (Level 2)
UC06	Student's supervisor/agency POC submits Behavior survey (Level 3)
UC07	Student's agency management submits Results survey (Level 4)
UC08	TIM program staff/agency personnel perform data analysis
UC09	Administrator authors/modifies surveys/tests
UC10	Administrator authors/modifies analysis reports

Figure 3.5 shows the use case framework in terms of these three blocks of functionality.

The balance of this section describes the process of the main success scenario and alternate scenarios, as applicable, for each use case (Tables 3.6–3.15).

Functional Requirements

Driven by the use cases defined in the previous section, the functional requirements for the system are organized around the three functional areas and the interactions among them.

Architecture

The high-level operational concept and deployment topology of the TIM assessment tool are depicted in Figure 3.6.

Commercial Off-the-Shelf Products and Services

The limited scope, funding, and time frame of this research project dictated maximum use of off-the-shelf technology and little to no custom software development. This drove the selection of the following products and services that were used in the system.

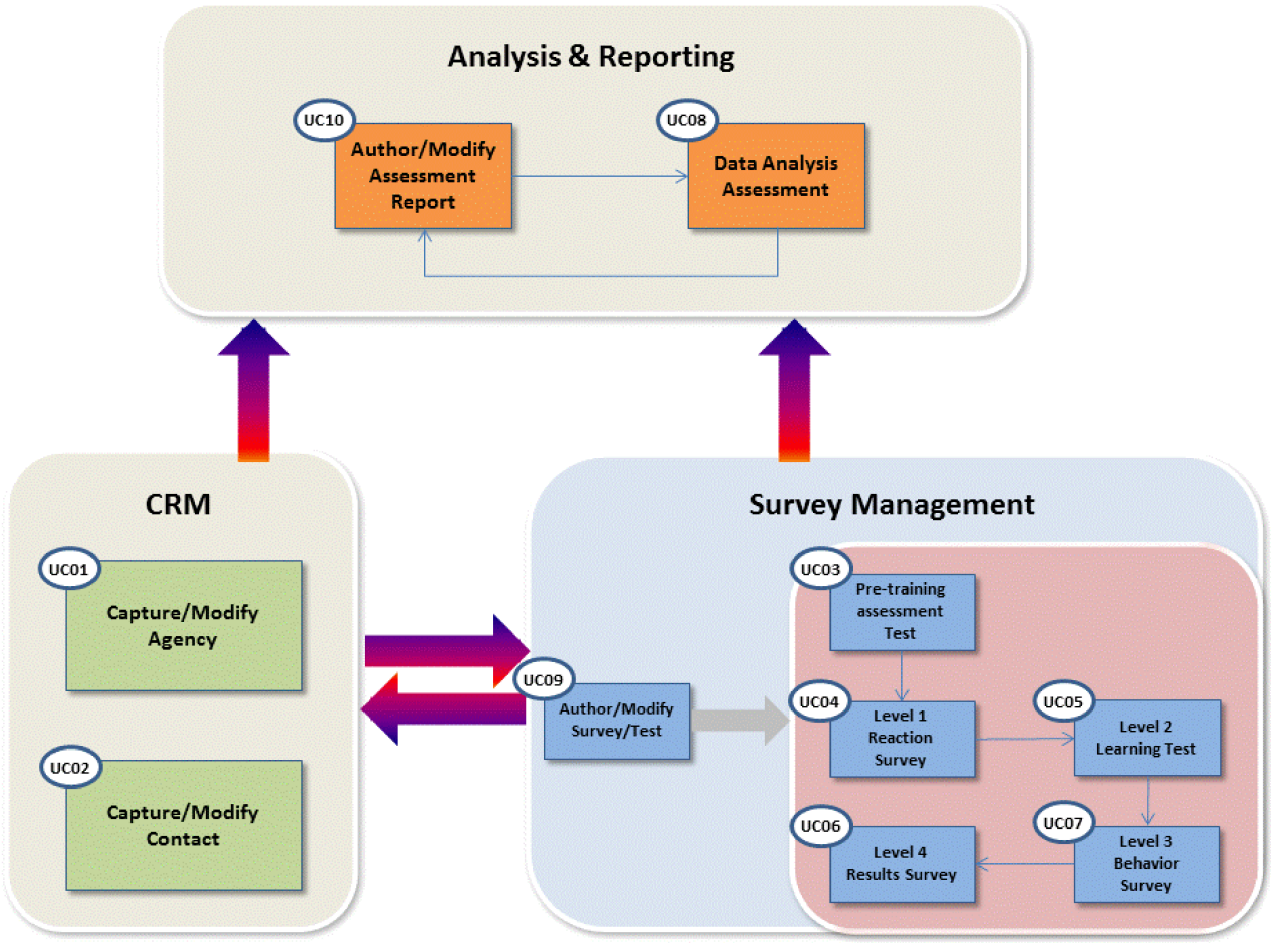

Figure 3.5. Use case framework.

Table 3.7. Administrator Captures/Modifies a Participating Agency

Step	Main Success Scenario	Alternate Scenarios
1	Administrator logs into the system.	
2	Administrator adds a new participating agency.	If the agency already exists, the administrator can modify agency information or delete the agency.
3	Administrator specifies a POC for the newly added agency.	

Table 3.8. Administrator Captures/Modifies a Contact

Step	Main Success Scenario	Alternate Scenarios
1	Administrator logs into the system.	
2	Administrator adds a new contact and assigns the contact to a participating agency.	If the user already exists, the administrator can modify contact information or delete the contact.

Table 3.9. Student Takes Pretraining Assessment Test

Step	Main Success Scenario	Alternate Scenarios
1	Student logs into the system.	If this is a new student, the system will prompt him/her to register and select his/her associated agency.
2	System presents pre-training assessment test to the student.	If the test results are supplied by external sources, the system will import and store the test results.
3	Student completes the test.	Student may save incomplete test and finish later.
4	Student submits test results.	If test is incomplete, system will prompt the student to complete the test before submitting.
5	System saves test results.	

Table 3.10. Student Takes Posttraining Reaction Survey (Level 1)

Step	Main Success Scenario	Alternate Scenarios
1	Student logs into the system immediately following the training class.	
2	System presents Level 1 Reaction survey to the student.	If the survey results are supplied by external sources, the system will import and store the survey results.
3	Student completes the survey.	
4	Student submits survey results.	If survey is incomplete, system will prompt the student to complete the survey before submitting.
5	System saves survey results.	

Table 3.11. Student Takes Posttraining Learning Test (Level 2)

Step	Main Success Scenario	Alternate Scenarios
1	When student submits Level 1 Reaction survey, system presents Level 2 Learning survey/test to the student.	Student will need to login first if not already logged in.
2	Student completes the survey.	If the test results are supplied by external sources, the system will import and store the test results.
3	Student submits test results.	If test is incomplete, system will prompt the student to complete the test before submitting.
4	System saves test results.	

Table 3.12. Student's Supervisor/Agency POC Submits Behavior Survey (Level 3)

Step	Main Success Scenario	Alternate Scenarios
1	A configurable period of time after the class, the system sends reminder to the student's supervisor or the agency's designated personnel about completing Level 3 Behavior survey.	
2	User logs into the system.	
3	User takes the survey.	
4	User completes the survey.	User saves incomplete survey. If survey is not completed after a configurable period of time, system will send reminder to the user to complete the survey.
5	User submits survey results.	If survey is incomplete, system will prompt the user to complete the survey before submitting.
6	System saves survey results.	

Table 3.13. Agency Management Submits Results Survey (Level 4)

Step	Main Success Scenario	Alternate Scenarios
1	A configurable period of time after the class, the system sends reminder to the agency's manager about completing Level 4 Results survey.	
2	User logs into the system.	
3	User takes the survey.	
4	User completes the survey.	User saves incomplete survey. If survey is not completed after a configurable period of time, system will send reminder to the user to complete the survey.
5	User submits survey results.	If survey is incomplete, system will prompt the user to complete the survey before submitting.
6	System saves survey results.	

Table 3.14. TIM Program Staff/Agency Personnel Perform Data Analysis

Step	Main Success Scenario	Alternate Scenarios
1	User logs into the system.	
2	User selects a report.	
3	User specifies report parameters.	There are no parameters for the report.
4	System performs data analysis.	
5	System generates report.	
6	User saves the report.	

Table 3.15. Administrator Authors/Modifies Surveys/Tests

Step	Main Success Scenario	Alternate Scenarios
1	Administrator logs into the system.	
2	Administrator authors a new survey or test.	If the survey/test already exists, the administrator can modify or delete it.
3	Administrator saves the new or modified survey/test.	Administrator discards the changes.

Table 3.16. Administrator Authors/Modifies Analysis Reports

Step	Main Success Scenario	Alternate Scenarios
1	Administrator logs into the system.	
2	Administrator authors a new data analysis report.	If the report already exists, the administrator can modify or delete it.
3	Administrator saves the new or modified report.	Administrator discards the changes.

Table 3.17. CRM Requirements

Requirement ID	Description
CRM-1	The system shall allow administrators to create different types of constituents such as participating agencies, trainers, and trainees.
CRM-2	The system shall maintain pertinent information about each constituent.
CRM-3	The system shall allow administrators to modify or delete existing constituents.
CRM-4	The system shall allow authorized users to create calendar events for constituents.
CRM-5	The system shall manage follow-up tasks such as sending notifications or reminders to constituents to take appropriate surveys.
CRM-6	The system shall allow administrators to import constituent-related information such as newly registered trainees and the training classes for which they registered.

Table 3.18. Survey Management Requirements

Requirement ID	Description
SVY-1	The system shall allow an authorized user to take a survey.
SVY-2	The system shall allow a user to save an incomplete survey and finish it at a later time.
SVY-3	The system shall allow a user to submit a completed survey.
SVY-4	The system shall allow an administrator to create new surveys.
SVY-5	The system shall allow an administrator to modify or delete existing surveys.
SVY-6	The system shall be accessible to users with Internet connectivity and current versions of Internet browsers.
SVY-7	The system shall allow an authorized user to import survey results from external sources.

Table 3.19. Analysis and Reporting Requirements

Requirement ID	Description
AR-1	The system shall allow an authorized user to create new data analysis reports.
AR-2	The system shall allow an authorized user to modify or delete existing analysis reports.
AR-3	The system shall allow reports to have zero or more input parameters.
AR-4	The system shall provide data aggregation capability.
AR-5	The system shall provide data filtering capability.
AR-6	The system shall allow reports to be saved in PDF and/or other appropriate formats.

Table 3.20. Integration Requirements

Requirement ID	Description
INT-1	The Survey Management component shall provide survey access information (such as a URL) to the CRM component.
INT-2	The CRM component shall provide survey access information to the recipient when sending out notification or reminder for the recipient to take the survey.
INT-3	The CRM component shall provide certain pertinent information such as agency name and department to the Survey Management component.
INT-4	The Survey Management component shall provide survey results to the Analysis and Reporting component.
INT-5	The CRM component shall provide certain pertinent information such as agency name, department, and state to the Analysis and Reporting component.
INT-6	The Survey Management component shall provide survey results to the Analysis and Reporting component.

CRM

Salesforce.com (www.salesforce.com) is a market-leading customer/constituent relationship management (CRM) system that is delivered as software-as-a-service (SaaS). In a SaaS model, an organization subscribes for a particular service level and pays a monthly or annual usage fee, and the vendor hosts and manages the entire application environment in the cloud. No hardware or software needs to be purchased, managed, or maintained, and the application is accessed through a web browser.

Salesforce.com was selected for this project for numerous reasons, including its

- Market leadership status;
- Completeness of functionality in key areas related to managing information about organizations/agencies, individual contacts, and scheduling and tracking follow-up activities and communications;
- Ease of customization and integration with other systems; and
- Adoption by various federal agencies, including the U.S. DOT.

Salesforce.com features that were used in the TIM assessment tool include the following:

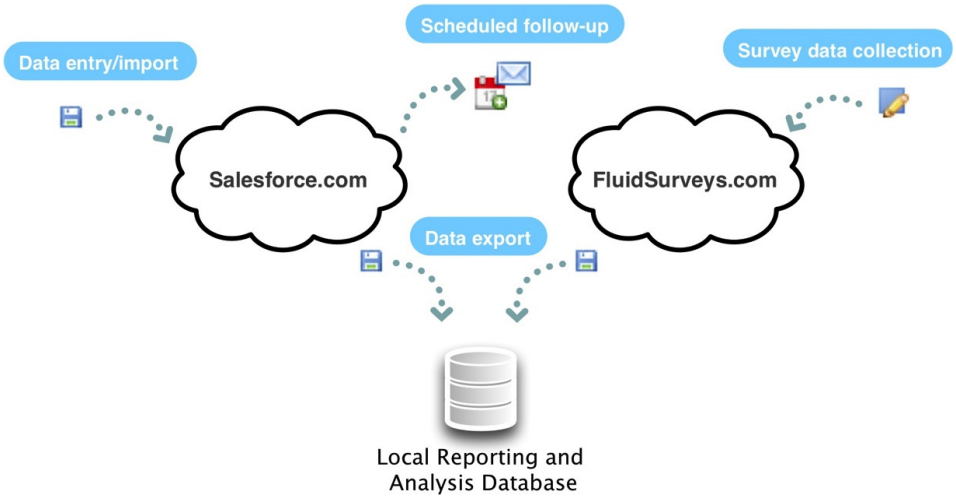

Figure 3.6. System architecture.

- Contact management—adding and updating information about people and the entities with which they are associated;
- Activity tracking—creating follow-up tasks, calls, e-mails, and other relevant events associated with people or entities;
- Workflows—triggering time- and event-based activities related to people or entities;
- Reports—with tabular lists of people or entities by state, responder discipline [emergency medical services (EMS), law enforcement, etc.], and other attributes; and
- Data loader—importing data from external sources and exporting data for more complex reporting and analysis.

Survey Management

FluidSurveys (www.fluidsurveys.com) is a widely used survey management system that is also delivered in SaaS form. FluidSurveys was selected because it is

- A complete survey authoring and collection system;
- Cost-effective and easy-to-use; and
- Simple to integrate with Salesforce.com.

FluidSurveys features that were used in the TIM assessment tool include

- Drag-and-drop editor for authoring and modifying surveys;
- Multiple question types (only a few of the 35+ types were used);
- Styling tool to create a theme and brand surveys;
- Online survey results collection; and
- Surveys exportable to printable format.

Analysis and Reporting

The research team selected Microsoft Access for the initial implementation of the TIM analysis and reporting functionality. The rationale for using this product is that

- It is a commonly installed component of the Microsoft Office suite.
- Users with analysis and reporting responsibilities are usually familiar with it.
- Access databases can be readily up-scaled to SQL Server.

The Access database is as a repository containing data from both CRM and survey applications. These data are used to generate reports and answer questions such as "What percentage of trainees from each state found the training helpful to their job performance?" and "What percentage of agencies saw TIM performance improvement after participating in TIM training?"

Data and Integration Models

Information about TIM stakeholders is managed in Salesforce.com. A simplified view of the core Salesforce.com data model applicable to this project is shown in Figure 3.7.

An account object represents an agency or organization, which can have many associated contacts. In turn, each contact can have many associated tasks and events. This is the fundamental, hierarchical data structure that is managed by this portion of the TIM assessment tool.

Information about training effectiveness is collected using FluidSurveys. The FluidSurveys data model is very simple. Each survey that is "published" is accessible at a unique URL and associated with a specific survey collector ID. As surveys are completed, the data are stored in the FluidSurveys cloud. At any point, an authorized user can export the collected data in a variety of formats. Each record is a self-contained representation of the survey, consisting of information collected by the system (date, time started, time completed, etc.), each question, and each response.

While both Salesforce.com and FluidSurveys provide built-in reporting capabilities, these are mainly oriented to generating lists and tabular reports of current information. Historical reporting and analysis over time requires the use of a separate database to accumulate information for these purposes, which is why it is part of the system.

By design, the overall system architecture is loosely coupled to simplify development and preserve flexibility. While both Salesforce.com and FluidSurveys provide comprehensive application programming interfaces (APIs), a simpler integration model based on data export/import scripts supports all of the use cases envisioned within the scope of the L32C project. These points of integration are shown in Figure 3.6.

Registration data from Project L32B/NHI is imported into Salesforce.com using the service's built-in data loader. Other sources of contact/agency data (e.g., rosters from previous classes and workshops, mailing lists) can be imported through the same mechanism. Data are exported to the reporting and analysis database using the FluidSurveys export tool, then imported using the Salesforce.com data loader.

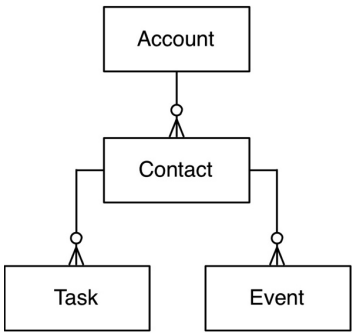

Figure 3.7. Simplified core CRM data model.

Functional Specifications

The functional specifications for the TIM assessment tool fall into two broad categories: user-visible functions and the design of the reporting and analysis database. Each category is discussed in the following sections.

User-Visible Functions

Each major user-visible function of the TIM assessment tool is explained in terms of the use cases described previously. (See Tables 3.21–3.30 and Figures 3.8–3.24.)

Database Design

The TIM assessment tool database is designed for the purpose of data analysis and reporting. It assimilates data from both the CRM and the Survey Management software. The database contains the following tables:

1. Organizations;
2. Contacts;
3. Responses; and
4. Answer keys.

Figure 3.25 shows an entity relationship diagram of the tool's database.

Guiding Principles

The research team used the following guiding principles when designing the database:

a) The database shall not contain information that links a particular survey response or test results to a specific trainee.
b) The database shall be flexible and scalable to accommodate future survey changes or expansion.
c) The database shall allow for ease of reports creation.

As a result of adhering to guiding principle (*a*), certain essential information required for analysis and reporting will need to be collected as a part of each Level 1 and Level 2 survey. The trainee will need to provide the following information:

- Agency;
- Discipline (DOT, EMS, law enforcement, etc.);
- Number of years in the position;
- Affiliation (paid professional or volunteer);
- Reason for training;
- If this is a retake;
- If this is an online course;
- Training session start date;
- Training session city; and
- Training session state.

(*text continues on page 44*)

Table 3.21. UC01: Administrator Captures/Modifies Participating Agency

Topic	Specifications
Description	This function is used to add, change, or delete information about any agency, organization, company, or other entity that participates in the TIM training program. The function was implemented by customizing the Salesforce.com account-related form's layouts and fields.
Actors	Constituent Data Administrator (CDA, which is a role or responsibility)
Preconditions	The CDA has to be logged into the CRM module and have permission to edit account objects.
Inputs	Data from an external source, such as list of registrants for a training class
Events sequence	The CDA is able to create a new account by clicking the "New" button on the Accounts home screen, which takes him/her to the New Account screen. Account Name is the only required field and is the link that connects all contacts to an account. Note that Salesforce.com can model an organizational hierarchy through the optional Parent Account field. Whether or not to implement this field is a business decision. Once the account-related information has been entered, the CDA can click the "Save" button, or "Cancel" to exit without saving. The CDA has numerous ways to look up an account to modify it, including a dropdown list of all accounts and numerous preconfigured views or reports—all accessible on the Accounts home page. A search box at the top of every screen in the CRM module can also be used to locate the desired account. Once the target account is located, double-clicking on the account name will open the Account Detail screen. The CDA can click the "Edit" button, modify any of the necessary fields, then click the "Save" button to apply the changes, or "Cancel" to exit without saving.
Postconditions	The new account (agency, organization, etc.) is created or modified.
Requirements map	CRM-1, CRM-2, CRM-3, CRM-4
Related user interface (UI)	Figures 3.8–3.10

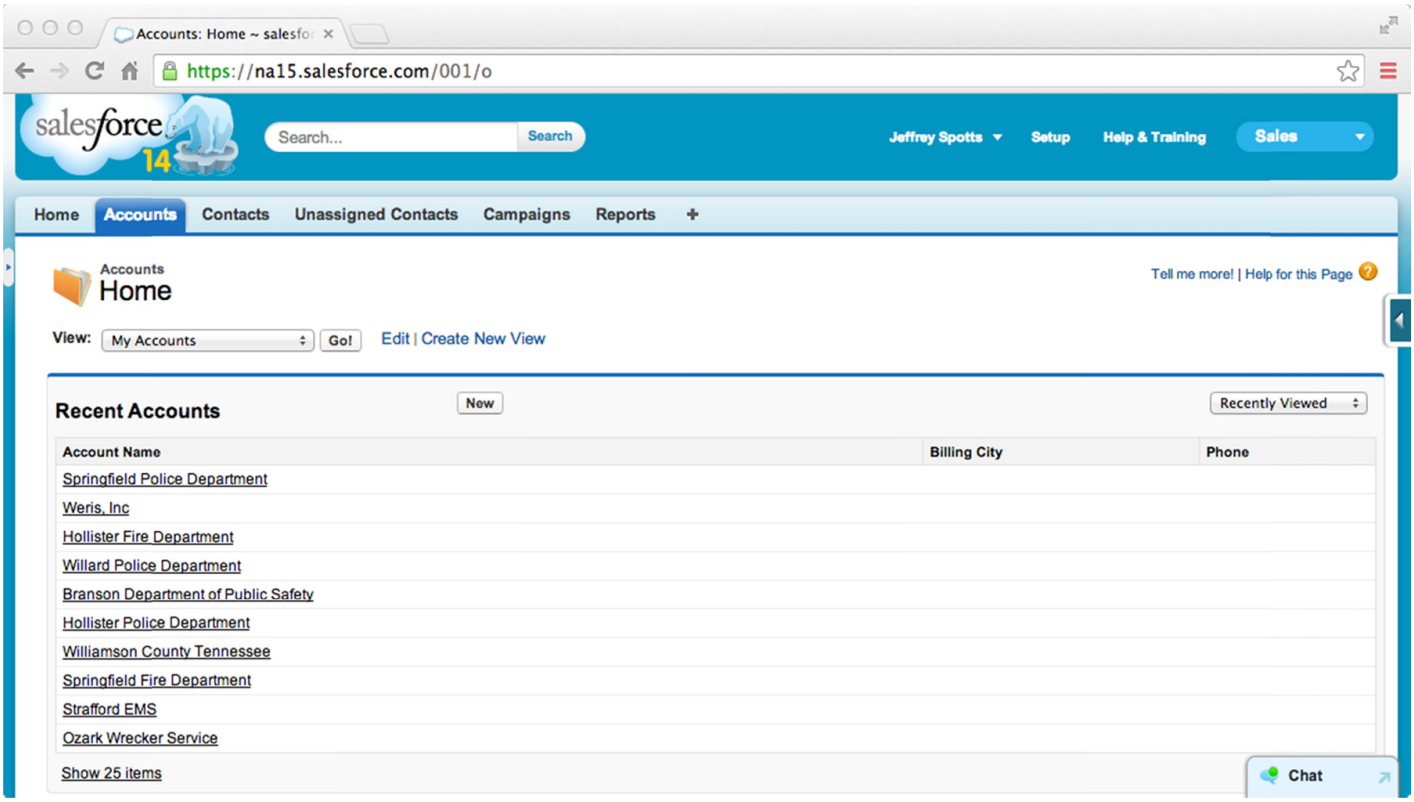

Figure 3.8. Accounts home screen.

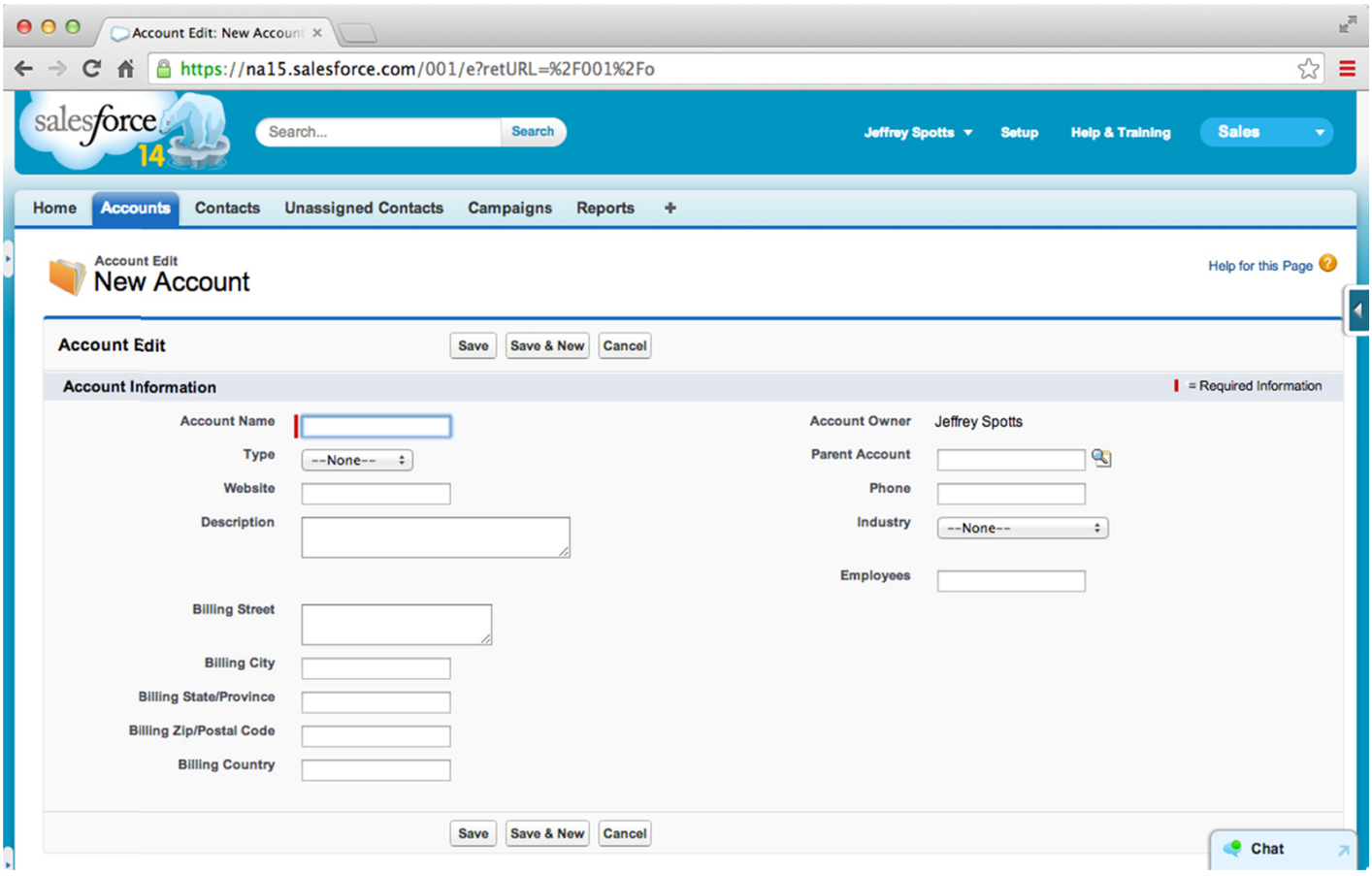

Figure 3.9. New account screen.

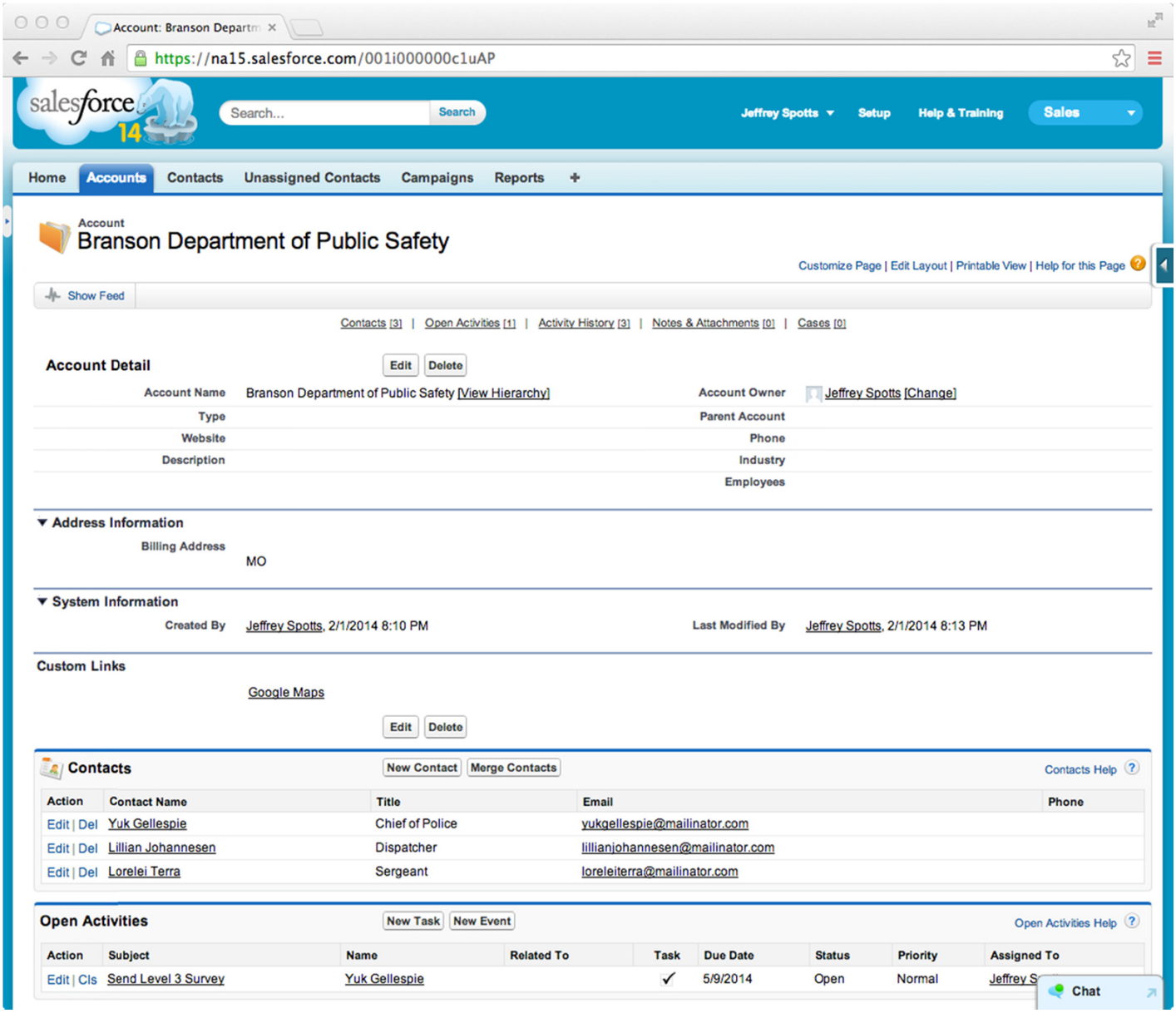

Figure 3.10. Accounts detail screen.

Table 3.22. UC02: Administrator Captures/Modifies Contact

Topic	Specifications
Description	This function is used to add, change, or delete information about any person who participates in the TIM training program. The function was implemented by customizing the Salesforce.com contact form layout and fields.
Actors	CDA (which is a role or responsibility)
Preconditions	The CDA has to be logged into the CRM module and have permission to edit contact objects.
Inputs	Data from external source, such as list of registrants for a training class
Events sequence	The CDA is able to create a new contact by clicking the "New" button on the Contacts home screen, which takes him/her to the New Contact screen. As described for UC01 (Table 3.21), Account Name forms the link between Accounts and Contacts and is thus a required field. A look-up function (accessed by clicking a magnifying glass symbol) can be used to find the account with which the contact is associated. Note that Salesforce.com can also model reporting relationships through the optional Reports To field. Whether or not to use this field is a business decision. Once the contact-related information has been entered, the CDA can click the "Save" button, or "Cancel" to exit without saving. The CDA will have numerous ways to look up a contact to modify information about the individual, including a dropdown list of all contacts, a drilldown by account, and numerous preconfigured views or reports—all accessible on the Contacts home page. A search box at the top of every screen in the CRM module can also be used to locate the desired contact. Once the target contact is located, double-clicking on the contact name will open the Contact Detail screen. The CDA can click the "Edit" button, modify any of the necessary fields, then click the "Save" button to apply the changes, or "Cancel" to exit without saving. A contact's link to training events is captured using Salesforce.com's Campaign functionality. An individual contact's training history can be seen in the Campaign History of the Contact Detail screen. Training events are defined as campaigns, which can be seen in the Campaigns home and Campaign Detail screens. The Campaign Members section of the latter screen shows the linkage of multiple contacts to a particular training event.
Postconditions	The new contact is created or modified and linked to the correct account.
Requirements map	CRM-1, CRM-2, CRM-3, CRM-4
Related UI	Figures 3.11–3.15

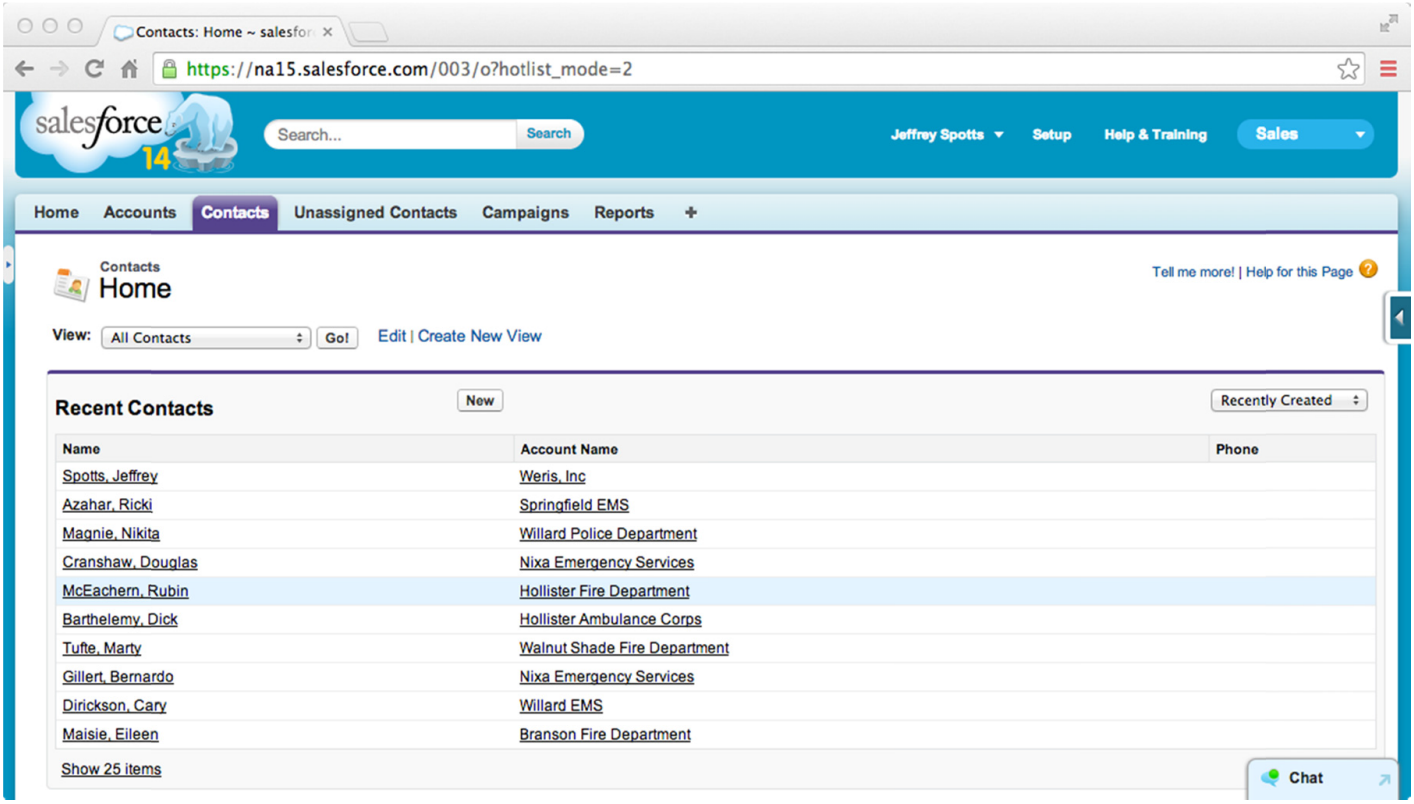

Figure 3.11. Contacts home screen.

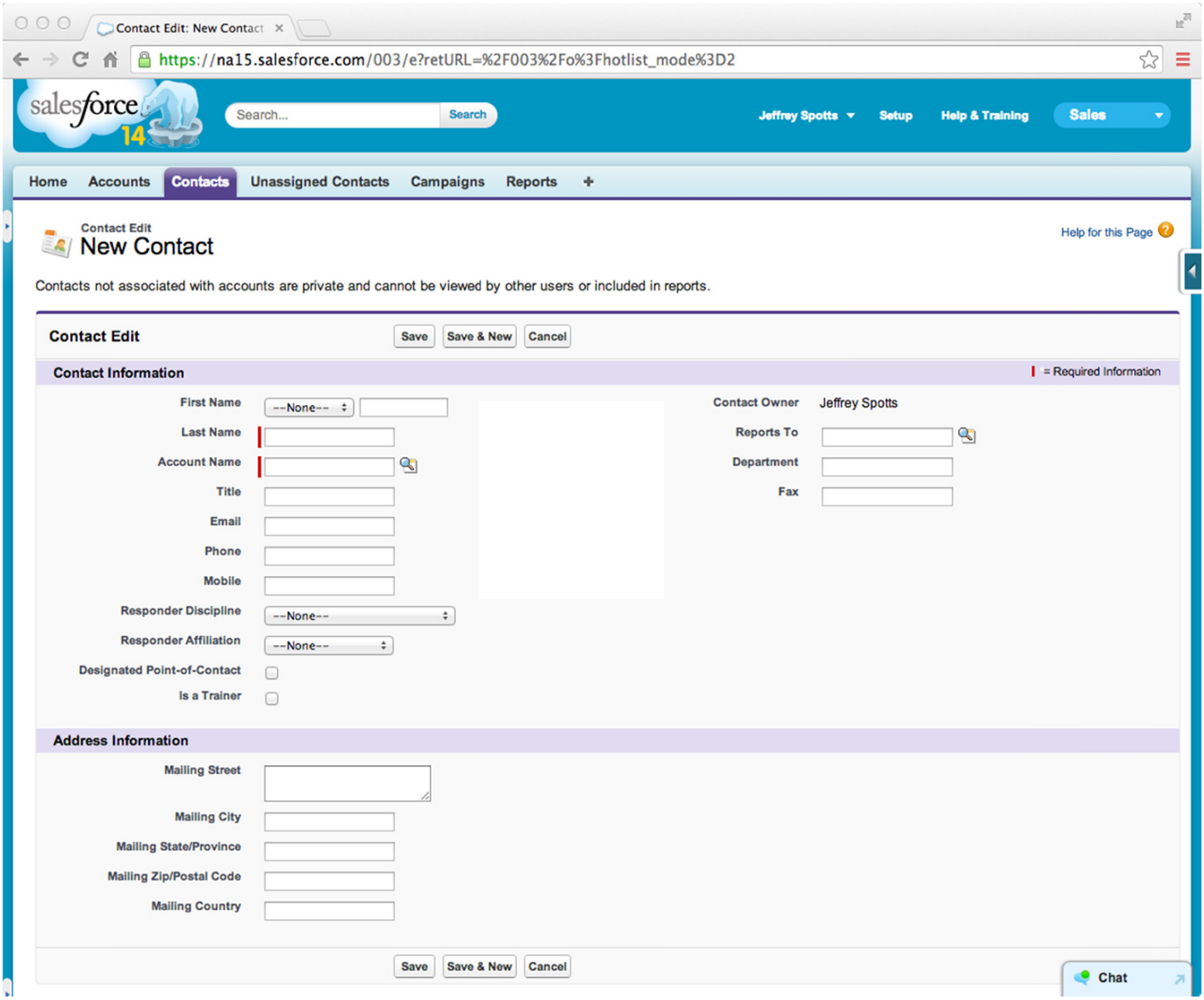

Figure 3.12. New contact screen.

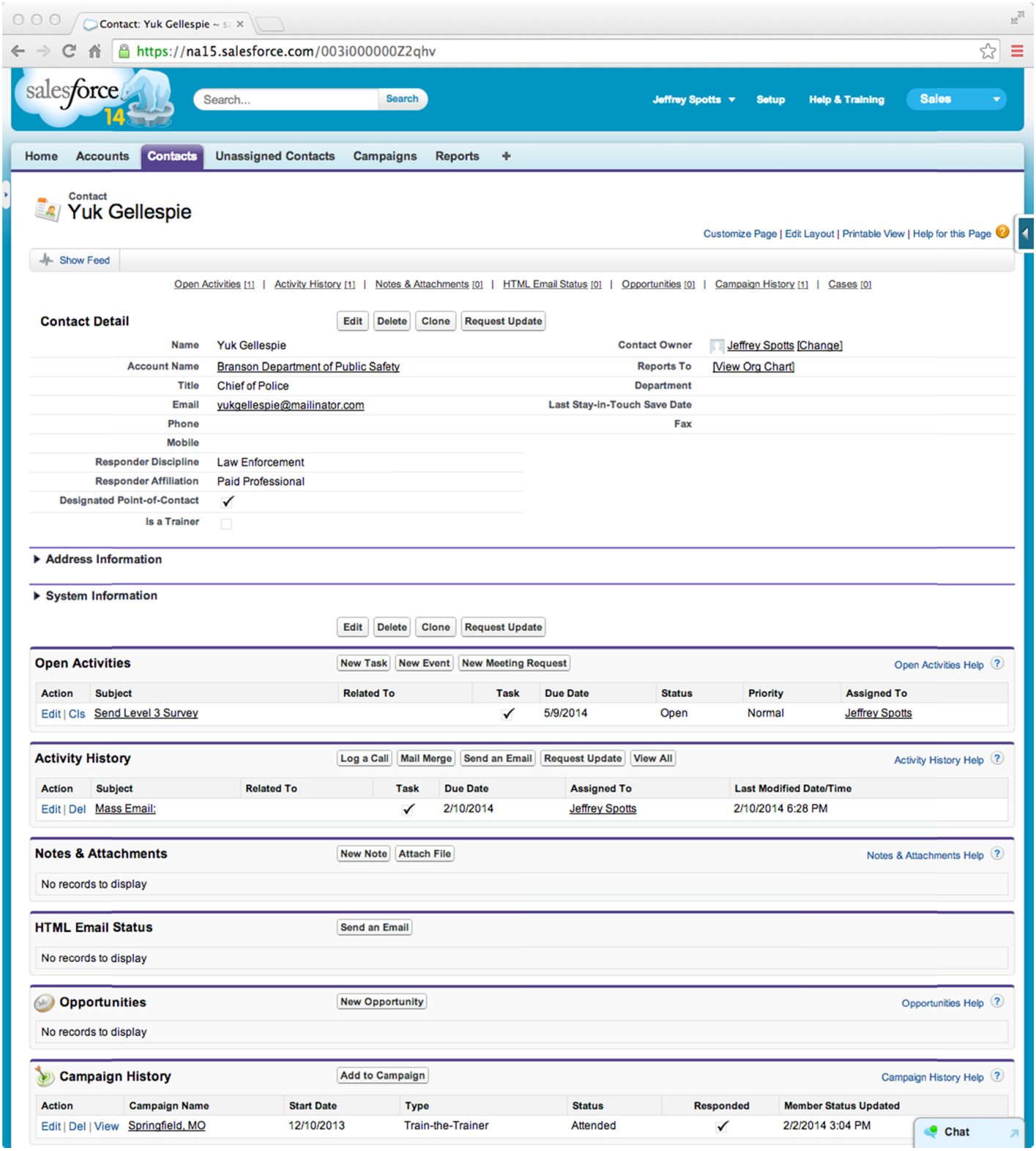

Figure 3.13. Contacts detail screen.

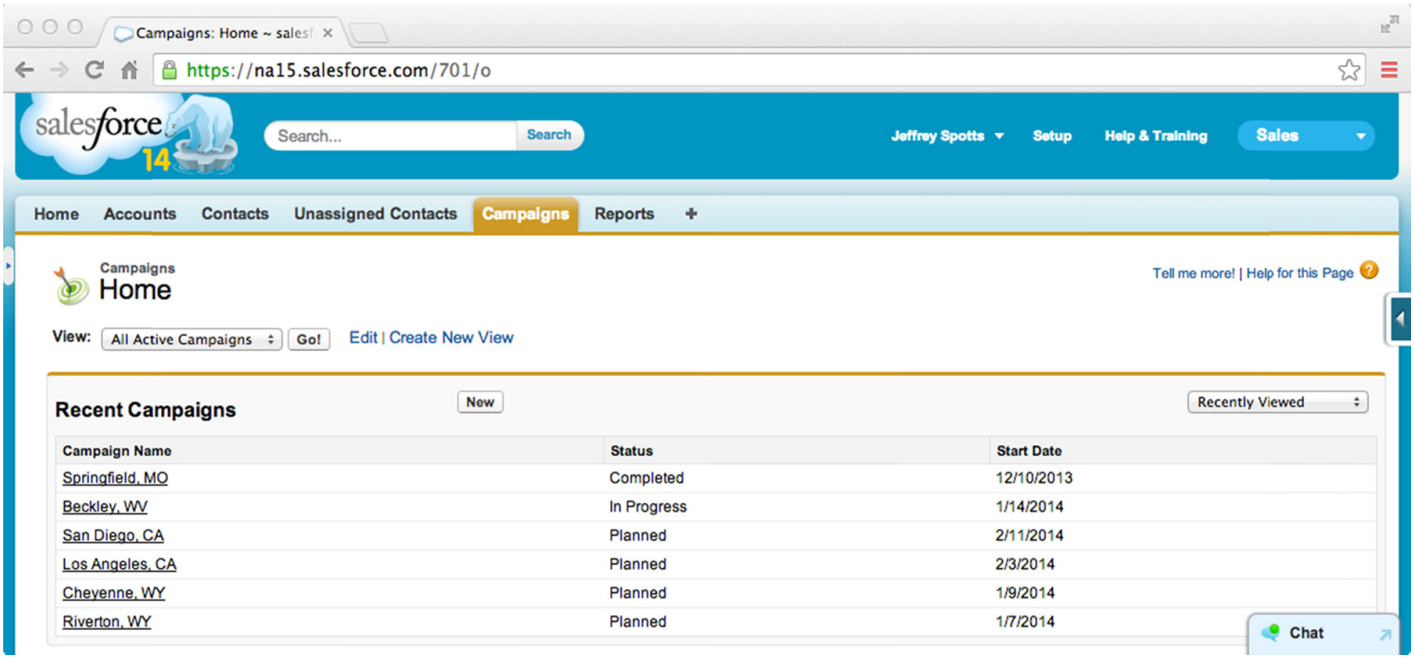

Figure 3.14. Campaigns home screen.

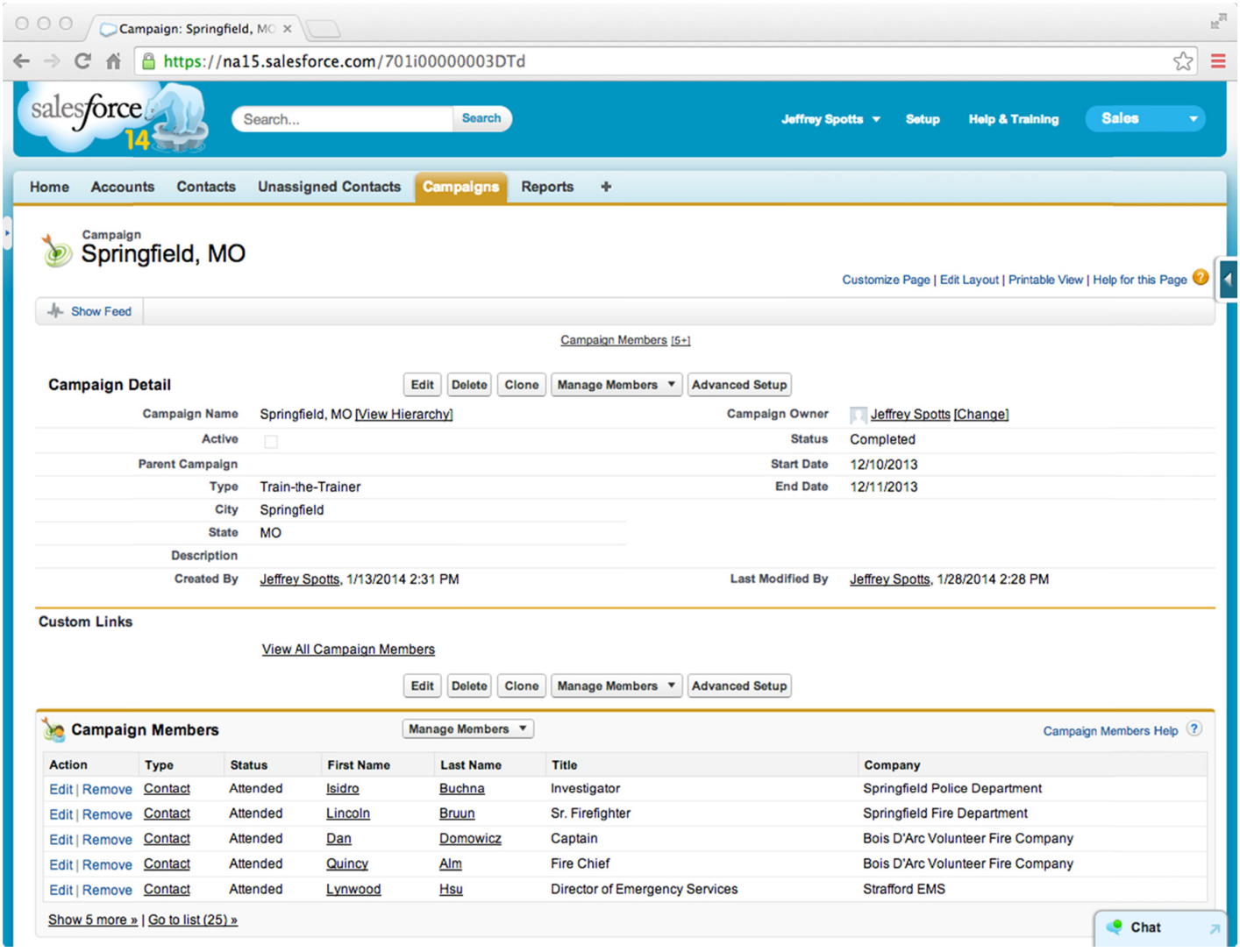

Figure 3.15. Campaigns detail screen.

Table 3.23. UC03: Student Takes Pretraining Assessment Test

Topic	Specifications
Description	This function allows the TIM training program to assess a student's knowledge before he/she participates in a training course or module. This function was implemented through FluidSurveys' data collection capabilities.
Actors	Student, plus a Survey Data Administrator (SDA, which is a role or responsibility) in the case of a paper-based assessment
Preconditions	The survey has been authored and published on the web and, optionally, exported to PDF format to make it print-ready—all as described in UC09 (Table 3.29). The student has been provided with a URL to take the assessment online or has been provided with a paper-based version of the assessment vehicle that will be entered into the online system by the SDA, who must be logged into the Survey Management module to do so.
Inputs	Online: na Paper-based: Completed assessment form
Events sequence	Online: The student enters the URL provided into his/her preferred web browser and begins to enter his/her responses. Alternatively, if the URL has been e-mailed to the student, the e-mail client software may allow him/her to click through to the target URL. An on-screen progress bar shows percentage completed. When all required questions have been answered, the student clicks "Submit" to save his/her responses. Paper-based: The SDA visits an administrative URL and follows a similar procedure to enter the student's written responses into the Survey Management module.
Outputs	na
Postconditions	The student's responses are recorded and available for subsequent reporting and analysis.
Requirements map	SVY-1, SVY-2, SVY-3, SVY-6, SVY-7
Related UI	Variant of 3.17

Note: na = not applicable.

Table 3.24. UC04: Student Takes Posttraining Reaction Survey (Level 1)

Topic	Specifications
Description	This function allows the TIM training program to assess a student's reaction to a training course. This function was implemented through FluidSurveys' data collection capabilities.
Actors	Student, plus an SDA (which is a role or responsibility) in the case of a paper-based assessment
Preconditions	The student has been provided with a URL to take the assessment online or has been provided with a paper-based version of the assessment vehicle that will be entered into the online system by the SDA.
Inputs	Online: na Paper-based: Completed assessment form
Events sequence	Online: The student enters the URL provided into his/her preferred web browser and begins to enter his/her responses. Alternatively, if the URL has been e-mailed to the student, the e-mail client software may allow him/her to click through to the target URL. An on-screen progress bar shows percentage completed. When all required questions have been answered, the student clicks "Submit" to save his/her responses. Paper-based: The SDA visits an administrative URL and follows a similar procedure to enter the student's written responses into the Survey Management module.
Outputs	na
Postconditions	The student's responses are recorded and available for subsequent reporting and analysis.
Requirements map	SVY-1, SVY-2, SVY-3, SVY-6, SVY-7
Related UI	Figure 3.16

Note: na = not applicable.

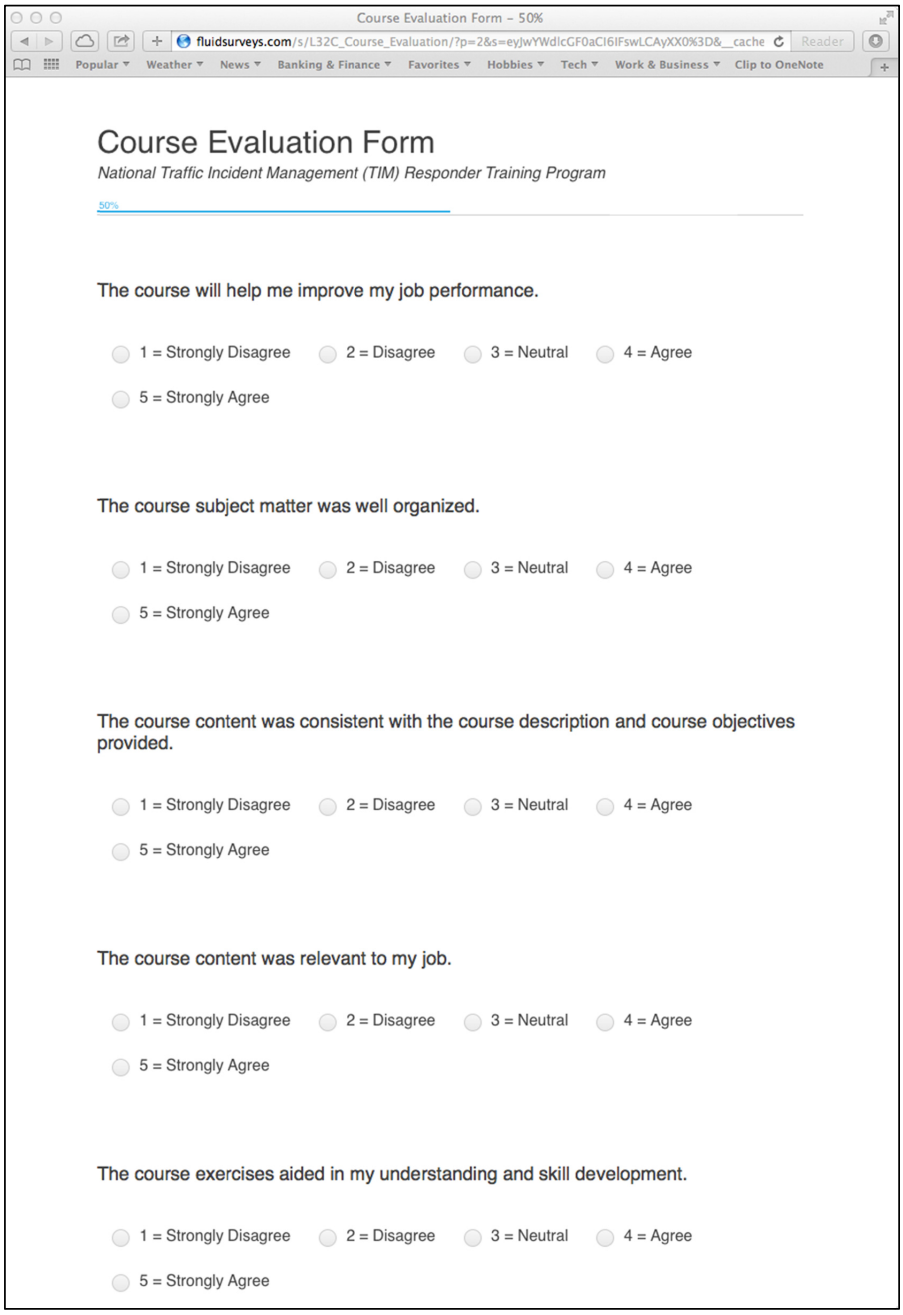

Figure 3.16. Level 1 reaction survey.

Table 3.25. UC05: Student Takes Posttraining Learning Test (Level 2)

Topic	Specifications
Description	This function allows the TIM training program to assess how well a student has learned material presented in a training course or module. This function was implemented through FluidSurveys' data collection capabilities.
Actors	Student, plus an SDA (which is a role or responsibility) in the case of a paper-based assessment
Preconditions	The student has been provided with a URL to take the assessment online or has been provided with a paper-based version of the assessment vehicle that will be entered into the online system by the SDA.
Inputs	Online: na Paper-based: Completed assessment form
Events sequence	Online: The student enters the URL provided into his/her preferred web browser and begins to enter his/her responses. Alternatively, if the URL has been e-mailed to the student, the e-mail client software may allow him/her to click through to the target URL. An on-screen progress bar shows percentage completed. When all required questions have been answered, the student clicks "Submit" to save his/her responses. Paper-based: The SDA visits an administrative URL and follows a similar procedure to enter the student's written responses into the Survey Management module.
Outputs	na
Postconditions	The student's responses are recorded and available for subsequent reporting and analysis.
Requirements map	SVY-1, SVY-2, SVY-3, SVY-6, SVY-7
Related UI	Figure 3.17

Note: na = not applicable.

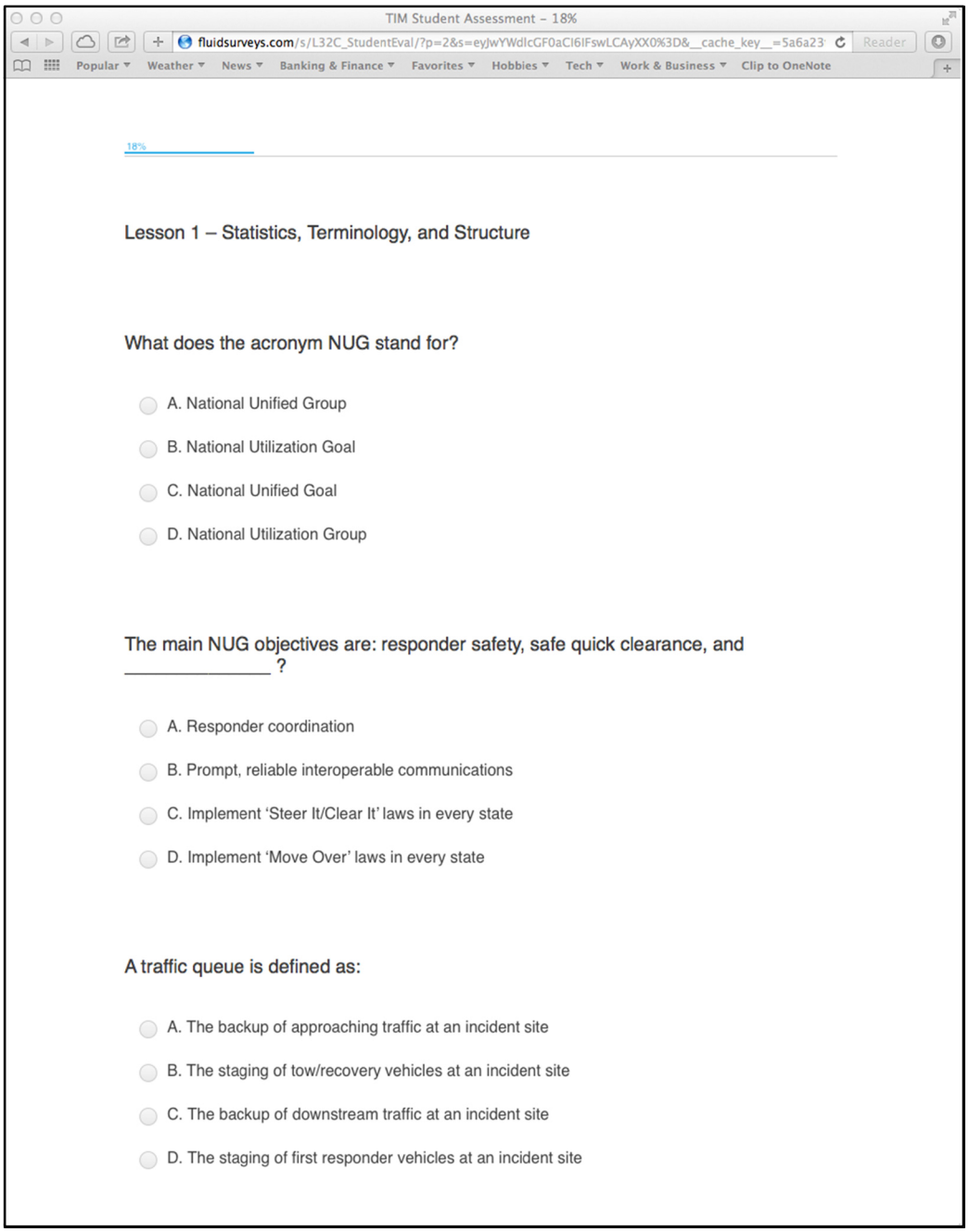

Figure 3.17. Level 2 learning survey.

Table 3.26. UC06: Student's Supervisor/Agency POC Submits Behavior Survey (Level 3)

Topic	Specifications
Description	This function allows the TIM training program to assess long-term changes in student behavior. This function was implemented through FluidSurveys' data collection capabilities. The follow-up activity is scheduled by a Salesforce.com workflow. The request to complete the survey may be sent as an e-mail from Salesforce.com, in which case it will be recorded as an activity related to the contact. Such an e-mail will contain the URL at which the recipient can complete the survey. The request can also be sent by mail (a manual process) and, optionally, recorded as an activity related to the contact.
Actors	Designated point of contact (POC) at an organization whose personnel have participated in the TIM training program, plus an SDA (which is a role or responsibility) in the case of a paper-based assessment
Preconditions	The POC has been provided with a URL to take the assessment online or has been provided with a paper-based version of the assessment vehicle that will be entered into the online system by the SDA.
Inputs	Online: na Paper-based: Completed survey form
Events sequence	Online: The POC enters the URL provided into his/her preferred web browser and begins to enter his/her responses. Alternatively, if the URL has been e-mailed to the POC, the e-mail client software may allow him/her to click through to the target URL. An on-screen progress bar shows percentage completed. When all required questions have been answered, the POC clicks "Submit" to save his/her responses. Paper-based: The SDA visits an administrative URL and follows a similar procedure to enter the POC's written responses into the Survey Management module.
Postconditions	The POC's responses are recorded and available for subsequent reporting and analysis.
Requirements map	CRM-4, CRM-5, SVY-1, SVY-2, SVY-3, SVY-6, SVY-7
Related UI	Figure 3.18

Note: na = not applicable.

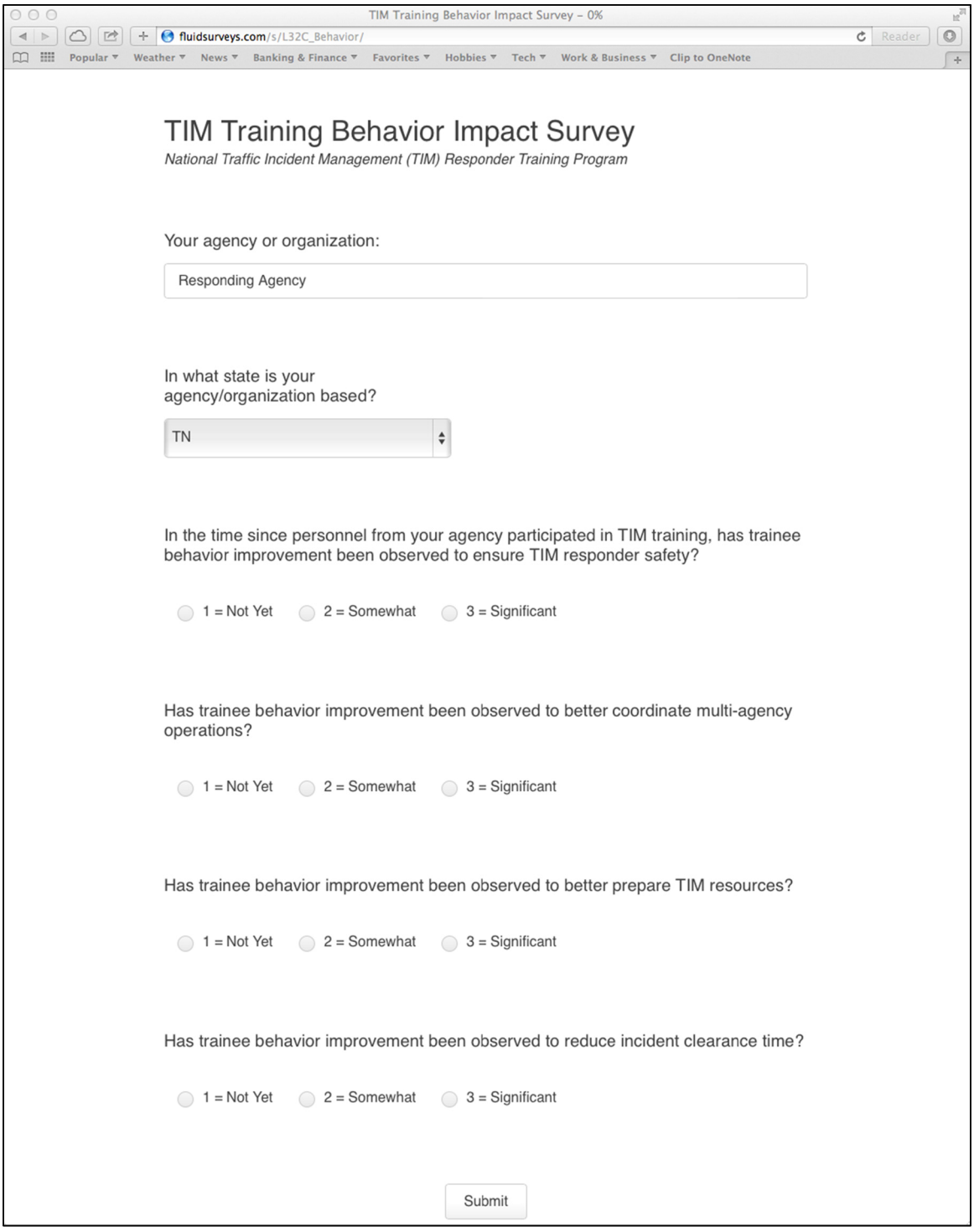

Figure 3.18. Level 3 behavior impact survey.

Table 3.27. UC07: Student's Agency Management/POC Submits Results Survey (Level 4)

Topic	Specifications
Description	This function allows the TIM training program to assess long-term changes in strategic outcomes after an organization's personnel have participated in a training event. This function was implemented through FluidSurveys' data collection capabilities. The follow-up activity is scheduled by a Salesforce.com workflow. The request to complete the survey may be sent as an e-mail from Salesforce.com, in which case it will be recorded as an activity related to the contact. Such an e-mail will contain the URL at which the recipient can complete the survey. The request can also be sent by mail (a manual process) and, optionally, recorded as an activity related to the contact.
Actors	Designated POC at an organization whose personnel have participated in the TIM training program, plus an SDA (which is a role or responsibility) in the case of a paper-based assessment
Preconditions	The POC has been provided with a URL to take the assessment online or has been provided with a paper-based version of the assessment vehicle that will be entered into the online system by the SDA.
Inputs	Online: na Paper-based: Completed survey form
Events sequence	Online: The POC enters the URL provided into his/her preferred web browser and begins to enter his/her responses. Alternatively, if the URL has been e-mailed to the POC, the e-mail client software may allow him/her to click through to the target URL. An on-screen progress bar shows percentage completed. When all required questions have been answered, the POC clicks "Submit" to save his/her responses. Paper-based: The SDA visits an administrative URL and follows a similar procedure to enter the POC's written responses into the Survey Management module.
Postconditions	The POC's responses are recorded and available for subsequent reporting and analysis.
Requirements map	CRM-4, CRM-5, SVY-1, SVY-2, SVY-3, SVY-6, SVY-7
Related UI	Figure 3.19

Note: na = not applicable.

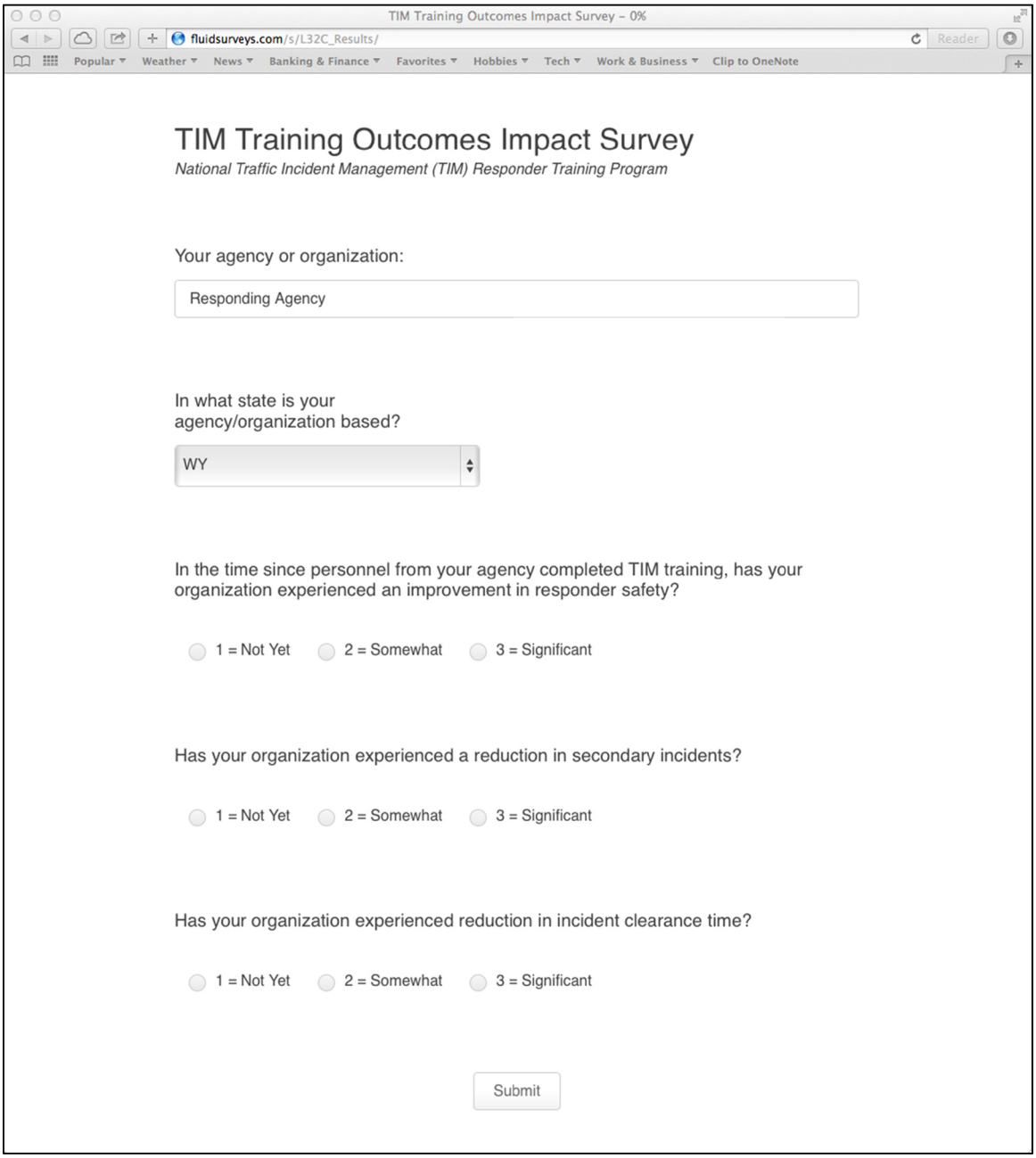

Figure 3.19. Level 4 online survey example.

Table 3.28. UC08: TIM Program Staff/Agency Personnel Perform Data Analysis

Topic	Specifications
Description	This function allows TIM program staff or agency personnel to perform analysis on data collected via Level 1 through Level 4 surveys. Data analysis is performed using a Microsoft Access–based assessment tool. A set of predefined assessment reports was created as part of this tool. The reports answer questions such as whether students think the TIM course helps their job performance, how well students scored on each lesson, and whether participating agencies see TIM performance improvement after the training. Reports can be aggregated by agency, state, discipline, student affiliation, or training method as appropriate.
Actors	Program manager or analyst
Preconditions	Predefined reports have been created in Access. The user has been granted login credentials and access privileges to run reports and to save them in PDF format or export them to Excel.
Inputs	Organization and contact information from Salesforce.com, survey results from FluidSurveys
Events sequence	The user logs into the assessment reporting tool and navigates through the user interface to select the report level (1–4) and a desired report. He/she may also specify data filters and/or report aggregation level when appropriate and desired. The user will run the selected report and save the report as a PDF file or export the data to a CSV/Excel file.
Outputs	A PDF report of CSV/Excel data file
Postconditions	The report file or data file can be distributed; the Excel data file can be further analyzed.
Requirements map	AR-3, AR-4, AR-5, AR-6
Related UI	Figures 3.20 and 3.21

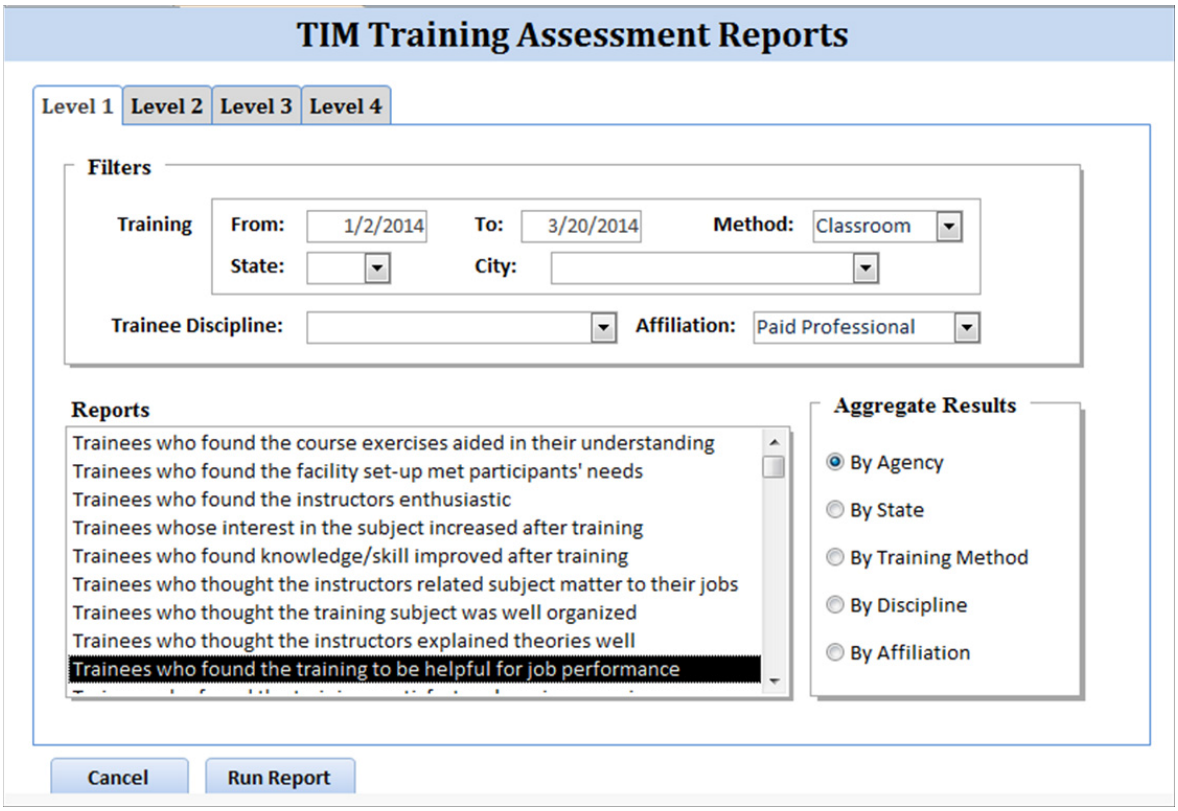

Figure 3.20. Select and run assessment reports.

Trainees Who Found The Training To Be Helpful For Job Performance

by Organization

Affiliation: Paid Professional

Organization Name	% Responders	# Responders
Branson Department of Public Safety	100%	1
Ozark Fire Department	100%	1
Ozark Wrecker Service	25%	4
Springfield EMS	50%	4
Willard EMS	50%	2
Willard Police Department	60%	5

Figure 3.21. Sample assessment report.

Table 3.29. UC09: Administrator Authors/Modifies Surveys/Tests

Topic	Specifications
Description	This function allows the TIM training program to create new assessment vehicles or change existing ones. This function was implemented through FluidSurveys' survey authoring capabilities.
Actors	Survey Author (SA, which is a role or responsibility)
Preconditions	The SA is familiar with training objectives and desired outcomes and is knowledgeable about designing assessments. The SA must be logged into the Survey Management module and have permission to author, edit, and publish surveys.
Inputs	na
Events sequence	The SA clicks the "New Survey" button to create a new survey or selects the name of an existing survey and then clicks the "Edit" button to begin modifying the survey. If the SA wishes to use an existing survey as the basis for a new one, he/she can select the existing survey, then click the "Actions" button and select "Duplicate" from the dropdown list to create a copy that can subsequently be modified. The process of creating and modifying surveys is covered in detail by documentation and how-to videos available at http://fluidsurveys.com/help-tutorials/.
Outputs	na
Postconditions	The new or modified survey is available to collect responses online or be exported to a printable format.
Requirements map	SVY-4, SVY-5
Related UI	Figure 3.22

Note: na = not applicable.

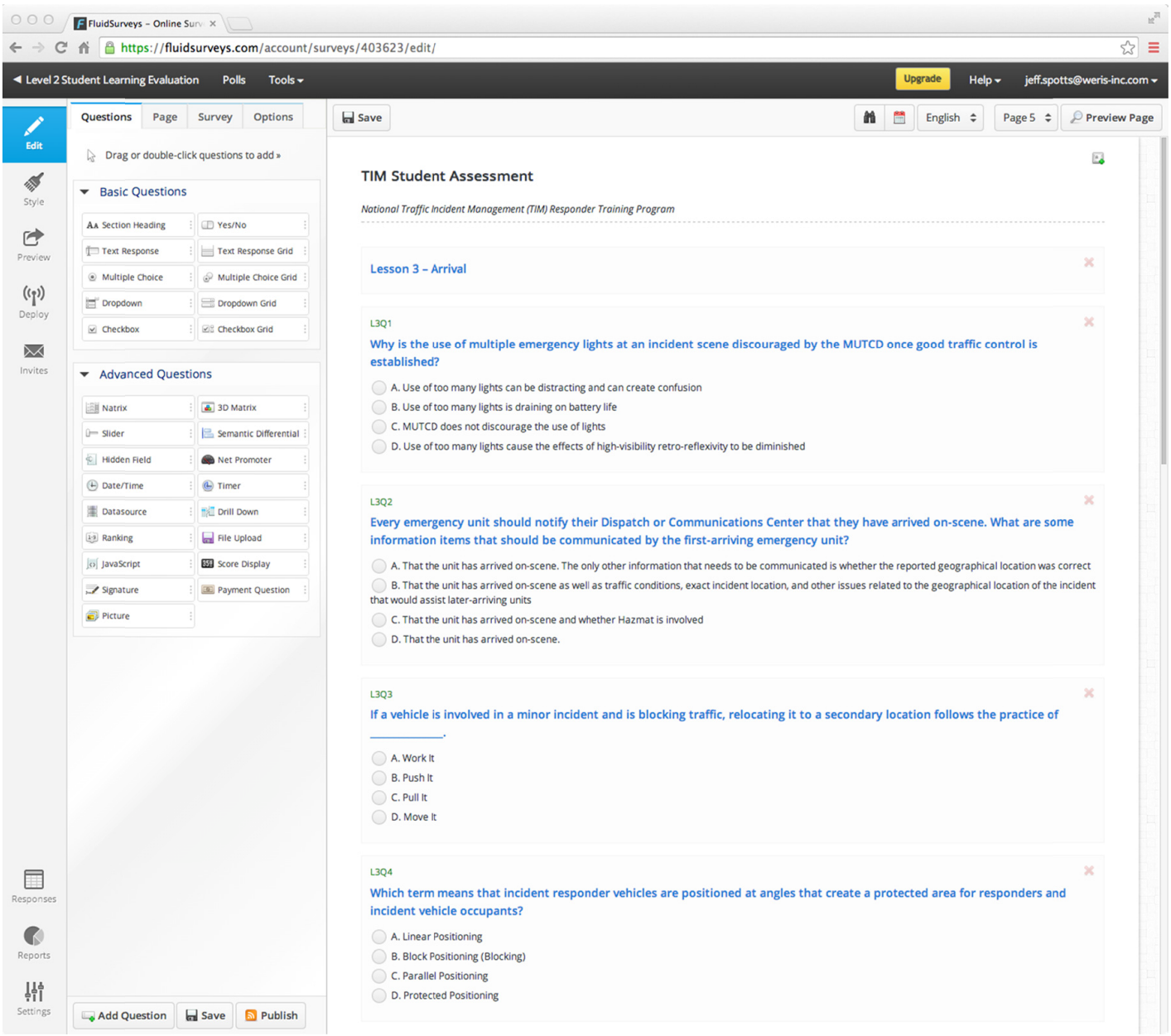

Figure 3.22. Authoring and editing surveys.

Table 3.30. UC10: Administrator Authors/Modifies Analysis Reports

Topic	Specifications
Description	This function allows the training program manager or business analyst to create new assessment reports and to modify or delete existing reports. Newly created reports are made available through the Access assessment reporting tool's user interface; deleted reports are removed from the user interface.
Actors	Training program manager or business analyst
Preconditions	The user has been granted login credentials to the Access assessment reporting tool and has Access privileges to create, modify, and delete reports. The user has also been granted privileges to create and modify user interface screens.
Inputs	na
Events sequence	The Training program manager or business analyst logs into the Access tool. He/she will create new assessment reports using SQL queries and report layout. The reports will have the ability to filter and/or aggregate data when appropriate. The user will modify the assessment user interface to make the newly created reports available for program managers and analysts to perform data analysis. If the user deletes an existing report, it will be unavailable from the Access user interface.
Outputs	New or modified assessment reports
Postconditions	New assessment reports are created; existing reports are modified or removed.
Requirements map	AR-1, AR-2, AR-3, AR-4, AR-5
Related UI	Figures 3.23 and 3.24

Note: na = not applicable.

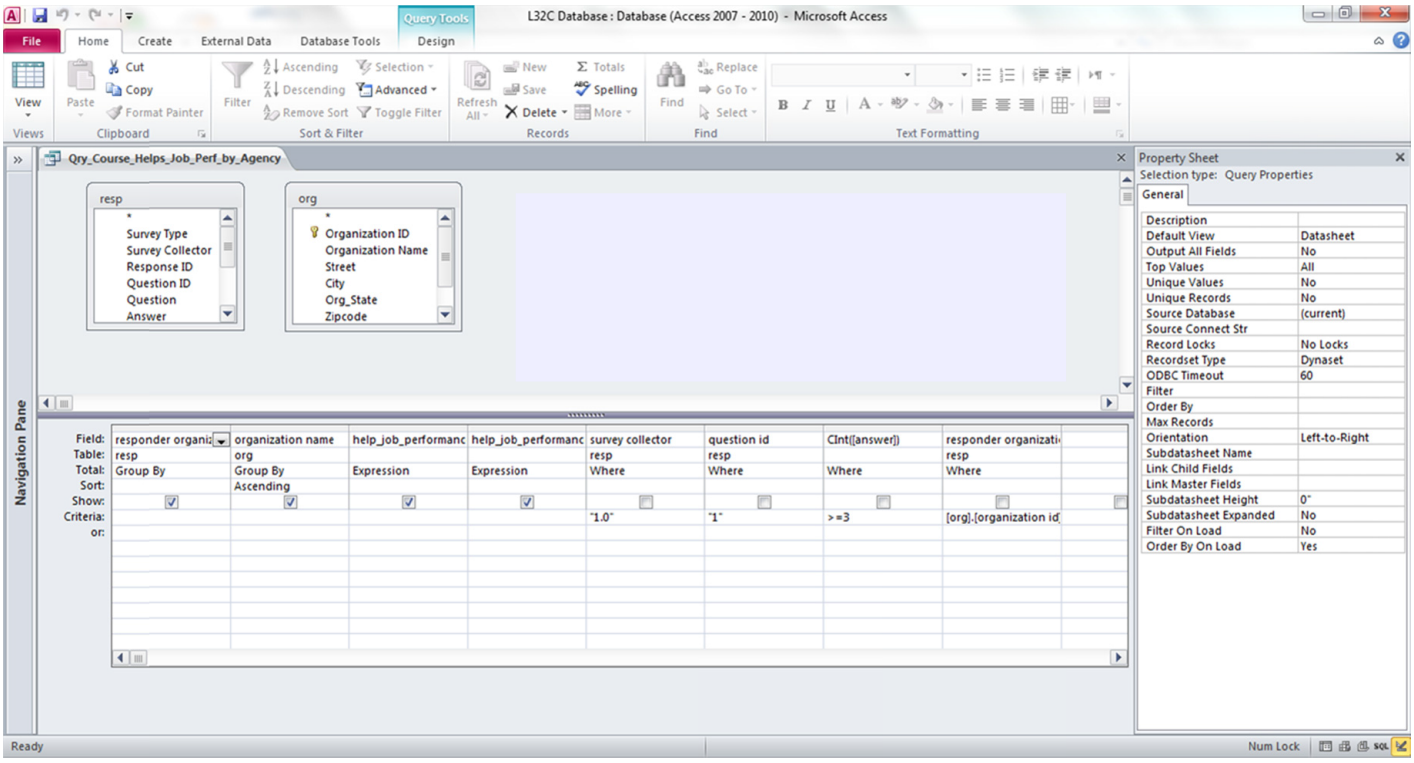

Figure 3.23. Report query design.

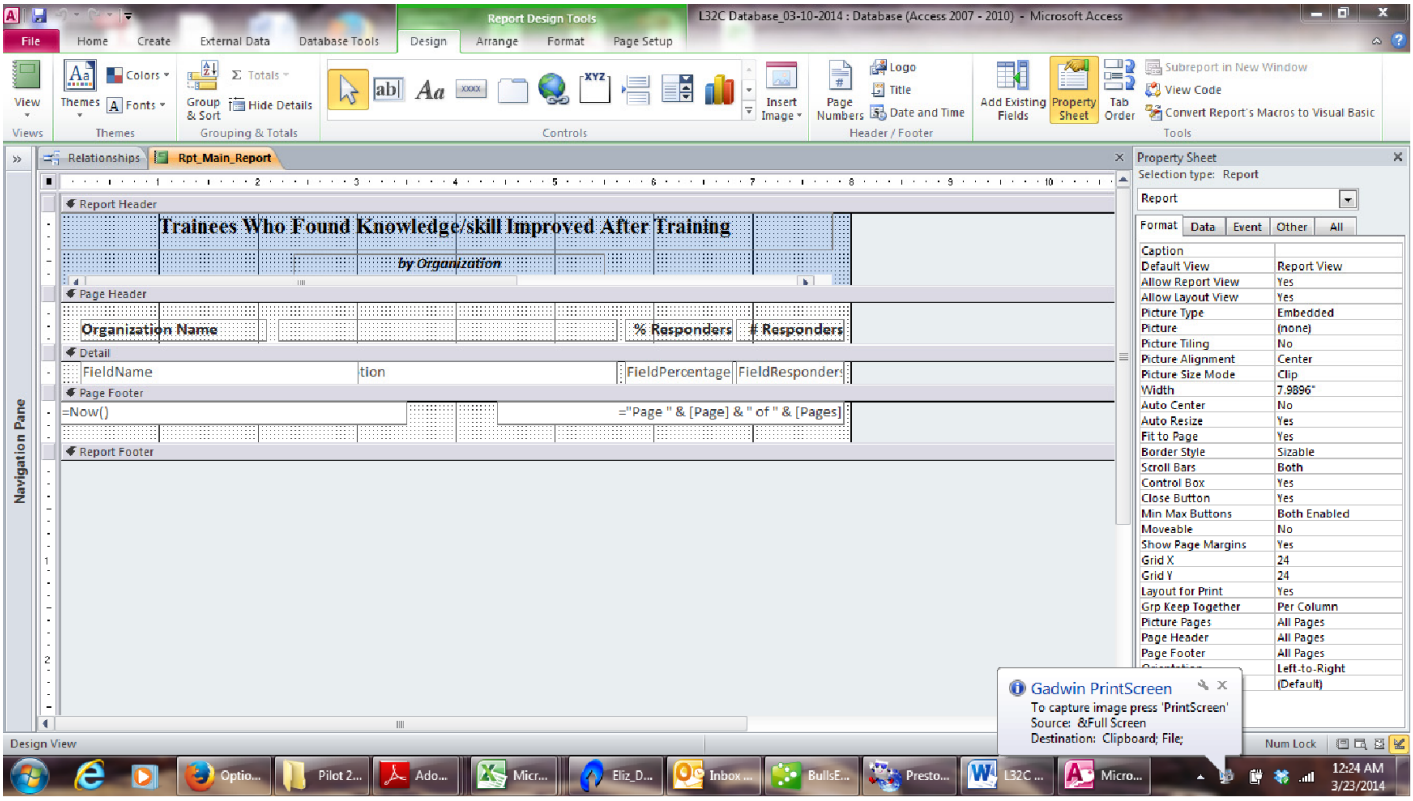

Figure 3.24. Report design.

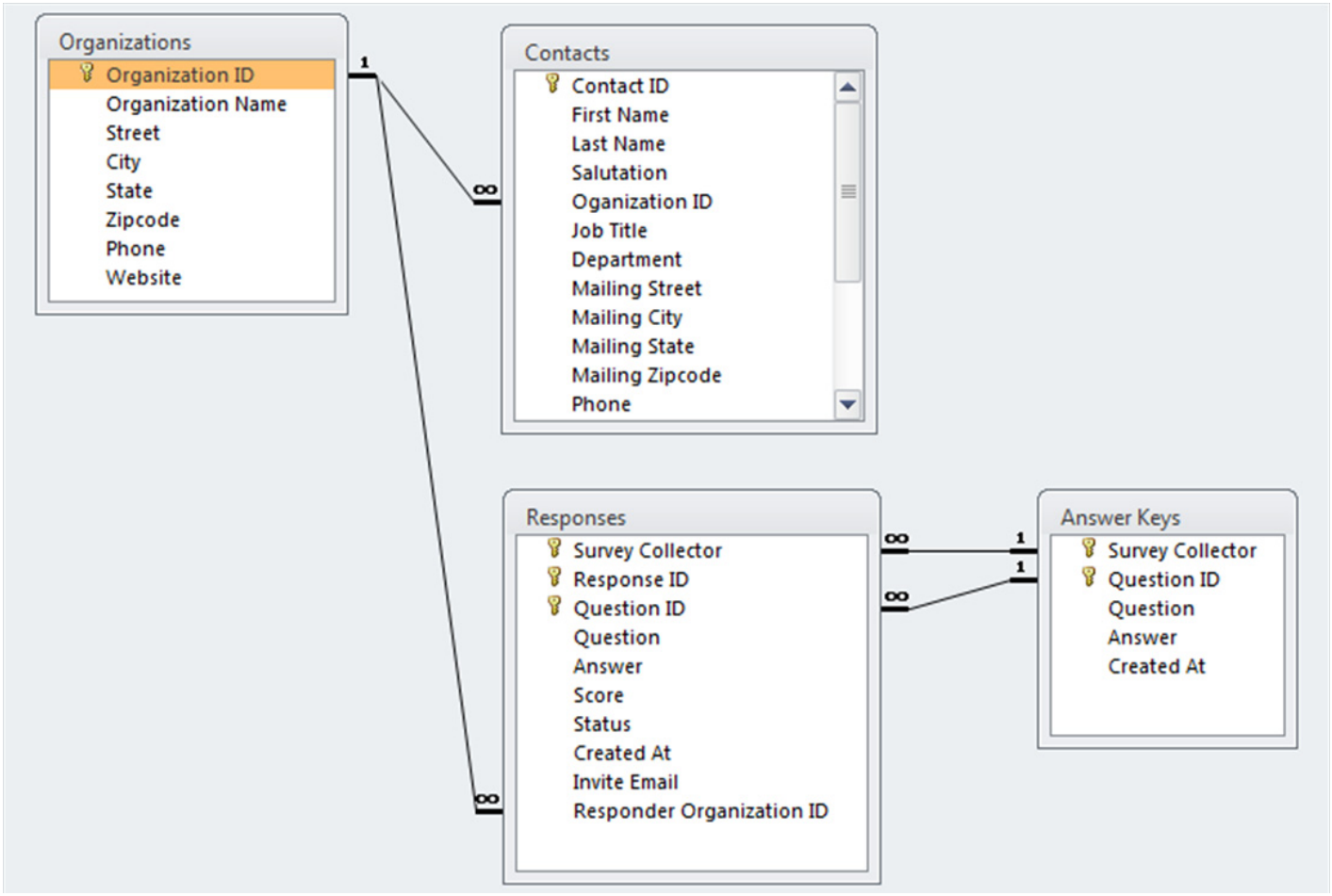

Figure 3.25. Database entity relationship diagram.

Table 3.31. Organizations Table Design

Column Name	Description
Organization ID (PK)	Unique identifier for an organization, generated by the CRM system
Organization name	Name of the organization
Street	Street address of the organization
City	City where the organization is located
State	State of the organization
Zip code	Postal code for the organization
Phone	Main phone number of the organization
Website	The organization's website

Note: PK = primary key.

(*continued from page 23*)

Database Tables

The remainder of this section provides a detailed description for each database table.

Organizations. Table 3.31 contains a list of all agencies/organizations participating in the TIM training program.

Contacts. Table 3.32 contains a list of all trainees and trainers participating in the TIM training program. It also identifies an organization's POC for Level 3 and Level 4 follow-up surveys.

Responses. Table 3.33 contains responses for all surveys. For flexibility and scalability, each row in this table represents the response to one survey question.

Answer Keys. Table 3.34 contains the answer keys to the Level 2 survey (test) questions. Each row in this table represents the answer key to one question.

System Test and Pilot

Scope of Testing

The research team employed standard practices for testing the software. These included unit testing during development, the execution of a set of tests based on the use cases described earlier, and various ad hoc tests.

For example, when core product functionality was being used to create an account or contact in Salesforce.com or to author a survey and collect survey data online with FluidSurveys, the research team made the assumption that the vendor had performed thorough quality assurance testing, which did not need to be replicated. The research team therefore confined the scope of testing mostly to extensions or customizations, such as the addition of custom fields, and to validating the integrity of data flowing through the system.

Table 3.32. Contacts Table Design

Column Name	Description
Contact ID (PK)	Unique identifier for the person, generated by the CRM system
First name	Contact's first name
Last name	Contact's last name
Salutation	Contact's salutation
Organization ID	The organization that the contact belongs to
Job title	Contact's job title
Department	The department of the organization for the contact
Mailing street	Contact's street address
Mailing city	City of the contact's mailing address
Mailing state	State of the contact's mailing address
Mailing zip code	Postal code for the contact's mailing address
Phone	Contact's phone number
Fax	Contact's fax number
Mobile	Contact's mobile phone number
E-mail	Contact's e-mail address
Responder discipline[a]	Contact's disciplinary field, chosen from the following list of values: • DOT • Emergency Medical Services • Fire and Rescue • Hazmat • Law Enforcement • Towing and Recovery • Other
Responder affiliation[a]	Contact's affiliation, chosen from the following list of values: • Paid Professional • Volunteer • Not Applicable
Is trainer[a]	Whether the contact is a TIM trainer: • No • Yes
Is designated POC[a]	Whether the person is a designated point of contact for the organization

[a] This information is not currently collected during the NHI course registration process. These attributes are collected via Level 1 and 2 surveys and stored in the Responses table (Table 3.33). However, since there is no direct connection between a survey response and the survey responder, these attributes are not reflected in this (Contacts) table. The related fields are thus placeholders should the TIM training registration process be modified in the future to gather these additional attributes.

Table 3.33. Responses Table Design

Column Name	Description
Survey type	Level 1, Level 2, Level 3, or Level 4
Survey collector (PK)	A means to gather survey responses over time and through multiple versions of the surveys
Response ID (PK)	Unique identifier of response to a survey
Question ID (PK)	Unique identifier of a survey question within a survey collector
Question	Text of the survey question
Answer	Responder's answer to the question
Lesson	The training lesson this question is related to
Score	Whether or not the answer matches the answer key (1) or (0), used only by Level 2 surveys/tests
Status	Status of the survey response • Complete • Incomplete
Created at	Date/time when the response was created
Invite e-mail	E-mail address for the survey invite
Responder organization ID	Responder's organization ID

Table 3.34. Answer Keys Table Design

Column Name	Description
Survey type	Level 1, Level 2, Level 3, or Level 4
Survey collector (PK)	A means to gather survey responses over time and through multiple versions of the surveys
Question ID (PK)	Unique identifier of a survey question within a survey collector
Question	Text of the survey question
Answer	Answer key to the survey question
Lesson	The training lesson this question is related to
Created at	Date/time when the answer key was created

Pilot

The original project plan anticipated conducting a pilot to test the TIM assessment tool in a setting approximating production usage. The pilot was to be conducted in conjunction with pilot testing of the online TIM training course being developed by SHRP 2 Project L32B. However, because that project was extended beyond the March 31, 2014, end date of Project L32C, a joint pilot was not feasible.

In lieu of a pilot, SHRP 2 program staff requested that the L32C research team document the requirements for data integration between the TIM assessment tool and the NHI system hosting the L32B online courseware. The research team produced such a document, which is attached to this report as Appendix A. The team also provided NHI with sample data files conforming to this document so the agency could assess its ability to produce exportable data in this format.

During the pilot time frame, the research team also conducted three separate briefings and demonstrations of the TIM assessment tool to SHRP 2 program staff, personnel from various FHWA departments, and the TETG.

CHAPTER 4

Conclusions, Recommendations, and Summary

Conclusions

The research team believes it has established that a full, four-level Kirkpatrick Model evaluation methodology is applicable and implementable for a nationwide rollout of the Interdisciplinary TIM Training Curriculum. The research affirms the feasibility and practicality of implementing a TIM assessment tool that meets the requirements set forth in the original project RFP, using readily available, cost-effective technology.

While Level 3 and Level 4 measures of training effectiveness are widely viewed as the most valuable, most organizations are not able to attain them. The effectiveness of any training program can only be measured over time and with many inputs. Doing this requires a sustained organizational commitment to an assessment process. The TIM assessment tool, which is the product of this research project, is a means to that end but not an end in and of itself. The successful implementation of a TIM assessment program requires clear business ownership, leadership, committed staffing, and other resources.

Recommendations

The TIM assessment tool represents not only a new application to be supported but also a new functional area within the TIM program. The initial business model developed early in this research might serve as a useful framework to assess staffing and other resources required to implement a TIM assessment program.

When a sponsoring agency takes ownership of the TIM assessment tool, high-level goals to consider include maturing the L32C application, generating more interest from the user community, and building up program support around the measurement of training effectiveness.

The following are suggestions for possible work that the sponsoring agency could undertake.

Use L32C Product for Ongoing TIM Training Activities

The sponsoring agency might use the TIM assessment tool to support ongoing training activities, including workshops, train-the-trainer and other classroom training events, and planned online courses. Staff support will be needed to collect information and Level 1 and 2 surveys from attendees and, in the case of online training, import similar information from NHI. Staff support will also be required to implement subsequent Level 3 and 4 assessments and to produce reports and analyses that provide insights to the TIM program.

The sponsoring agency will need to continue hosting and administering the TIM assessment tool. That will mean

- Monitoring system health and usage and taking remedial actions whenever necessary to maintain adequate service levels;
- Performing tasks such as granting/revoking user access privileges and installing patches and updates in the production environment; and
- Providing customer support and identifying, documenting, and addressing system defects.

Enhance Functions and Processes

As the tool is used more broadly, user feedback and suggestions will likely be received. This input should be periodically reviewed, analyzed, and prioritized to identify issues that should be addressed. A structured mechanism to track, respond to, and analyze support requests is highly desirable and is available through the customer support function of the chosen CRM module.

Also, any enhancement to the application should be documented, designed, and tested before being rolled into the production system.

Communications and Outreach

An effective TIM assessment process will require the engagement of all potential stakeholders, since they will provide the primary inputs into the process. Therefore, the sponsoring agency should incorporate benefits-oriented messaging about TIM training effectiveness into its communications and outreach efforts to the potential user community.

Summary

The L32C product not only represents a tool but also implies new requirements for business planning, staffing, and other resources to support an effective long-term process for measuring training effectiveness.

References

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Kirkpatrick, D. L. (1994). *Evaluating Training Programs: The Four Levels,* 3rd ed. Berrett-Koehler Publishers, Inc., San Francisco, Calif.

National Fire Academy. (2009). Long-Term Evaluation Report. http://www.usfa.fema.gov/downloads/pdf/nfa/course_eval_2009.pdf.

Transportation Research Board of the National Academies. (2013). SHRP 2 Project L32A Final Report: Train-the-Trainer Pilot Courses for Incident Responders and Managers. http://www.trb.org/Publications/Blurbs/168921.aspx.

APPENDIX A

External Input Data Requirements

This appendix outlines the formatting and data type specifications for data to be exported to the L32C assessment tool. Three main categories of data exports are required, represented by the following tables: Organizations (Table A.1), Contacts (Table A.2), and Survey Responses (Table A.3). Each responder and contact must belong to an organization supplied in the Organizations table.

Export files must use the comma-separated values (*.csv) format. Further information regarding the fields and data types is supplied in the tables.

Organizations

Table A.1. Organization Field Specifications

Field Name	Data Type	Length (characters)	Comment
Name	Text	255	—
Billing Street	Text	255	—
Billing City	Text	255	—
Billing State	Text	2	—
Billing Postal Code	Text	10	—
Phone	Text	50	—
Website	Text	255	—

Contacts

Table A.2. Contact Field Specifications

Field Name	Data Type	Length (characters)	Comment
First Name	Text	50	—
Last Name	Text	50	—
Mailing Street	Text	255	—

(continued)

Table A.2. Contact Field Specifications (continued)

Field Name	Data Type	Length (characters)	Comment
Mailing City	Text	255	—
Mailing State	Text	2	—
Mailing Postal Code	Text	10	—
Phone	Text	50	—
Fax	Text	50	—
Mobile Phone	Text	50	—
E-mail	Text	255	—
Organization Name	Text	255	—
Title	Text	255	Contact's job title
Department	Text	255	—
Responder Discipline C	Text	255	Contact's job discipline, selected from the following list: DOT, Emergency Medical Services, Fire and Rescue, Law Enforcement, Towing and Recovery
Is Trainer C	Boolean	—	TRUE if contact is considered a trainer, FALSE otherwise
Designated POCC	Boolean	—	TRUE if contact is considered a designated point of contact (POC), FALSE otherwise
Responder Affiliation C	Text	255	Contact's affiliation, selected from the following list: Paid Professional, Volunteer, Not Applicable

Table A.3. Response Field Specifications

Field Name	Data Type	Length (characters)	Comment
Question	Text	255	Question text, must be prefixed with a header, for example, [L#Q#].[a]
Response	Text	255	The user's response to multiple-choice, true/false questions
Comment	Text	255	The user's response to open-ended questions
Date/Time	Date	—	The user's response to questions regarding dates
Created At	Date	—	Creation date of survey question
Internal ID	Number	8	Unique identifier for each survey responder
Collector	Text	255	Identifies the iteration of a set of surveys; formatted as 1.0, 2.1, etc.

[a] The two #s in the header [L#Q#] denote the lesson number and question number. For questions with multiple subparts, use the header format [L#Q#|A] where A stands for the part of the question [e.g., Question 1. (a), (b), (c)]. For the pertinent responder questions outlined in Table A.4, use the header [Q#], as there is no associated lesson.

Responses

The Responses table contains sets of survey responses for each of the responders to the surveys. Within the scope of this project, only Level 1 and Level 2 survey types may require external data input. For optimal assessment, all the responders to the Level 1 survey should also complete the Level 2 survey. Additionally, every responder has a unique ID string that is to be used in both survey types.

A set of pertinent responder questions, outlined in Table A.4, must be included at the beginning of every survey, regardless of survey type. The remaining questions for Level 1 and Level 2 will be supplied by the sponsoring agency. For Level 1, these questions should be prefixed with the header string [Q#] where # is the question number. For Level 2, the prefix is [L#Q#] where the first # refers to the lesson number under which the question falls. Survey export file names must begin with the string Level # where # can be either 1 or 2.

Table A.4. Question Specifications and Sample Responses

Question	Response	Comment	Date/Time	Created At
[Q1] Your agency or organization:		Brentwood Fire and Rescue		1/18/2014 12:25
[Q2] In what state is your agency/organization based?	TN			1/18/2014 12:25
[Q3] Your affiliation with this agency/organization:	Paid Professional			1/18/2014 12:25
[Q4] Your primary TIM discipline:	Fire and Rescue			1/18/2014 12:25
[Q5] Why did you take this course?	A. Required by my agency/organization			1/18/2014 12:25
[Q6] Course start date			1/30/2014	1/18/2014 12:25
[Q7] Did you take this course online?	Yes			1/18/2014 12:25
[Q8] Training location—city		Warwick		1/18/2014 12:25
[Q9] Training location—state	RI			1/18/2014 12:25

Related SHRP 2 Research

Training of Traffic Incident Responders (L12)

Train-the-Trainer Pilot Courses for Incident Responders and Managers (L32A)

e-Learning for Training Traffic Incident Responders and Managers (L32B)