

SHRP 2 Reliability Project L32C

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

*PREPUBLICATION DRAFT • NOT EDITED*



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

Final Report

Prepared for  
The Strategic Highway Research Program 2  
Transportation Research Board  
of  
The National Academies

Zongwei Tao  
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Weris, Inc.  
Reston, VA  
March 25, 2014

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## **ACKNOWLEDGEMENTS**

This work was sponsored by the Federal Highway Administration in cooperation with the American Association of State Highway and Transportation Officials. It was conducted in the second Strategic Highway Research Program (SHRP 2), which is administered by the Transportation Research Board of the National Academies. The project was managed by Reena Matthews, SHRP 2 Senior Program Officer, Capacity and Reliability.

Dr. Zongwei Tao, P.E., founder and president of Weris, Inc., was the Principal Investigator. Other contributors were Elizabeth Hess and Jeffrey Spotts, also from Weris, Inc.

## **ABSTRACT**

This report documents and presents the results of a research project intended to design a process and develop a tool (system) to assess the effectiveness of a multidisciplinary, multiagency training curriculum for traffic incident management (TIM). Needs were analyzed, business requirements established, and a TIM assessment tool was specified, designed, developed and tested. The findings of the research established the business and technical feasibility of developing such a TIM assessment tool, using readily available, cost-effective technology, which would support a full, four-level "Kirkpatrick Model" evaluation methodology applicable to evaluating the effectiveness of this training curriculum.

## 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 upon the foundation of earlier projects that created a body of multidisciplinary, multiagency TIM training materials.

Specific goals for Project L32C were to design a training evaluation process and then 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. It was required that the tool apply across multiple target groups within incident response agencies and organizations at all organizational levels, and that it be applicable to a variety of training delivery mechanisms and 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 TIM assessment tool.

The product of the L32C research is a TIM assessment tool that 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.
- It is feasible and practical to implement a TIM assessment tool that meets the requirements set forth in the original project RFP, 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, 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.

## 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, multi-disciplinary 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
- 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 where traffic backups from crashes are cleared quickly and efficiently, responders are never injured or killed at the scene, and inter-agency 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 Request for Proposal (RFP) the goal of Project L32C is 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 multi-faceted, sustainable, and scalable to a variety of applications (e.g., applicable to classes, online and email-based training, executive briefings, etc.).
- 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, which following the completion of the project, would evolve into a full production system, as shown in Figure 1:

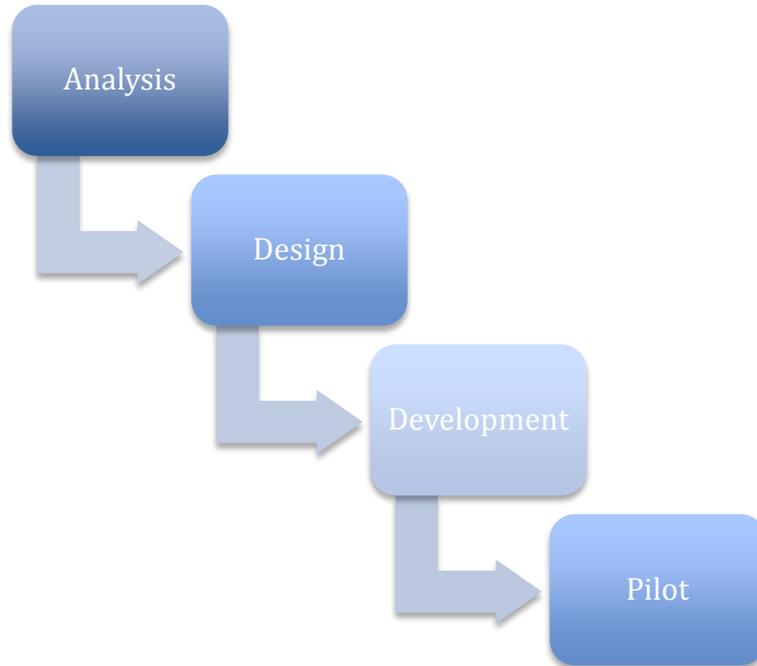
1. Demonstrating initial functionality and maturity by the end of the L32C project (the scope and subject of this report).
2. Continuing to mature and become close to production-ready during a transition period prior to takeover by an “owning” agency.
3. Operating as a full production system after formal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



**Figure 1: Evolution of the TIM assessment tool over time.**

## CHAPTER 2: RESEARCH APPROACH

The work for this project was divided roughly into four stages, as shown in Figure 2.



**Figure 2: L32C project stages.**

Our 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 and assess other relevant training initiatives in order to develop a business model that specified how best to develop, implement, and sustain the TIM assessment tool.

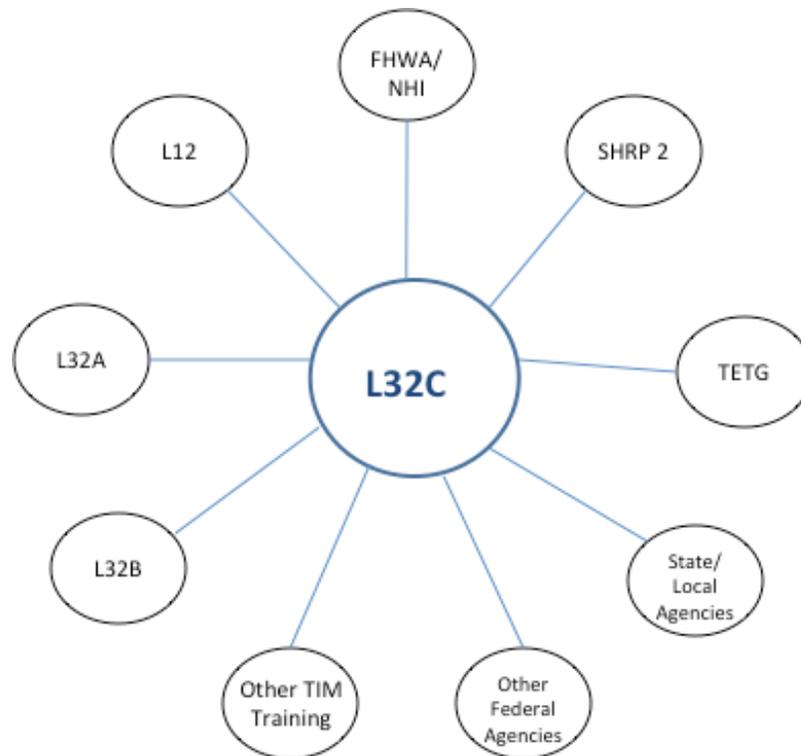
The research team then developed a set of use cases that served as a framework for the development of functional requirements, which guided subsequent system architectural design, development, and testing.

Finally, the research team demonstrated the TIM assessment tool to SHRP 2 program staff, FHWA personnel, and the TETG.

Key aspects of our research approach are discussed in the following sections.

### **COLLABORATIVE NATURE OF PROJECT L32C**

The fact that L32C is tightly coupled with L12, L32A, L32B, and other TIM training programs nationwide, and requires support from many federal, state and local agencies, made L32C a highly collaborative effort. Figure 3 shows the interactions and communications between L32C and other projects and organizations.



**Figure 3. Collaboration between L32C and other projects/organizations.**

During the course of our work the L32C team:

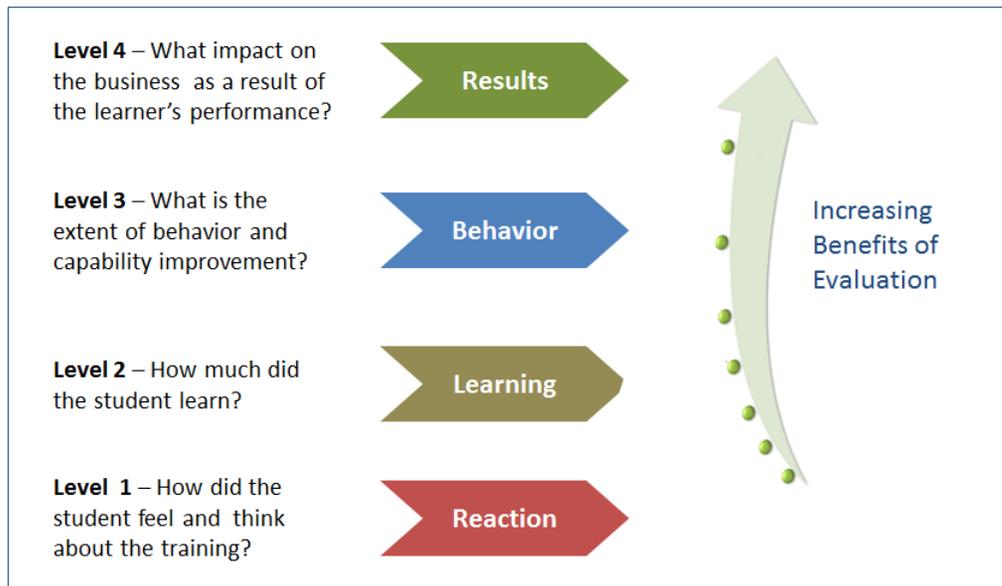
- Attended project meetings with L32B, SHRP2, and FHWA to review tasks, milestones, and timeline for L32B and L32C, and to discuss dependencies between L32B and L32C.
- Engaged with National Highway Institute (NHI) regarding its e-Learning platform and mechanisms for integrating with it.
- Reviewed L12 and L32A final reports and course materials.
- Reviewed L32A course evaluation questionnaires and student exam.
- Reviewed 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.
- Interviewed responder agency managers and training professionals.

## CONCEPTUAL MODEL FOR TRAINING EVALUATION

Early in the project the research team decided to utilize 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, *Evaluation of Training Programs*.<sup>(1,2)</sup>

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 4.



**Figure 4. Kirkpatrick's four levels of learning evaluation.**

**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 would 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 behavior changes have occurred as a result of students attending the training, and if so, to what extent. Trainees, their immediate supervisors, 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 behavior changes often take time, and the “right” environment must be provided for the students to implement their behavior changes. Additionally, those who participate in this evaluation would need to be observant to note the behavior changes that took place.

**Level 4** – This level measures the impact on the business as a result of students attending the training and their subsequent on-the-job behavior 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. It is also reasonable to expect that the evaluation would need to determine what business results have been achieved due to 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.

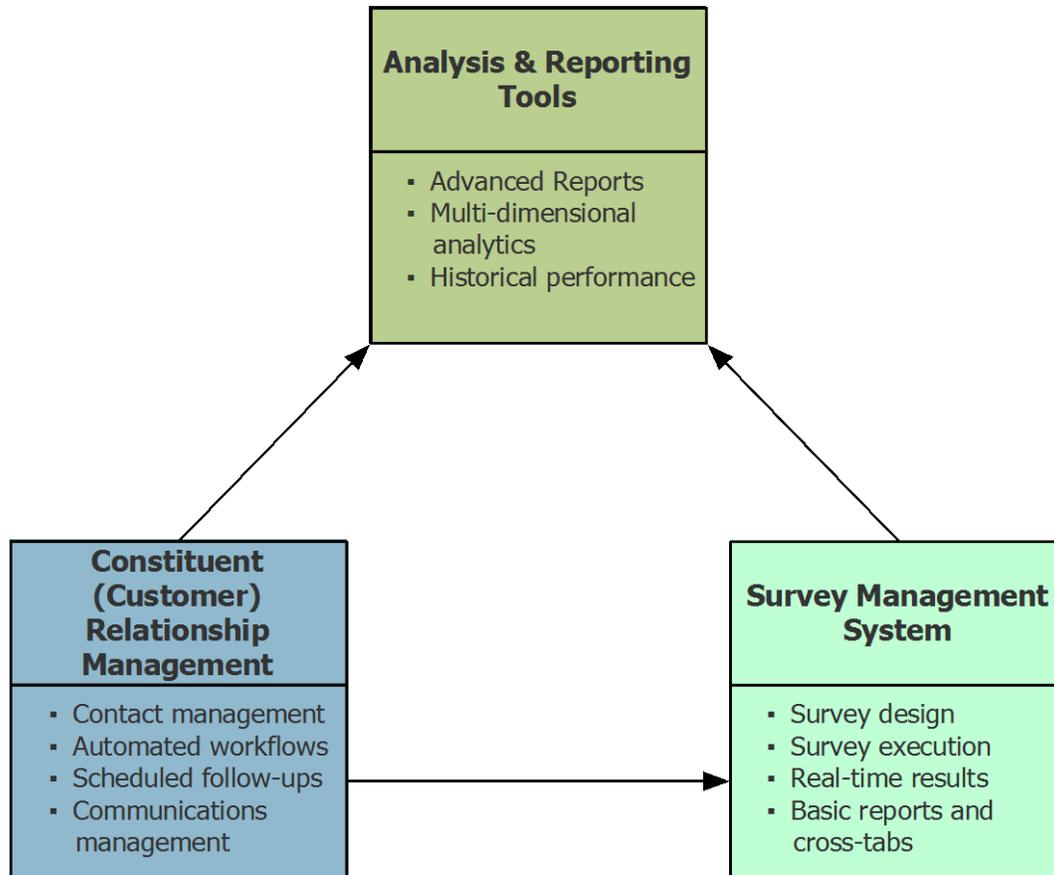
## **SYSTEM DEVELOPMENT METHODOLOGY AND APPROACH**

The research team followed a typical systems development lifecycle (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.
- Developed the software and performed unit testing.

The high-level concept for the system the team envisioned is shown in Figure 5, consisting 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, etc.



**Figure 5: High-level system concept.**

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 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 SaaS (software-as-a-service) 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 compute, 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.

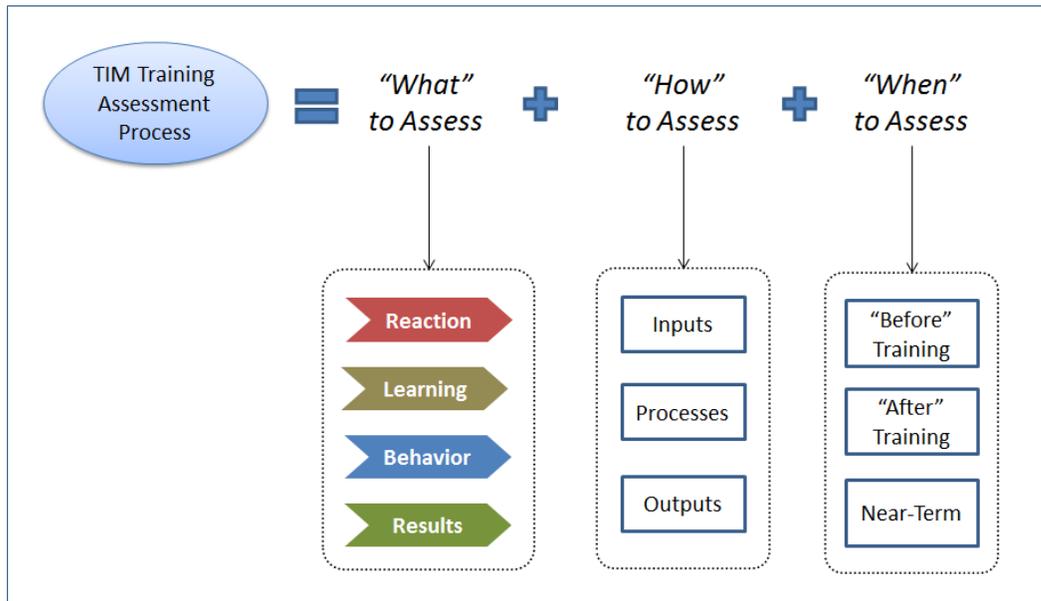
As described in more detail in the Findings section of this report, our approach was to use SaaS subscriptions for survey management and CRM functions, while the analysis and reporting functions were based on desktop products that integrate with a cloud-computing platform.

## CHAPTER 3: FINDINGS

This section of the report presents major findings from our research efforts, which began with an analysis of business needs, followed by the specification, design, development, and testing of the TIM assessment tool.

### NEEDS ANALYSIS

Figure 6 provides a visual overview of the assessment needs and the assessment process.



**Figure 6. L32C TIM training 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 behavior changes. Both types of learning have the potential to positively impact 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.

- Whether the course was perceived to be helpful in terms of improving the student's job performance.
- Whether the subject matter was well organized.
- Whether training materials were effectively presented.
- Whether the training session provided the student opportunities to participate
- Whether 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 our 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:

- Did the students learn what was intended to be taught?
- Did the students experience what was intended for them 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:

- 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.
  - 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 our project's Level 2 assessment.<sup>(3)</sup>

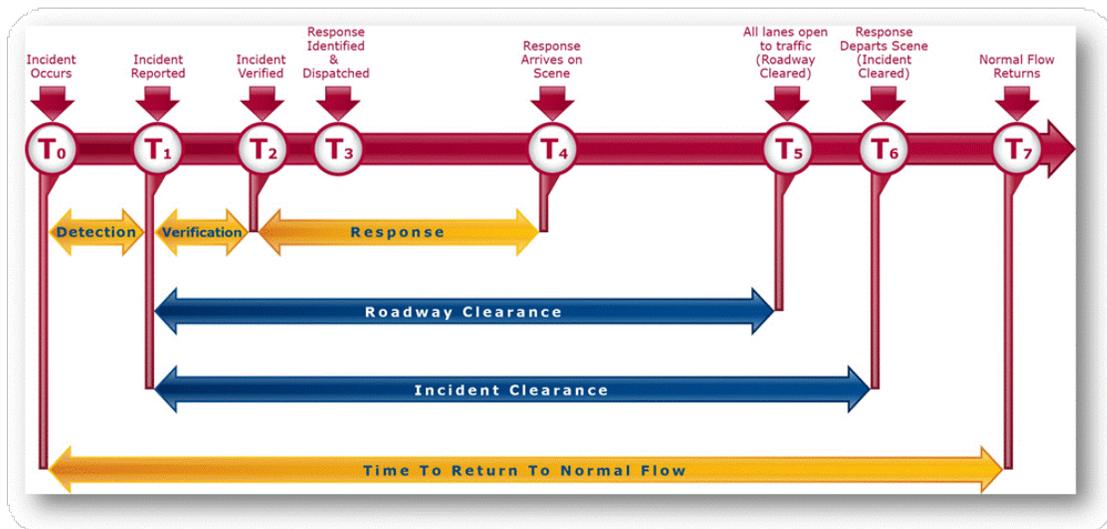
### Level 3 Assessment - Behavior

Behavior evaluation is the extent to which the trainees applied the learning and changed their behaviors, and 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 their learning to another person?

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

- Using the definition of TIM Timeline in Figure 7, what student behavior changes were implemented or observed to shorten the duration of each phase?



Source: FHWA

**Figure 7. TIM timeline.**

- Were student behavior changes implemented or observed to:
  - Better communicate locations of incidents?
  - Better describe the nature of incidents?
- Were student behavior changes implemented or observed to better ensure response contains the appropriate resources?
- Were student behavior changes implemented or observed in terms of responder vehicle positioning?

- Were student behavior changes implemented or observed in terms of lane blocking?
- Were student behavior changes implemented or observed to ensure that TIM responders wear appropriate safety apparel?
- Were student behavior changes implemented or observed to better coordinate multi-agency TIM operations?
- Were student behavior 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.
- Improved incident and roadway clearance time.
- Reduction in number of secondary incidents.
- Equipment and resource readiness.
- Reduction in TIM responder turnover.

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

- How many TIM responder injuries occurred on average in a six-month period prior to TIM training? How many TIM responder injuries occurred in the most recent six months after TIM training?
- How many secondary incidents occurred on average in a six-month period prior to TIM training in your state? How many secondary incidents occurred in the most recent six months after TIM training?
- What was the average time it took to clear a major incident prior to TIM training? What is the average time it takes to clear a major incident during the most recent six months after the TIM training?
- How many times was incident clearance was delayed due to lack of equipment and/or resource readiness in a six month period prior to TIM training? How many times incident clearance was delayed due to lack of equipment and/or resource readiness in the most recent six months after TIM training?
- What was the TIM responder turnover rate prior to TIM training? What is the TIM responder turnover rate during the most recent six 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 six-month period in order to obtain assessment data within our project timeframe).
- When the evaluation period starts – as stated previously, behavior changes take time, and those changes need to be observed prior to 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 8 is a concept of operations diagram for the overall assessment process.

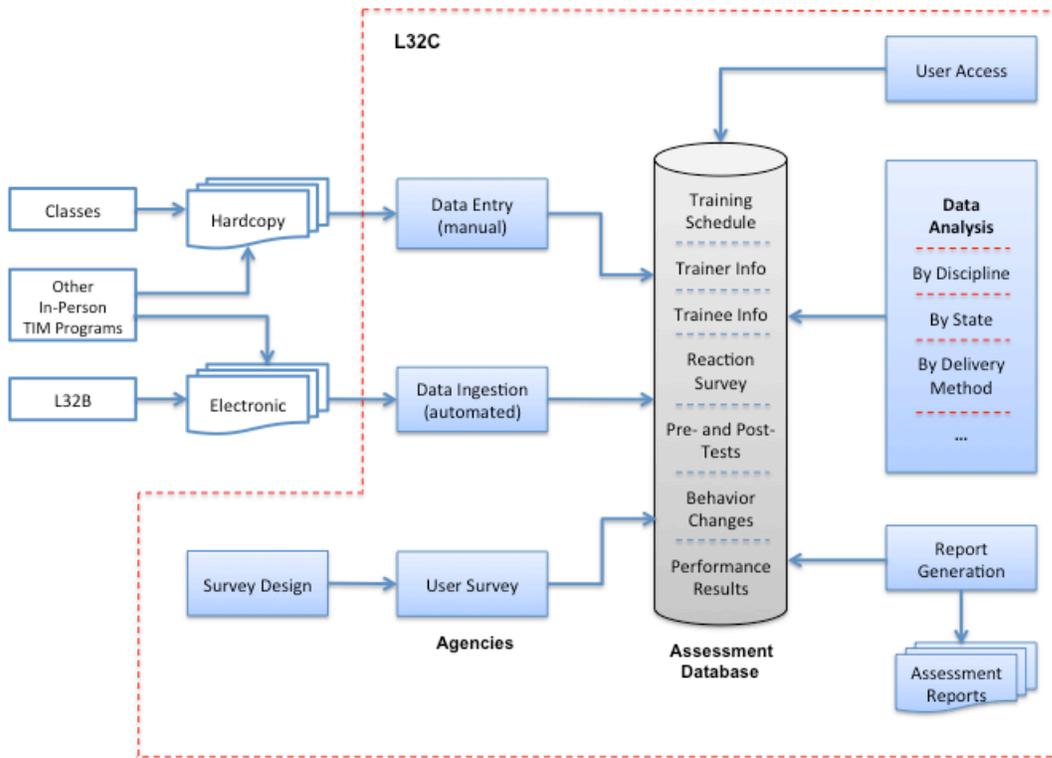


Figure 8. Concept of operations for the assessment process.

### Essential Student Information

Since a clear requirement for the tool is the ability to perform multidimensional analysis, certain essential student information must be collected upon course registration, or when the student completes an assessment form, in order to enable this level of analysis with the L32C assessment tool. This includes information about the student’s agency and the nature of their affiliation with it, their responder discipline, etc. The type of data that is required is discussed in more detail in the Database Design section.

It is reasonable to expect that some data administration would be required to ingest survey results, test scores, and other input data into the assessment tool.

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 our assessment tool to generate the output. Another aspect of our assessment would involve 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 behavior changes on the job, which in turn translates 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 our data analysis would be presented in the form of statistical analysis results and their graphical representations when appropriate. The output would take on some type of electronic format such as Excel spreadsheet, XML file, and/or PDF file, which can be downloaded or emailed to interested parties. Additionally, the assessment tool will have the capability for registered users to review input data and to perform their own analysis.

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

Table 1 provides a summary of critical success factors and input data sources at each evaluation level.

**Table 1. Critical success factors and data sources for evaluations.**

<b>Evaluation Level</b>	<b>Critical Success Factors</b>	<b>Data Source</b>
1 – Reaction	<ul style="list-style-type: none"> <li>• Need to be done immediately after training ends</li> </ul>	<ul style="list-style-type: none"> <li>• Trainees</li> </ul>
2 – Learning	<ul style="list-style-type: none"> <li>• Need to be done before and after training</li> </ul>	<ul style="list-style-type: none"> <li>• Trainees</li> </ul>
3 – Behavior	<ul style="list-style-type: none"> <li>• Need to allow time for behavior changes to be observed</li> <li>• Trainees must be allowed the right work environment to implement behavior changes</li> <li>• Peers and/or immediate supervisors must be able to observe the behavior changes</li> </ul>	<ul style="list-style-type: none"> <li>• Supervisors</li> <li>• Peers</li> <li>• Trainees</li> </ul>
4 – Results	<ul style="list-style-type: none"> <li>• More time will likely be needed to obtain organizational results</li> <li>• Management support is a must</li> <li>• Need pre-training and post-training results for comparison</li> <li>• Ability to determine what improvements are due to training efforts as opposed to other organizational initiatives</li> </ul>	<ul style="list-style-type: none"> <li>• Management</li> <li>• TIM Performance Measures</li> </ul>

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, it would be best if this evaluation is carried out immediately following the completion of the TIM training, preferably before students leave the classroom.

### **Inputs**

Table 2 contains the origin and format of the expected Level 1 input data.

**Table 2. Level 1 input data origin and format.**

<b>Input Data Origin</b>	<b>Input Data Format</b>
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

### **Analysis**

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

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

## ***Level 2 Assessment - Learning***

### **When to Assess**

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

### **Inputs**

Table 3 contains the origin and format of the expected Level 2 input data.

**Table 3. Level 2 input data origin and format.**

<b>Input Data Origin</b>	<b>Input Data Format</b>
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 teams expects 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.
- Whether or not there are certain questions that students consistently miss.

***Level 3 Assessment - Behavior*****When to Assess**

Behavior changes take time. Therefore, behavior observation and evaluation over time would be 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 one to two months after the completion of a TIM training course. The research team also believes that it is beneficial to repeat this evaluation over a longer period of time, if feasible. Repeated evaluation would give insights to the sustainability of the behavior changes, as well as discover additional changes that take longer to implement.

**Inputs**

The research team developed an initial set of Level 3 survey questions. The survey is hosted on the L32C assessment platform, with target survey responders being the trainees' supervisors, peers, or the trainees themselves. Ideally, input data will ideally 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 provide information such as the following:

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

## ***Level 4 Assessment - Results***

### **When to Assess**

It is safe to assume that measurement of organizational results may take many months. The time to measure the results of the TIM training may very well be longer due to the multidisciplinary and multiagency nature of the training programs.

The research team suggests that Level 4 evaluation be performed at least three months after the completion of a TIM training course. It will also be beneficial to repeat this evaluation over a longer period of time. The repeated evaluation would uncover not only organizational results that take longer to realize, but also improvements as a result of 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, with target survey responders being agencies' senior management. Ideally, input data will ideally 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 behavior changes translate into TIM performance improvement?
- What measureable 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, who provided useful input into training assessment.

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

The following section of this report summarizes the sources the team examined in our literature review and the lessons they offer for Project L32C, if any.

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AASHTO	AASHTO does not directly offer any training but related entities described below provide information about or access to training resources.
NTIMC	<p>The National Traffic Incident Management Coalition (NTIMC), has a presence on the AASHTO website, which provides a link to training resources at <a href="http://ntimc.transportation.org/Pages/TRAININGRESOURCES.aspx">http://ntimc.transportation.org/Pages/TRAININGRESOURCES.aspx</a>.</p> <p>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 our literature search and cover when discussing that source.</p>
Emergency Transportation Operations, FHWA	<p>This arm of FHWA provides a link to training at <a href="http://www.ops.fhwa.dot.gov/eto_tim_pse/training/index.htm">http://www.ops.fhwa.dot.gov/eto_tim_pse/training/index.htm</a></p> <p>At the time of our literature review the only available reference was to an August 2012 webinar related to SHRP 2 National TIM Responder training.</p>

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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):

Similar information is captured on paper-based registration for classroom training.

Once a course has been purchased it is accessible by logging in to a personalized My Training page:

### Welcome to My Training

My Courses | Unofficial Transcript | Official Transcript | My Downloads | My Training Help

**My Courses**

	Course Title	Course Number	Type	Start Date	Progress	Launch	Evaluation / Certificate
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](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. The paper-based form used in classroom settings is attached in Appendix A, and similar information is captured online. 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 and 4 assessment program.

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, where a specific access code is required, and the student's organizational affiliation is chosen from a drop-down list. Since a CE ID# is required, it can be inferred that some Level 2 assessment is done to assure course completion.

**McNeil & Company** E-Learning Registration

Organization Type:  Student  Training Officer  Agent

Access Code:

Organization:

E-mail Address:

Confirm E-mail:

Password:

Confirm Password:

First Name:

Last Name:

CE ID#:

Position:

Optional Identifier:

[Where Do I Get My Access Code?](#)

By checking this box you certify that you have read and agree to the McNeil & Company, Inc. E-Learning Terms and Conditions.

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Our research suggests that no systematic Level 3 or 4 follow-up assessments are done.

I-95 Corridor Coalition	<p>This organization provides a number of online courses accessible via <a href="http://www.i95coalition.org/i95/Training/tabid/87/Default.aspx">http://www.i95coalition.org/i95/Training/tabid/87/Default.aspx</a>.</p> <p>Some of the courses, including ones related to incident management, are self-hosted. Registration is required but only involves providing an email address, which is validated by clicking through on an emailed link.</p> <p>Courses of this type examined 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.</p> <p>Other courses are actually hosted by CITE (discussed separately) and those that are fee-based require registration with that organization.</p>
ERSI	<p>The Emergency Responder Safety Institute (ERSI) has a “Learning Network” accessible at <a href="https://learning.respondersafety.com">https://learning.respondersafety.com</a>. 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. Organization name is required but it can be entered arbitrarily. Organization type is selected from a drop-down list. A unique email per registrant is required so that unique training record can be maintained.</p> <p>Adobe Flash is a technical pre-requisite 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.</p> <p>For example, the “Intro to Fire Service Traffic Control Professional” course skills challenge consists of twelve multiple-choice questions. Correctly answering 75% or more of the questions generates a course completion certificate in PDF format that automatically downloads.</p> <p>Our research suggests that no systematic Level 3 or 4 follow-up assessments are done.</p>
International Association of Chiefs of Police	<p>This association’s Center for Police Leadership and Training (CPLT) provides information and registration services for training offerings at <a href="http://www.theiacp.org/LeadershipandTraining/tabid/68/Default.aspx">http://www.theiacp.org/LeadershipandTraining/tabid/68/Default.aspx</a>.</p> <p>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.</p> <p>It does not seem that the IACP offers anything instructive for Project L32C.</p>

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Towing and Recovery Association of America	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.
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TRAA also offer other training materials on a Products page on their web site. 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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NTED	FEMA's 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.
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Because of the restricted nature of access to this entity's offerings the research team was only able to gain insight into their assessment process through a TETG-facilitated introduction to an agency employee. The summary of what the research team learned is 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 our contact was not certain that it was done in a manner that facilitated meaningful analysis.
  - Kirkpatrick-style Level 3 & 4 assessments (Behavior and Results) are at the "wish list" 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 a student six months after they have attended a course.
  - Survey responses are manually entered into an Access database and analyzed qualitatively.
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CITE	<p>The Consortium for ITS Training and Education (CITE) offers a range of certificate programs, blended courses, as well as online training. The latter is available at <a href="http://www.i95coalition.org/i95/Training/tabid/87/Default.aspx">http://www.i95coalition.org/i95/Training/tabid/87/Default.aspx</a>.</p> <p>Registration is required for all courses and all but two involve fees of \$50 to \$200. The free courses require between two to eight 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.</p>
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National Fire Academy This arm of the U.S. Fire Administration, which is part of FEMA, provides a very wide range of courses in on-campus and off-campus classroom settings, and offers a subset of courses online settings via NFA Online at <http://www.usfa.fema.gov/nfa/nfaonline/browse/index.shtm>.

Offerings include National Incident Management System (NIMS) ICS-series courses familiar to many responders, especially those in supervisory positions or higher.

This is another example of where an introduction facilitated by the TETG was essential in order to get a big picture view of process from an agency employee. It's important to note that, while very useful, the insights gained from one person 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.

The summary of what the research team learned is 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. The only case where any pre-testing is done (a potentially useful strategy for deeper Level 2 assessment) is in a Hazmat-oriented chemistry course so that the instructor can determine students' baseline level.
- In an online setting it's easy to mandate completion of a survey and exam and thus accomplish Level 1 and 2 assessment. When asked how NFA gets students to comply in classroom settings, our source said that there is an "unspoken rule" that one has to complete an evaluation in order 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, six 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) assessment. The admissions/registration process requires chain of command approval or sponsorship, and always captures the student's then-current supervisor information.
- NFA publishes an annual evaluation report. The most recent one available is for 2009.<sup>(4)</sup>

Law Enforcement Training Professional	<p>Our discussion with this senior professional focused mainly on issues related to participation, governance and sustainability:</p> <p>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 Level 3 &amp; 4).</p> <p>He emphasized the need for programmatic incentives or mandates to drive participation, both at the individual learner and supervisor/management level. The term “carrot and stick” was used. In eras of tight budgets, it is very difficult to allot officer and management time to training and assessment.</p> <p>He felt that online delivery of training was essential to 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.</p>
NLEARN	<p>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 our literature search efforts. NLEARN offers over 200 online courses.</p> <p>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 potential source.</p>
Fire Service Professional	<p>This senior professional is experienced with managing and training fire and rescue personnel. During our discussion:</p> <p>He stressed the vital importance of supervisor and management participation in any Level 3 and 4 assessment process, and insuring that individuals responding to any survey that measures strategic outcomes (i.e., Level 4, Results) have the authority to do so.</p> <p>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, and any changes they made with respect to how they communicate with other disciplines.</p> <p>In terms of Level 4 (Results) assessment, he felt that incident clearance time was an important measure.</p>

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Kirkpatrick Community	Dr. Donald Kirkpatrick and family have established an online community that provides members with access to training evaluation resources that build upon the conceptual model he created. Our team engaged this community to identify best practices that might be applicable to Project L32C.
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Since 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 report.

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## **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's aspirations for Project L32C, the team consistently got feedback along the lines of "please keep us informed about your progress, as this sounds exactly like what we want to do..."

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 4.

**Table 4. Synthesis of best practices.**

Category	Best Practice
General	<ul style="list-style-type: none"> <li>The assessment program should be driven by the desired end result (strategic goals) and how the training will specifically impact it.</li> </ul>
Level 1 Assessment – Reaction	<ul style="list-style-type: none"> <li>Should be done immediately after the training ends.</li> <li>Level 1 typically should use the least resources.</li> <li>The scope should be limited to identifying opportunities to improve the program, instruction, support, and administration.</li> </ul>
Level 2 Assessment – Learning	<ul style="list-style-type: none"> <li>Can precede Level 1. Learning can be measured in steps throughout the learning event.</li> <li>Use the results of quizzes and exams to provide insight into gaps in instruction, student materials, or deficiencies in test-item construction.</li> </ul>
Level 3 Assessment – Behavior	<ul style="list-style-type: none"> <li>Most resources/effort should be devoted to Level 3.</li> <li>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.</li> <li>Input from both graduates and their supervisors are necessary to evaluate the effectiveness of the program.</li> <li>It is critically important to involve line management in this level of assessment, since observation over time is required to assess change, relevance of change, and its sustainability.</li> <li>The trainee’s opinion is relevant but tends to be more subjective and less reliable.</li> </ul>
Level 4 Assessment – Results	<ul style="list-style-type: none"> <li>Effective Level 4 assessment requires senior management participation, as they are most attuned to their agency’s key performance indicators.</li> <li>As with Level 4, must be measured over time.</li> </ul>
Organizational/Institutional	<ul style="list-style-type: none"> <li>There must be a long-term commitment to collecting necessary data (Well-known adage: “You can’t manage/improve what you can’t measure....”) and conducting systematic assessment over time.</li> <li>Create incentive(s) (which can either be in the form of mandates or value in exchange) to drive program participation over time.</li> </ul>

Category	Best Practice
Process/Technology	<ul style="list-style-type: none"> <li>• Use a centralized, consistent registration function for all levels of training and types of delivery methods.</li> <li>• Involve the recipient agency in the enrollment process, even though individual trainees may self-register.</li> <li>• Capture organizational affiliation, role, supervisor, etc., for subsequent follow-up assessment, plus data aggregation and analysis.</li> </ul>

## 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, either in terms of process or business model. Our approach to developing a recommended business model was to map a synthesis of best practices to the known set of requirements for L32C.

The research team believes that the TIM training tool cannot be thought as a single, standalone software program. Consistent with the objectives for the tool outlined in the RFP (e.g., multi-faceted, sustainable, scalable to a variety of applications, framework for coordination at the local program level, suitable for integration into FHWA and other national program efforts, etc.) 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 9 shows how these fit together conceptually.

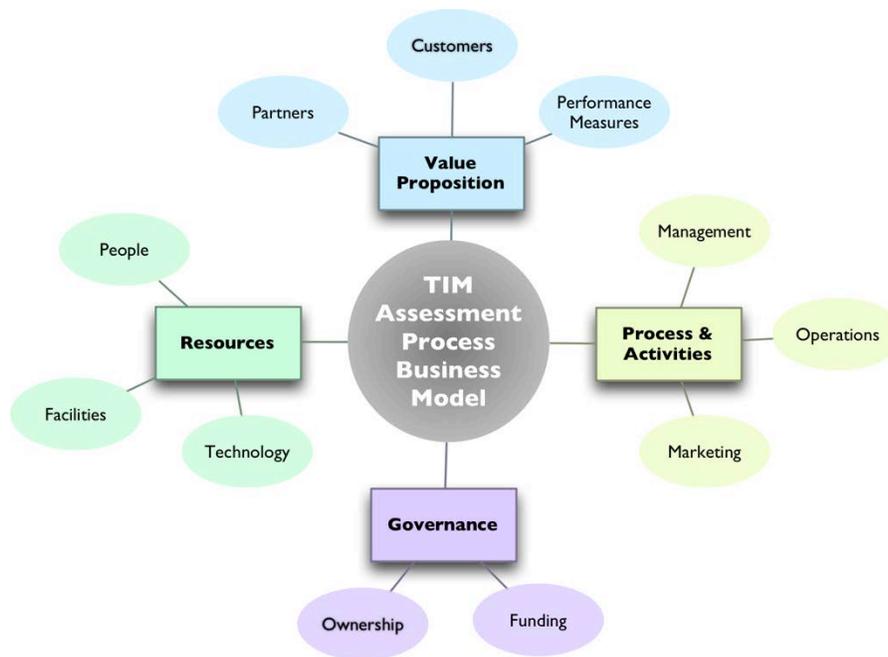


Figure 9. Conceptual business model.

The four key elements of this business model are:

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 upon helping 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, who will come from law enforcement, fire and rescue, DOT, 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, IADLEST, among others.
  - 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, Secondary Crashes, among others. Example performance measurement categories that the TIM assessment business model can be aligned with include:
    - FHWA's Focus State Initiative: TIM Performance Measures
    - The National Unified Goal for Traffic Incident Management from The National Traffic Incident Management Coalition
2. **Governance** – Post-implementation success of L32C will also depend on sustained funding, leadership, policies, leadership and decision-making.
3. **Process & Activities** – A number of key operational processes and activities must be planned and managed over the TIM assessment tool's lifecycle.
  - 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, which includes:
    - Program management – administering, executing and enhancing the overall assessment program.
    - Analysis and reporting – assessing various dimensions of performance from a program-wide perspective.
  - b) **Operations.** These processes will cover day-to-day activities in support of operating, administrating, and maintaining the assessment tool. This includes:
    - Systems management – including administration, backup/recovery, monitoring, security, and troubleshooting of the compute, network and storage environment that supports the assessment tool.
    - Application maintenance – implementing bug fixes and functional enhancements to the tool.
    - Help desk – providing a contact point for end-user assistance and troubleshooting.

- c) **Marketing** – promoting 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.** While 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 and 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 be accessing the assessment and reporting tool.

- **Participating Agency Point of Contacts (POC).** 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 properly and timely updated 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 post-training tests and surveys.
- **Trainees.** These are students of the TIM training program. They will use the assessment tool to take the pre-training tests, post-training Level 1 reaction surveys, and post-training 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 5 summarizes these use cases.

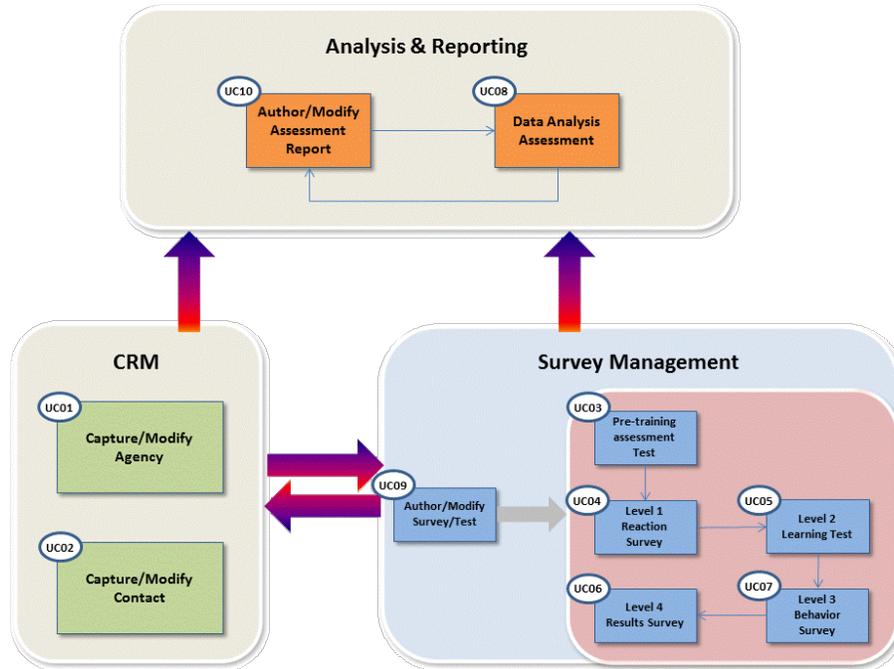
**Table 5. High-level use cases.**

<b>Ref.</b>	<b>Description</b>
UC01	Administrator Captures/Modifies a Participating Agency
UC02	Administrator Captures/Modifies a Contact
UC03	Student Takes Pre-Training Assessment Test
UC04	Student Takes Post-Training Reaction Survey (Level 1)
UC05	Student Takes Post-Training 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 Performs Data Analysis
UC09	Administrator Authors/Modifies Surveys/Tests
UC010	Administrator Authors/Modifies Analysis Reports

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 pre-training 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)
- Analysis and Reporting – used to enable program staff as well as participating agencies to analyze and report on training participation, needs, effectiveness, etc.

Figure 10 shows the use case framework in terms of these three blocks of functionality.



**Figure 10. Use case framework.**

The balance of this section describes the process of the main success scenario and alternate scenarios, where applicable, for each use case.

***Administrator Captures/Modifies a Participating Agency***

Step	Main Success Scenario	Alternate Scenarios
1	Administrator logs in to 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 point of contact (POC) for the newly added agency	

***Administrator Captures/Modifies a Contact***

Step	Main Success Scenario	Alternate Scenarios
1	Administrator logs in to 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

***Student Takes Pre-Training Assessment Test***

<b>Step</b>	<b>Main Success Scenario</b>	<b>Alternate Scenarios</b>
1	Student logs in to 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 result	If test is incomplete, system will prompt the student to complete the test before submitting
5	System saves test result	

***Student Takes Post-Training Reaction Survey (Level 1)***

<b>Step</b>	<b>Main Success Scenario</b>	<b>Alternate Scenarios</b>
1	Student logs in to 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 result	If survey is incomplete, system will prompt the student to complete the survey before submitting
5	System saves survey results	

***Student Takes Post-Training Learning Test (Level 2)***

<b>Step</b>	<b>Main Success Scenario</b>	<b>Alternate Scenarios</b>
1	Upon student submitting 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 result	If test is incomplete, system will prompt the student to complete the test before submitting
4	System saves test results	

***Student's Supervisor/Agency POC Submits Behavior Survey (Level 3)***

<b>Step</b>	<b>Main Success Scenario</b>	<b>Alternate Scenarios</b>
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 in to 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
6	User submits survey result	If survey is incomplete, system will prompt the user to complete the survey before submitting
7	System saves survey results	

**Agency Management Submits Results Survey (Level 4)**

<b>Step</b>	<b>Main Success Scenario</b>	<b>Alternate Scenarios</b>
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 in to 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
6	User submits survey result	If survey is incomplete, system will prompt the user to complete the survey before submitting
7	System saves survey results	

**TIM Program Staff/Agency Personnel Performs Data Analysis**

<b>Step</b>	<b>Main Success Scenario</b>	<b>Alternate Scenarios</b>
1	User logs in to the system	
2	User selects a report	
3	User specified report parameters	There are no parameters for the report
4	System performs data analysis	
5	System generates report	
6	User saves the report	

**Administrator Authors/Modifies Surveys/Tests**

Step	Main Success Scenario	Alternate Scenarios
1	Administrator logs in to 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

**Administrator Authors/Modifies Analysis Reports**

Step	Main Success Scenario	Alternate Scenarios
1	Administrator logs in to 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

**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 amongst them.

**CRM Requirements**

Req ID	Requirements 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 registered.

### Survey Management Requirements

Req ID	Requirements 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.

## Analysis and Reporting Requirements

Req ID	Requirements 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.

## Integration Requirements

Req ID	Requirements Description
INT-1	The Survey Management component shall provide survey access information (such as an 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 shall provide survey results to the Analysis and Reporting component.

## ARCHITECTURE

The high-level operational concept and deployment topology of the TIM assessment tool are depicted in Figure 11.



**Figure 11: System architecture.**

### COTS Products and Services

The limited scope, funding, and timeframe 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.

#### **CRM**

Salesforce.com ([www.salesforce.com](http://www.salesforce.com)) is a market-leading customer/constituent relationship management system that is delivered as software-as-a-service (SaaS). In a SaaS model, an organization subscribes for a particular service level, 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, and 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.
- Adoption by various Federal agencies, including DOT.

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

- Contact management – adding and updating information about people and the entities with which they are associated.
- Activity tracking – creating follow up tasks, calls, emails, and other relevant events associated with people or entities.
- Workflows – triggering time- and event-based activities related to people or entities.
- Reports – tabular lists of people or entities by state, responder discipline (EMS, Law Enforcement, etc.) and other attributes.
- Data Loader – importing data from external sources and exporting data for more complex reporting and analysis.

### ***Survey Management***

FluidSurveys ([www.fluidsurveys.com](http://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.
- Very cost-effective and easy-to-use.
- 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.
- Export survey to printable format.

### ***Analysis and Reporting***

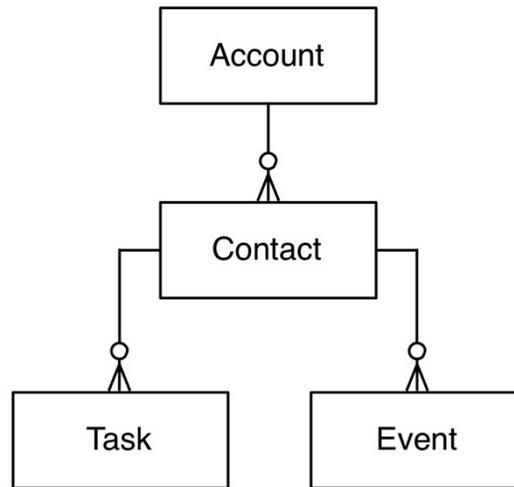
The research team selected Microsoft Access for the initial implementation of the TIM analysis and reporting functionality. The rationale for using this product is that:

- 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. This data is used to generate reports and answer questions such as “What percentage of trainees from each state found the training helpful to there 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 12.



**Figure 12: Simplified core CRM data model.**

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 is 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 this is part of the system.

By design, the overall system architecture is loosely coupled in order to simplify development and preserve flexibility. While both Salesforce.com and FluidSurveys provide comprehensive API's, a simpler integration model based upon data export/import scripts supports all of the use cases envisioned that are within the scope of the L32C project. These points of integration are shown in Figure 11.

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, etc., can be imported through the same

mechanism. Data is exported to the reporting and analysis database using the FluidSurveys export tool, then imported using the Salesforce.com data loader.

## 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.

<b>Use Case: UC01</b>	<b>Administrator Captures/Modifies a Participating Agency</b>
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 layouts and fields.
Actors	Constituent Data Administrator (CDA, which is a role or responsibility).
Pre-conditions	The CDA has to be logged in to the CRM module and have edit rights to Account objects.
Inputs	Data from an external source, such as list of registrants for a training class.

<b>Use Case: UC01</b>	<b>Administrator Captures/Modifies a Participating Agency</b>
Events sequence	<p>The CDA is able to create a new account by clicking the 'New' button on the Account Home screen, which takes him or her to the New Account screen. Account Name is the only required field and is the linkage 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 is a business decision. Once the account-related information has been input, the CDA can click the 'Save' button, or 'Cancel' to exit without saving.</p> <p>The CDA has numerous ways to lookup an account in order to modify it, including a dropdown list of all accounts, and numerous pre-configured 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.</p>
Post-conditions	The new account (agency, organization, etc.) is created or modified.
Requirements map	CRM-1, CRM-2, CRM-3, CRM-4
Related UI	Figure 13, Figure 14, Figure 15

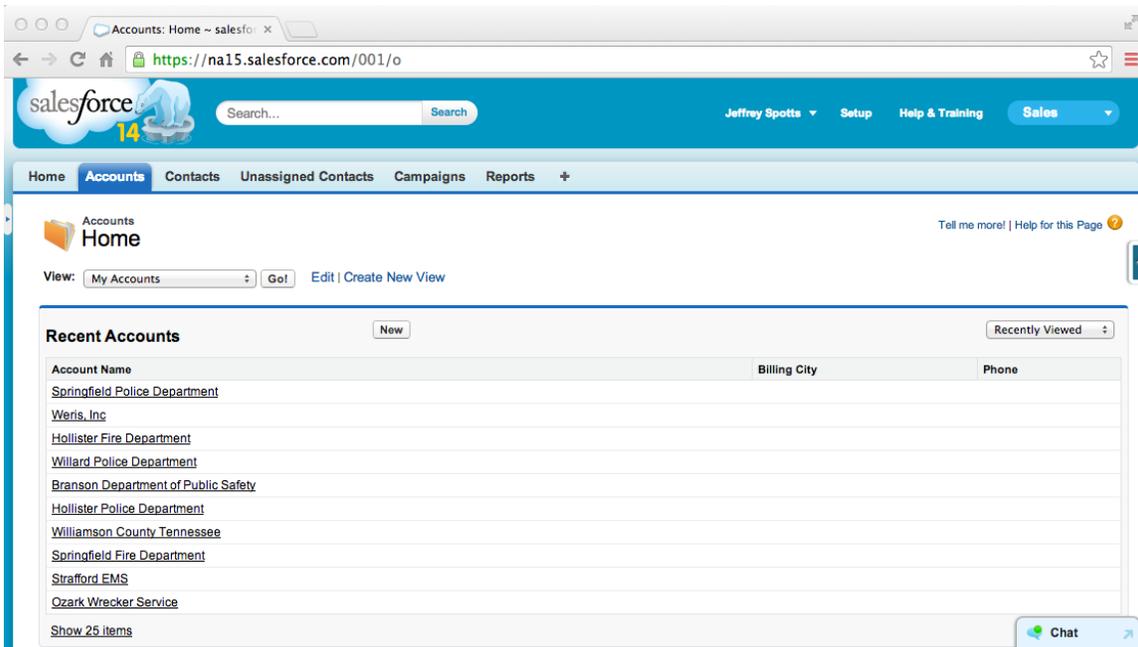


Figure 13: Accounts home screen.

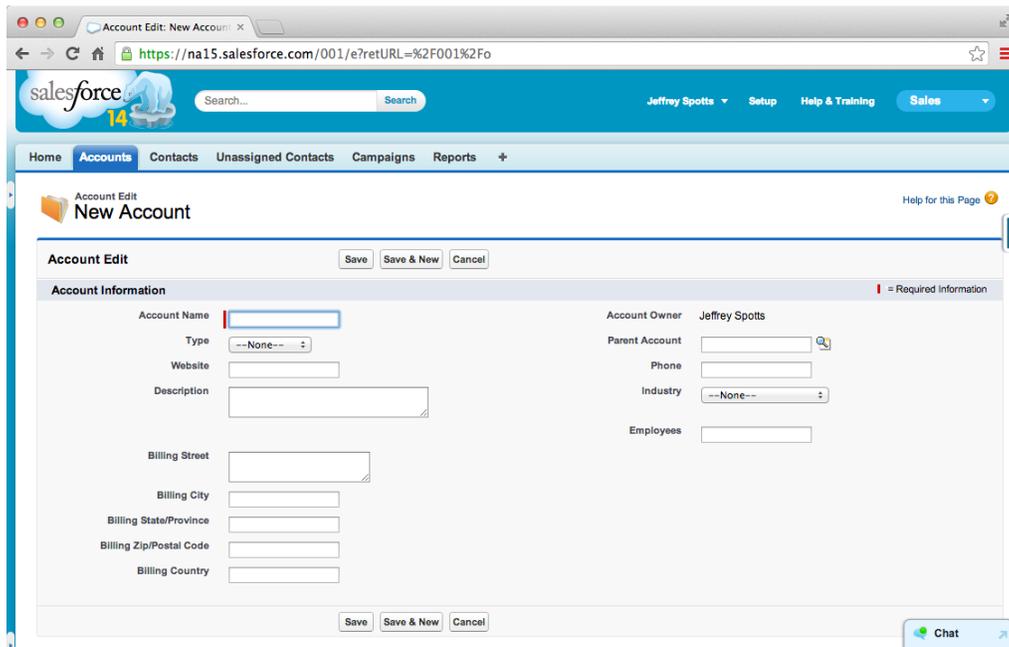


Figure 14: New account screen.

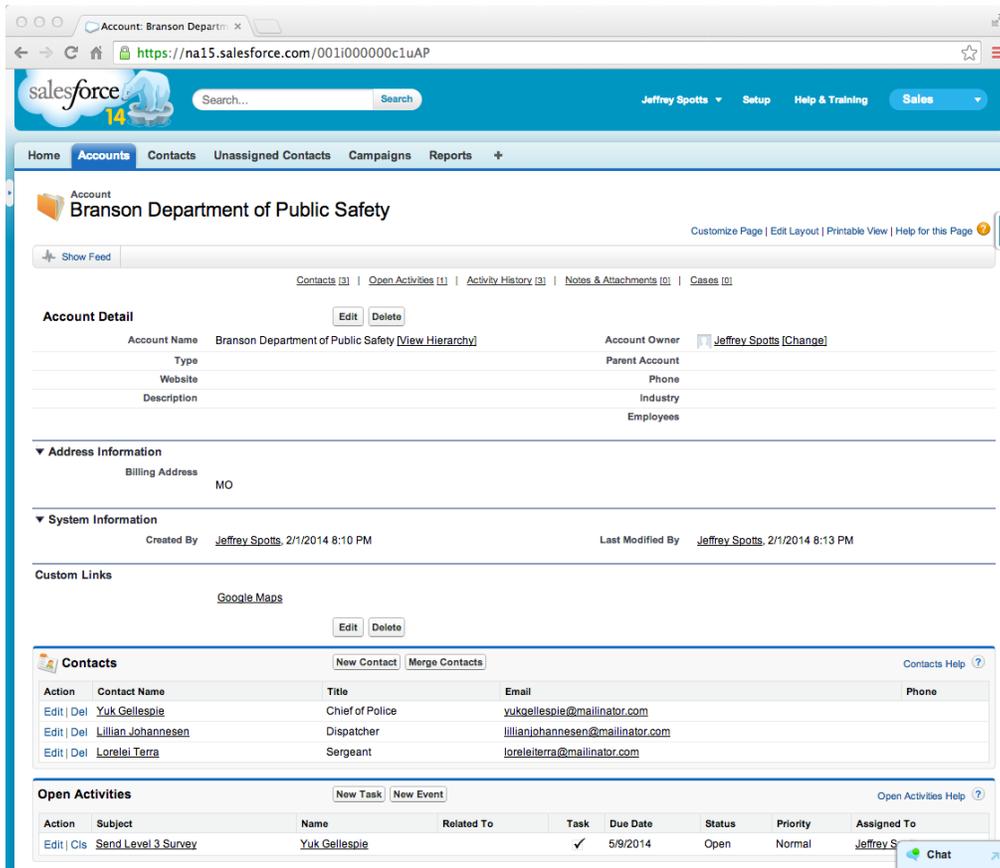


Figure 15: Account detail screen.

<b>Use Case: UC02</b>	<b>Administrator Captures/Modifies a Contact</b>
Description	<p>This function is used to add, change or delete information about any person that participates in the TIM training program.</p> <p>The function was implemented by customizing the Salesforce.com Contact form layout and fields.</p>
Actors	Constituent Data Administrator (CDA, which is a role or responsibility).
Pre-conditions	The CDA has to be logged in to the CRM module and have edit rights to Contact objects.
Inputs	Data from external source, such as list of registrants for a training class.

Use Case: UC02	Administrator Captures/Modifies a Contact
Events sequence	<p>The CDA is able to create a new contact by clicking the 'New' button on the Contact Home screen, which takes him or her to the New Contact screen. As described for UC01, Account Name forms the linkage between Accounts and Contacts, and is thus a required field. A lookup 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 utilize this is a business decision. Once the contact-related information has been input, the CDA can click the 'Save' button, or 'Cancel' to exit without saving.</p> <p>The CDA will have numerous ways to lookup a contact in order to modify information about the individual, including a dropdown list of all contacts, a drilldown by account, and numerous pre-configured 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.</p> <p>A contact's linkage 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 (Figure 18). Training Events are defined as Campaigns, which can be seen in the Campaigns Home (Figure 19) and Campaign Detail (Figure 20) screens. The Campaign Members section of the latter screen shows the linkage of multiple contacts to a particular training event (named Campaign).</p>
Post-conditions	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	Figure 16, Figure 17, Figure 18, Figure 19, Figure 20

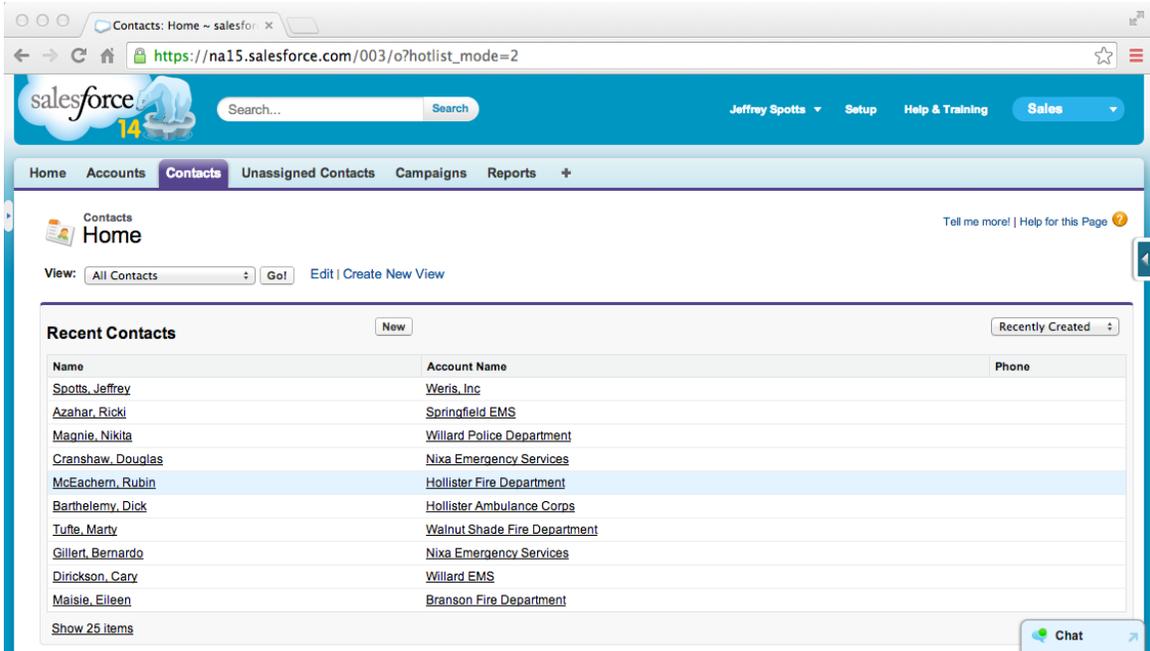


Figure 16: Contacts home screen.

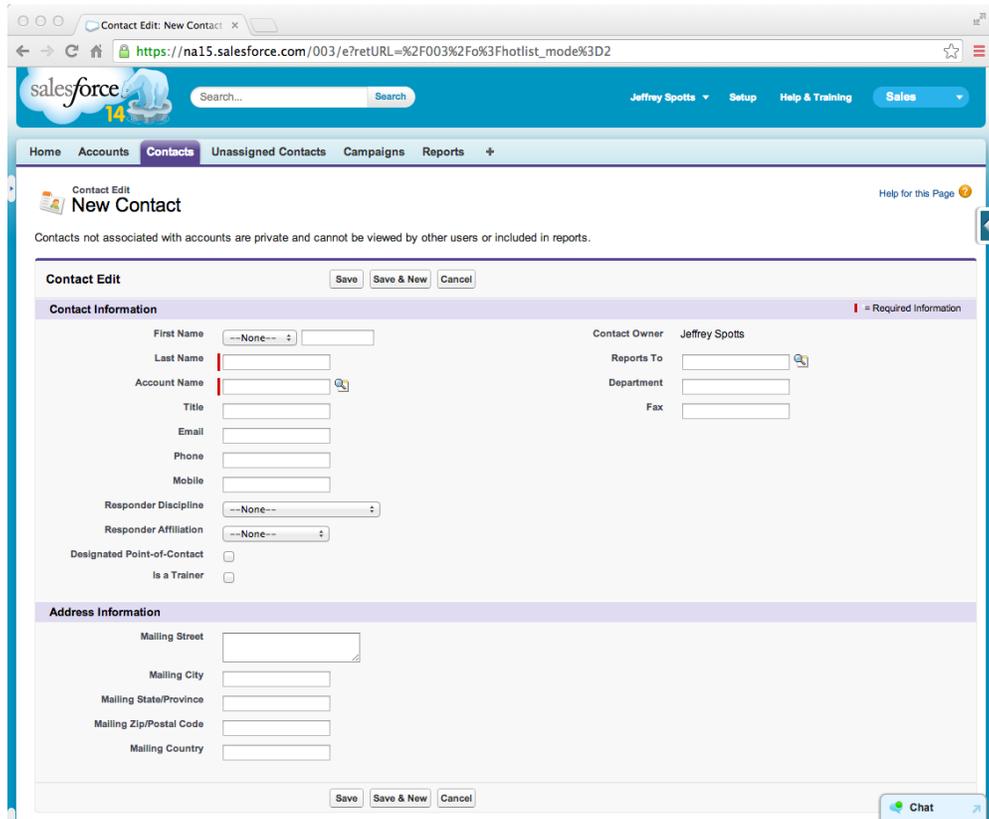


Figure 17: New contact screen.

The screenshot displays the Salesforce CRM interface for a contact named Yuk Gellespie. The page is organized into several sections:

- Contact Detail:** Includes fields for Name (Yuk Gellespie), Account Name (Branson Department of Public Safety), Title (Chief of Police), Email (yukgellespie@mailinator.com), and Contact Owner (Jeffrey Spotts).
- Address Information:** A section for the contact's address.
- System Information:** A section for system-related details.
- Open Activities:** A table listing active tasks. One task is visible: "Send Level 3 Survey" assigned to Jeffrey Spotts, due on 5/9/2014.
- Activity History:** A table listing past activities. One activity is visible: "Mass Email" performed on 2/10/2014.
- Notes & Attachments:** A section for notes and files, currently empty.
- HTML Email Status:** A section for email status, currently empty.
- Opportunities:** A section for sales opportunities, currently empty.
- Campaign History:** A table listing campaign participation. One record is visible: "Springfield, MO" campaign, started 12/10/2013, attended, with a member status update on 2/2/2014.

Figure 18: Contact detail screen.

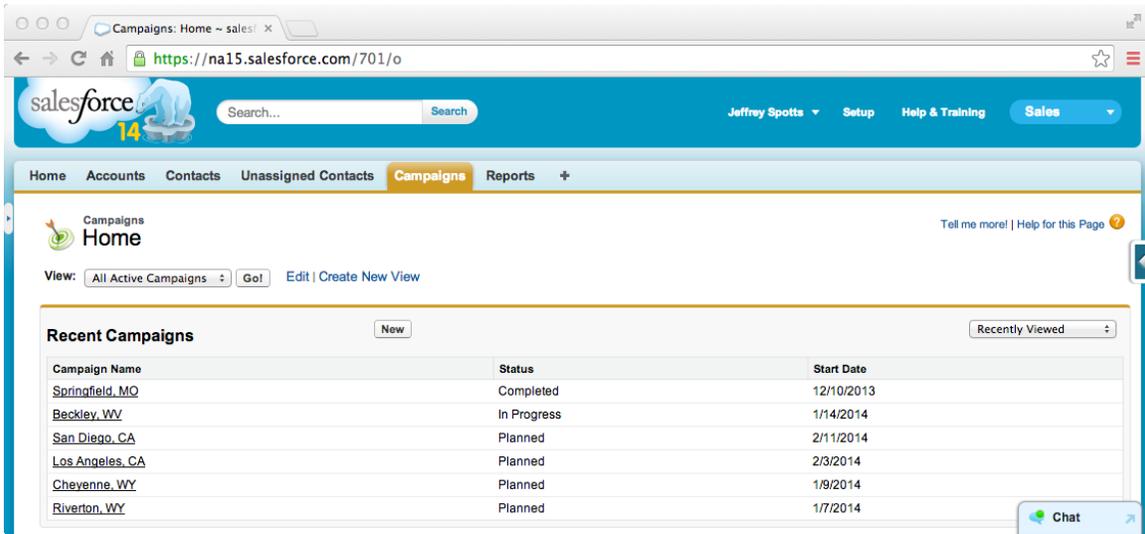


Figure 19. Campaigns home screen.

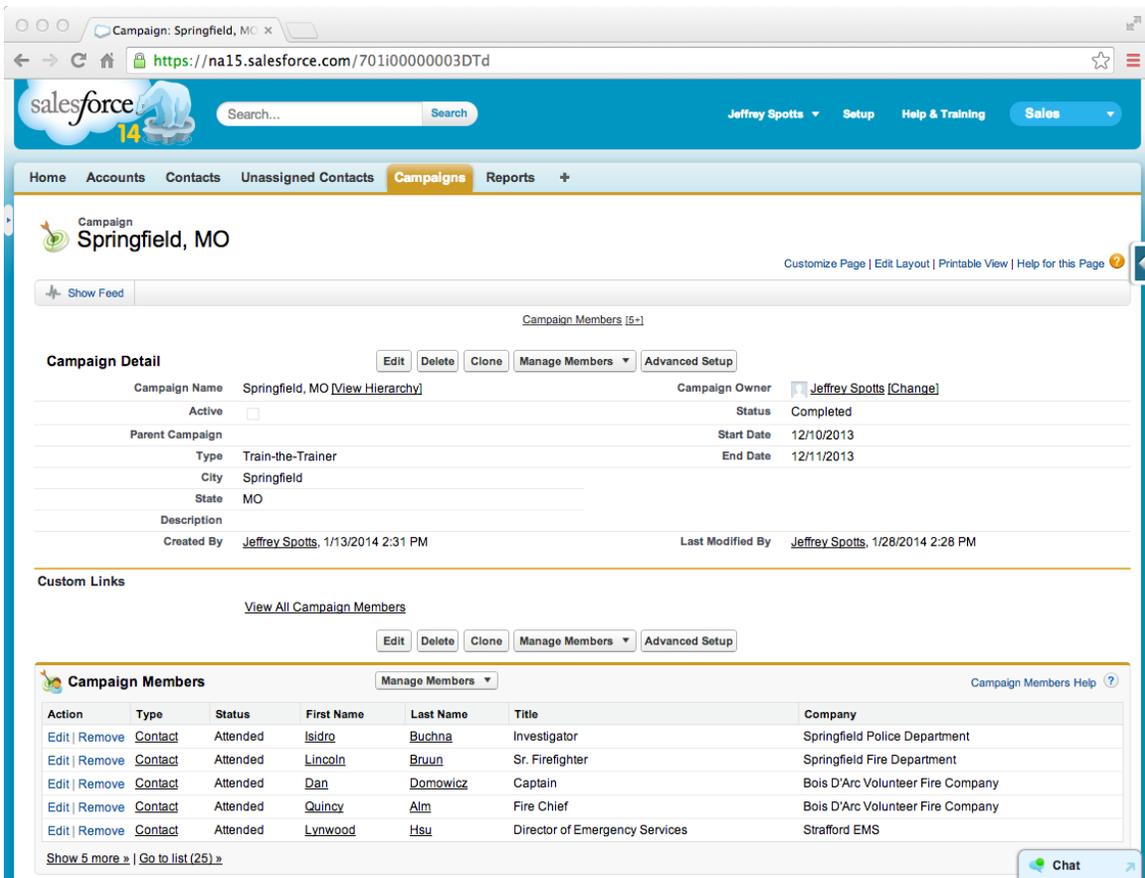


Figure 20. Campaign detail screen.

<b>Use Case: UC03</b>	<b>Student Takes Pre-Training Assessment Test</b>
Description	<p>This function allows the TIM training program to assess a student's knowledge prior to participating in a training course or module.</p> <p>This function was implemented through FluidSurveys' data collection capabilities.</p>
Actors	Student, plus a Survey Data Administrator (SDA, which is a role or responsibility) in the case of a paper-based assessment.
Pre-conditions	<p>The survey has been authored and published to the Web, and optionally been exported to PDF format to make it print-ready, all as described in UC09.</p> <p>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 in to the Survey Management module in order to do so.</p>
Inputs	<p><b>Online.</b> N/A.</p> <p><b>Paper-Based.</b> Completed assessment form.</p>
Events sequence	<p><b>Online.</b> The student enters the URL provided to them into their preferred web browser and begins to input his or her responses. Alternatively, if the URL has been emailed to them, their email client software may allow them 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 their response.</p> <p><b>Paper-Based.</b> The SDA visits an administrative URL and follows a similar procedure to enter the student's written responses into the Survey Management module.</p>
Outputs	N/A
Post-conditions	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 Figure 22.

<b>Use Case: UC04</b>	<b>Student Takes Post-Training Reaction Survey (Level 1)</b>
Description	<p>This function allows the TIM training program to assess a student's reaction to a training course.</p> <p>This function was implemented through FluidSurveys' data collection capabilities.</p>
Actors	Student, plus a Survey Data Administrator (SDA, which is a role or responsibility) in the case of a paper-based assessment.
Pre-conditions	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	<p><b>Online.</b> N/A.</p> <p><b>Paper-Based.</b> Completed assessment form.</p>
Events sequence	<p><b>Online.</b> The student enters the URL provided to them into their preferred web browser and begins to input his or her responses. Alternatively, if the URL has been emailed to them, their email client software may allow them 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 their response.</p> <p><b>Paper-Based.</b> The SDA visits an administrative URL and follows a similar procedure to enter the student's written responses into the Survey Management module.</p>
Outputs	N/A
Post-conditions	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 21

Course Evaluation Form - 50%

fluidsurveys.com/s/L32C\_Course\_Evaluation/?p=2&s=eyJwYWdlcGF0aCI6IiwLCAYXX0%3D&\_cache

## Course Evaluation Form

National Traffic Incident Management (TIM) Responder Training Program

50%

The course will help me improve my job performance.

1 = Strongly Disagree    2 = Disagree    3 = Neutral    4 = Agree

5 = Strongly Agree

The course subject matter was well organized.

1 = Strongly Disagree    2 = Disagree    3 = Neutral    4 = Agree

5 = Strongly Agree

The course content was consistent with the course description and course objectives provided.

1 = Strongly Disagree    2 = Disagree    3 = Neutral    4 = Agree

5 = Strongly Agree

The course content was relevant to my job.

1 = Strongly Disagree    2 = Disagree    3 = Neutral    4 = Agree

5 = Strongly Agree

The course exercises aided in my understanding and skill development.

1 = Strongly Disagree    2 = Disagree    3 = Neutral    4 = Agree

5 = Strongly Agree

Figure 21: Level 1 reaction survey.

Use Case: UC05	Student Takes Post-Training Learning Test (Level 2)
Description	<p>This function allows the TIM training program to assess how well a student has learned material presented in a training course or module.</p> <p>This function was implemented through FluidSurveys' data collection capabilities.</p>
Actors	Student, plus a Survey Data Administrator (SDA, which is a role or responsibility) in the case of a paper-based assessment.
Pre-conditions	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	<p><b>Online.</b> N/A.</p> <p><b>Paper-Based.</b> Completed assessment form.</p>
Events sequence	<p><b>Online.</b> The student enters the URL provided to them into their preferred web browser and begins to input his or her responses. Alternatively, if the URL has been emailed to them, their email client software may allow them 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 their response.</p> <p><b>Paper-Based.</b> The SDA visits an administrative URL and follows a similar procedure to enter the student's written responses into the Survey Management module.</p>
Outputs	N/A
Post-conditions	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 22

TIM Student Assessment - 18%

fluidsurveys.com/s/L32C\_StudentEval/?p=2&s=eyJwYWdlcGF0aCI6IFswLCAyXX0%3D&\_cache\_key\_=5a6a23

18%

**Lesson 1 – Statistics, Terminology, and Structure**

**What does the acronym NUG stand for?**

- A. National Unified Group
- B. National Utilization Goal
- C. National Unified Goal
- D. National Utilization Group

**The main NUG objectives are: responder safety, safe quick clearance, and \_\_\_\_\_ ?**

- A. Responder coordination
- B. Prompt, reliable interoperable communications
- C. Implement 'Steer It/Clear It' laws in every state
- D. Implement 'Move Over' laws in every state

**A traffic queue is defined as:**

- A. The backup of approaching traffic at an incident site
- B. The staging of tow/recovery vehicles at an incident site
- C. The backup of traffic downstream traffic at an incident site
- D. The staging of first responder vehicles at an incident site

**Figure 22: Level 2 learning survey.**

<b>Use Case: UC06</b>	<b>Student's Supervisor/Agency POC Submits Behavior Survey (Level 3)</b>
Description	<p>This function allows the TIM training program to assess long-term changes in student behavior.</p> <p>This function was implemented through FluidSurveys' data collection capabilities.</p> <p>The follow-up activity is scheduled by a Salesforce.com workflow. The request to complete the survey <i>may</i> be sent as an email from Salesforce.com, where it will be recorded as an activity related to the contact. Such an email would contain the URL at which the recipient can complete the survey. The request could also be sent by mail (a manual process), and this action optionally recorded as activity related to the contact.</p>
Actors	Designated Point of Contact (POC) at an organization whose personnel have participated in the TIM training program, plus a Survey Data Administrator (SDA, which is a role or responsibility) in the case of a paper-based assessment.
Pre-conditions	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	<p><b>Online.</b> N/A.</p> <p><b>Paper-Based.</b> Completed survey form.</p>
Events sequence	<p><b>Online.</b> The POC enters the URL provided to them into their preferred web browser and begins to input his or her responses. Alternatively, if the URL has been emailed to them, their email client software may allow them 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 their response.</p> <p><b>Paper-Based.</b> The SDA visits an administrative URL and follows a similar procedure to enter the POC's written responses into the Survey Management module.</p>
Post-conditions	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 23

TIM Training Behavior Impact Survey - 0%

fluidsurveys.com/s/L32C\_Behavior/

## TIM Training Behavior Impact Survey

*National Traffic Incident Management (TIM) Responder Training Program*

Your agency or organization:

Responding Agency

In what state is your agency/organization based?

TN

In the time since personnel from your agency participated in TIM training, has trainee behavior improvement been observed to ensure TIM responder safety?

1 = Not Yet    2 = Somewhat    3 = Significant

Has trainee behavior improvement been observed to better coordinate multi-agency operations?

1 = Not Yet    2 = Somewhat    3 = Significant

Has trainee behavior improvement been observed to better prepare TIM resources?

1 = Not Yet    2 = Somewhat    3 = Significant

Has trainee behavior improvement been observed to reduce incident clearance time?

1 = Not Yet    2 = Somewhat    3 = Significant

Submit

**Figure 23: Level 3 behavior impact survey.**

<b>Use Case: UC07</b>	<b>Student's Agency Management/POC Submits Results Survey (Level 4)</b>
Description	<p>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.</p> <p>This function was implemented through FluidSurveys' data collection capabilities.</p> <p>The follow-up activity is scheduled by a Salesforce.com workflow. The request to complete the survey <i>may</i> be sent as an email from Salesforce.com, where it will be recorded as an activity related to the contact. Such an email would contain the URL at which the recipient can complete the survey. The request could also be sent by mail (a manual process), and this action optionally recorded as activity related to the contact.</p>
Actors	Designated Point of Contact (POC) at an organization whose personnel have participated in the TIM training program, plus a Survey Data Administrator (SDA, which is a role or responsibility) in the case of a paper-based assessment.
Pre-conditions	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	<p><b>Online.</b> N/A.</p> <p><b>Paper-Based.</b> Completed survey form.</p>
Events sequence	<p><b>Online.</b> The POC enters the URL provided to them into their preferred web browser and begins to input his or her responses. Alternatively, if the URL has been emailed to them, their email client software may allow them 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 their response.</p> <p><b>Paper-Based.</b> The SDA visits an administrative URL and follows a similar procedure to enter the POC's written responses into the Survey Management module.</p>
Post-conditions	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 24

The image shows a screenshot of a web browser displaying an online survey. The browser's address bar shows the URL 'fluidsurveys.com/s/L32C\_Results/'. The survey title is 'TIM Training Outcomes Impact Survey' with the subtitle 'National Traffic Incident Management (TIM) Responder Training Program'. The survey consists of several questions:

- 'Your agency or organization:' followed by a text input field containing 'Responding Agency'.
- 'In what state is your agency/organization based?' followed by a dropdown menu showing 'WY'.
- 'In the time since personnel from your agency completed TIM training, has your organization experienced an improvement in responder safety?' with radio button options: '1 = Not Yet', '2 = Somewhat', and '3 = Significant'.
- 'Has your organization experienced a reduction in secondary incidents?' with radio button options: '1 = Not Yet', '2 = Somewhat', and '3 = Significant'.
- 'Has your organization experienced reduction in incident clearance time?' with radio button options: '1 = Not Yet', '2 = Somewhat', and '3 = Significant'.

A 'Submit' button is located at the bottom of the survey form.

**Figure 24: Level 4 survey example – online.**

<b>Use Case: UC08</b>	<b>TIM Program Staff/Agency Personnel Performs Data Analysis</b>
Description	<p>This function allows TIM program staff or agency personnel to perform analysis on data collected via Level 1 through Level 4 surveys.</p> <p>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 the students think the TIM course helps their job performance, how well the students scored on each lesson, and whether participating agencies see TIM performance improvement after the training.</p> <p>Reports can be aggregated by agency, by state, by discipline, by student affiliation, or by training method where appropriate.</p>
Actors	Program Manager or Analyst
Pre-conditions	Predefined reports have been created in Access. The user has been granted login credential 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	<p>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.</p> <p>The user will run the selected report, and save the report as a PDF file or export the data to a CSV/Excel file.</p>
Outputs	A PDF report of CSV/Excel data file
Post-conditions	<p>The report file or data file can be distributed;</p> <p>The Excel data file can be further analyzed.</p>
Requirements map	AR-3, AR-4, AR-5, AR-6
Related UI	Figure 25, Figure 26

**TIM Training Assessment Reports**

Level 1 **Level 2** Level 3 Level 4

**Filters**

Training From: 1/2/2014 To: 3/20/2014 Method: Classroom  
State: City:  
Trainee Discipline: Affiliation: Paid Professional

**Reports**

- Trainees who found the course exercises aided in their understanding
- Trainees who found the facility set-up met participants' needs
- Trainees who found the instructors enthusiastic
- Trainees whose interest in the subject increased after training
- Trainees who found knowledge/skill improved after training
- Trainees who thought the instructors related subject matter to their jobs
- Trainees who thought the training subject was well organized
- Trainees who thought the instructors explained theories well
- Trainees who found the training to be helpful for job performance**

**Aggregate Results**

- By Agency
- By State
- By Training Method
- By Discipline
- By Affiliation

Cancel Run Report

Figure 25: Select and run assessment reports.

<b>Trainees Who Found The Training To Be Helpful For Job Performance</b>		
<i>by Organization</i>		
Affiliation: Paid Professional		
<b>Organization Name</b>	<b>% Responders</b>	<b># Responders</b>
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

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**Figure 26: Sample assessment report.**

<b>Use Case: UC09</b>	<b>Administrator Authors/Modifies Surveys/Tests</b>
Description	<p>This function allows the TIM training program to create new assessment vehicles or change existing ones.</p> <p>This function was implemented through FluidSurveys' survey authoring capabilities.</p>
Actors	Survey Author (SA, which is a role or responsibility).
Pre-conditions	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 rights to author, edit and publish surveys.
Inputs	N/A
Events sequence	<p>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 or she can select the existing survey, then click the 'Actions' button and select 'Duplicate' from the dropdown list in order to create a new 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 <a href="http://fluidsurveys.com/help-tutorials/">http://fluidsurveys.com/help-tutorials/</a>.</p>
Outputs	N/A
Post-conditions	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 27

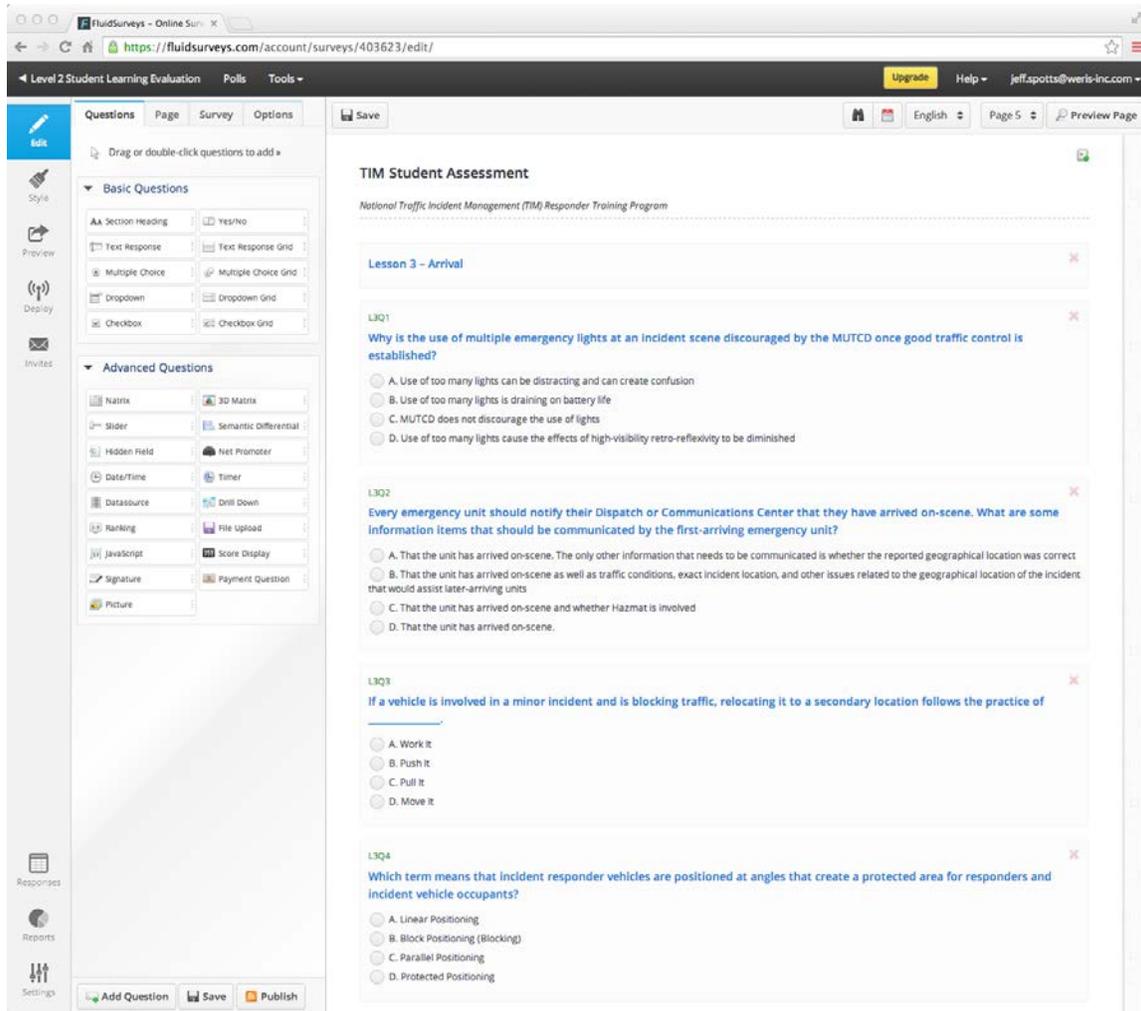


Figure 27: Authoring and editing a survey.

<b>Use Case: UC10</b>	<b>Administrator Authors/Modifies Analysis Reports</b>
Description	<p>This function allows the Training Program Manager or Business Analyst to create new assessment reports, modify or delete existing reports.</p> <p>Newly created reports are made available through the Access assessment reporting tool's user interface, while deleted reports are removed from the user interface.</p>
Actors	Training Program Manager or Business Analyst
Pre-conditions	The user has been granted login credential to the Access assessment reporting tool and the access privileges to create, modify, and delete reports. The user has also been granted privileges to create and modify user interface screens.
Inputs	N/A
Events sequence	<p>The Training Program Manager or Business Analyst logs in to the Access tool. He/she will create new assessment reports using SQL queries and report layout.</p> <p>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.</p> <p>If an existing report is deleted, the user will make it unavailable from the Access user interface.</p>
Outputs	New or modified assessment reports
Post-conditions	New assessment reports are created, while existing reports are modified or removed.
Requirements map	AR-1, AR-2, AR-3, AR-4, AR-5
Related UI	Figure 28, Figure 29

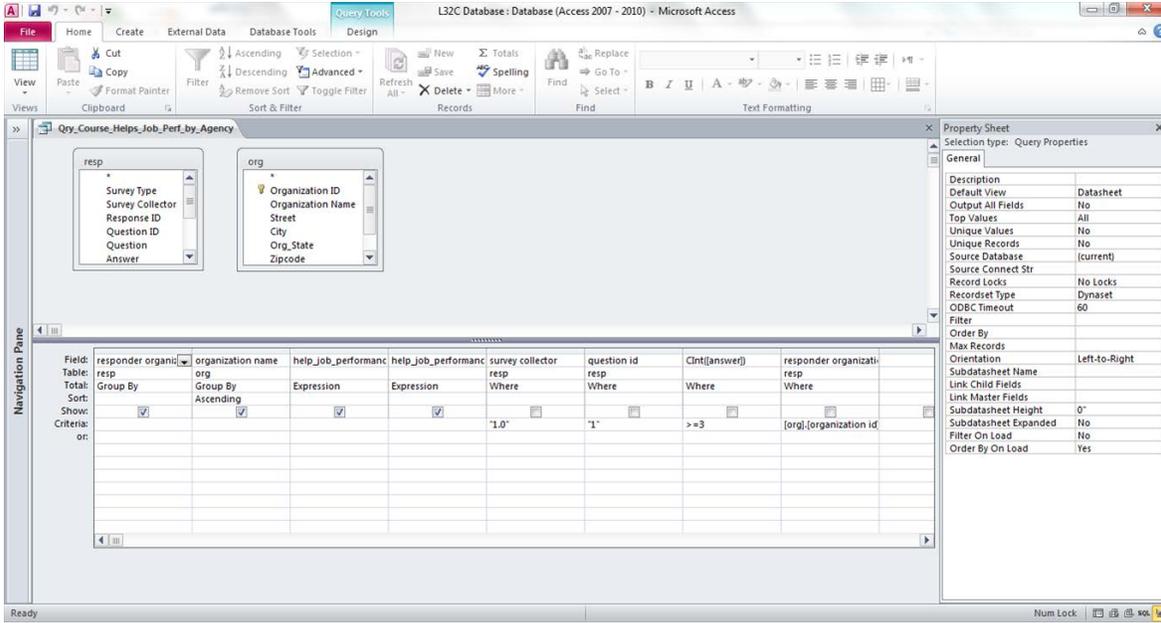


Figure 28: Report query design.

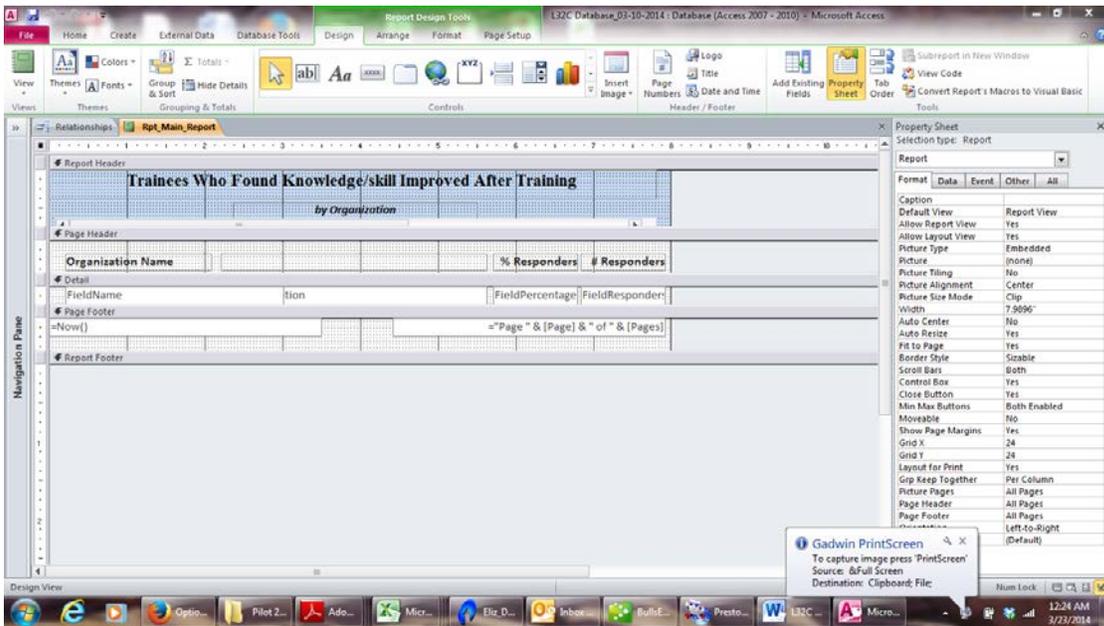


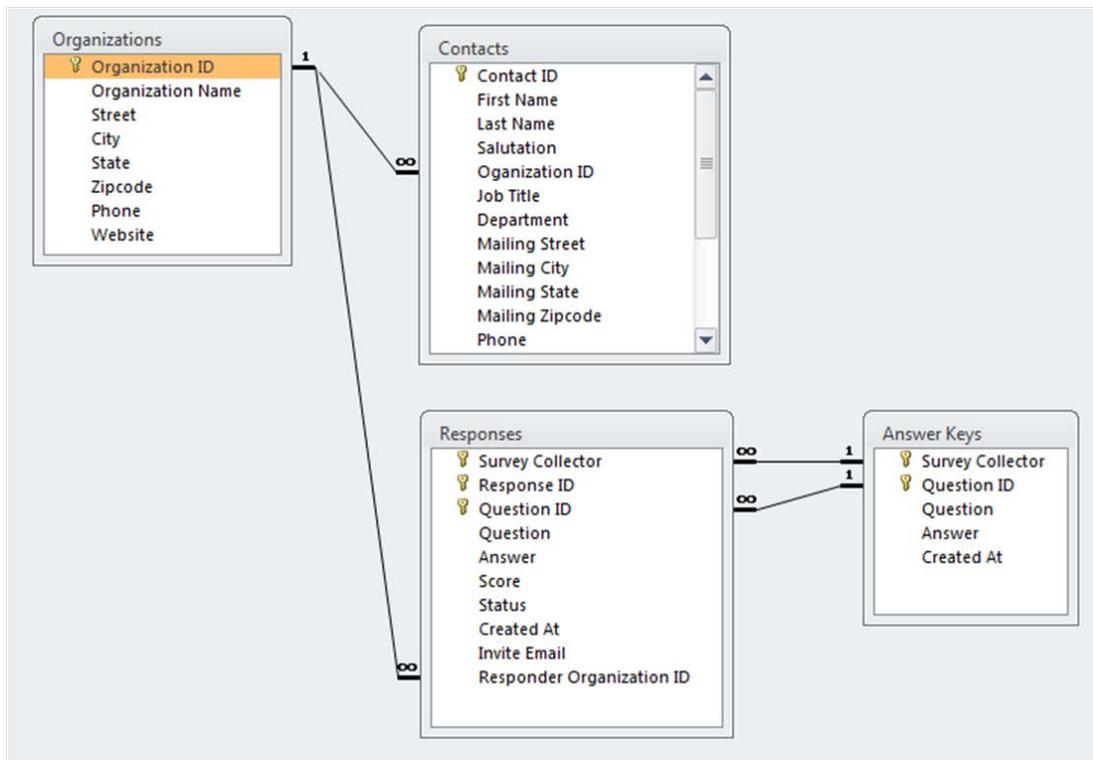
Figure 29: Report design.

## 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
4. Answer Keys

Figure 30 shows an entity relationship diagram of the tool's database.



**Figure 30. Database entity relationship diagram.**

## 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 “header” information:

- Agency
- Discipline (DOT, EMS, Law Enforcement, etc.)
- # Years in the Position
- Affiliation (Paid Professional or Volunteer)
- Reason for Training
- Is This a Retake?
- Is This an Online Course?
- Training Session Start Date
- Training Session City
- Training Session State

### ***Database Tables***

The remainder of this section provides a detailed description for each database table. The primary key columns for each table are highlighted.

***Organizations*** – This table contains a list of all agencies/organizations participating in the TIM training program.

<b>Column Name</b>	<b>Description</b>
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
Zipcode	Postal code for the organization
Phone	Main phone number of the organization
Website	The organization’s website

**Contacts** – This table contains a list of all trainees and trainers participating in the TIM training program. It also identifies an organization’s point of contact person for Level 3 and Level 4 follow-up surveys.

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 Zipcode	Postal code for the Contact’s mailing address
Phone	Contact’s phone number
Fax	Contact’s fax number
Mobile	Contact’s mobile phone number
Email	Contact’s email address
Responder Discipline**	Contact’s disciplinary field, chosen from the following list of values: <ul style="list-style-type: none"> <li>▪ DOT</li> <li>▪ Emergency Medical Services</li> <li>▪ Fire and Rescue</li> <li>▪ Hazmat</li> <li>▪ Law Enforcement</li> <li>▪ Towing and Recovery</li> <li>▪ Other</li> </ul>

Responder Affiliation**	Contact's affiliation, chosen from the following list of values: <ul style="list-style-type: none"> <li>▪ Paid Professional</li> <li>▪ Volunteer</li> <li>▪ Not Applicable</li> </ul>
Is Trainer**	Whether the Contact is a TIM trainer: <ul style="list-style-type: none"> <li>▪ No</li> <li>▪ Yes</li> </ul>
Is Designated POC**	Whether the person is a designated point of contact for the organization

NOTE: The columns designated with (\*\*) represent information that is not currently collected during NHI course registration process. These attributes are collected via Level 1 and 2 surveys, and stored in our Responses table. However, since there is no direct connection between a survey response and the survey responder, these attributes are not be reflected in the Contacts table. The related fields are thus placeholders should the TIM training registration process be modified in the future to gather these additional attributes.

**Responses** – This table contains responses for all surveys. For flexibility and scalability, each row in this table represents response to one survey question.

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

Column Name	Description
Status	Status of the survey response <ul style="list-style-type: none"> <li>▪ Complete</li> <li>▪ Incomplete</li> </ul>
Created At	Date/Time when the response was created
Invite Email	Email address for the survey invite
Responder Organization ID	Responder's organization ID

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

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

## SYSTEM TEST AND PILOT

### Scope of Testing

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

In instances where core product functionality was being used, for example, creating an account or contact in Salesforce.com, or authoring a survey and collecting survey data online using FluidSurvey, the research team made the assumption that the vendor had performed thorough QA testing, which did not need to be replicated. The research team therefore confined the scope of our testing mostly to any extensions or customizations, such as the addition of custom fields, and validating the integrity of data flowing through the system.

## **Pilot**

The original project plan anticipated conducting a pilot to test the TIM assessment tool in a setting approximating production usage. An expected scenario was to conduct the pilot in conjunction with pilot testing of the online TIM training course being developed by SHRP 2 Project L32B. Since that project is being extended beyond the March 31, 2014 ending 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 that they could assess their ability to produce exportable data in this format.

During the pilot timeframe, 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

### 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 shows that it is feasible and practical to implement 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 to be the most valuable, for most organizations, obtaining them remain aspirations. 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 our research might serve as a useful framework to assess staffing and other resources required to implement a TIM assessment program.

At such time as a sponsoring agency takes ownership of the TIM assessment tool, high-level goals to consider would be to mature the L32C application, generate more interest from the user community, and build 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, which include workshops, train-the-trainer and other classroom training events, and planned online courses. This will require support efforts 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 later 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, which includes:

- 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.
- Providing customer support, and identifying, documenting and addressing system defects.

### **Enhance Functions and Processes**

As the tool is used more broadly use, it is reasonable to expect that user feedback and suggestions will be received. This input should be periodically reviewed, analyzed, and prioritized to identify changes that should be addressed. A structured mechanism to track, respond to, and analyze support requests would be 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**

As described previously, the L32C product represents not only 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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3. TRB (2013). "Train-the-Trainer Pilot Courses for Incident Responders and Managers," SHRP 2 Project L32A Final Report (Prepublication, Non-Edited). Accessed at <http://onlinepubs.trb.org/onlinepubs/shrp2/SHRP2prepubL32Areport.pdf>
4. National Fire Academy (2009). Long Term Evaluation Report. Accessed at [http://www.usfa.fema.gov/downloads/pdf/nfa/course\\_eval\\_2009.pdf](http://www.usfa.fema.gov/downloads/pdf/nfa/course_eval_2009.pdf)

## APPENDIX A – EXTERNAL INPUT DATA REQUIREMENTS

This document 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, Contacts, and Survey Responses. Each responder and contact must belong to an organization supplied in the Organizations table.

Export files must use the Comma Separated Variable (\*.csv) format. Further information regarding the fields and data types for each of the three tables is supplied below.

### ORGANIZATIONS

#### Field Specifications

<i>Field Name</i>	<i>Data type</i>	<i>Length (chars)</i>	<i>Comment</i>
<i>Name</i>	Text	255	-
<i>BillingStreet</i>	Text	255	-
<i>BillingCity</i>	Text	255	-
<i>BillingState</i>	Text	2	-
<i>BillingPostalCode</i>	Text	10	-
<i>Phone</i>	Text	50	-
<i>Website</i>	Text	255	-

### CONTACTS

#### Field Specifications

<i>Field Name</i>	<i>Data type</i>	<i>Length (chars)</i>	<i>Comment</i>
<i>FirstName</i>	Text	50	-
<i>LastName</i>	Text	50	-
<i>MailingStreet</i>	Text	255	-
<i>MailingCity</i>	Text	255	-
<i>MailingState</i>	Text	2	-
<i>MailingPostalCode</i>	Text	10	-
<i>Phone</i>	Text	50	-
<i>Fax</i>	Text	50	-
<i>MobilePhone</i>	Text	50	-

<b>Field Name</b>	<b>Data type</b>	<b>Length (chars)</b>	<b>Comment</b>
<i>Email</i>	Text	255	-
<i>OrganizationName</i>	Text	255	-
<i>Title</i>	Text	255	Contact's job title.
<i>Department</i>	Text	255	-
<i>ResponderDiscipline_C</i>	Text	255	Contact's job discipline, selected from the following list: "DOT", "Emergency Medical Services", "Fire and Rescue", "Law Enforcement", "Towing and Recovery".
<i>IsTrainer_C</i>	Boolean	-	TRUE if contact is considered a Trainer, FALSE otherwise.
<i>DesignatedPOC_C</i>	Boolean	-	TRUE if contact is considered a Designated Point-of-Contact (POC), FALSE otherwise.
<i>ResponderAffiliation_C</i>	Text	255	Contact's affiliation, selected from the following list: "Paid Professional", "Volunteer", "Not Applicable".

## RESPONSES

The Responses table contains sets of survey responses for each of the responders to the surveys. Within the scope of this project, only survey types "Level 1" and "Level 2" may require external data input. For optimal assessment, all of 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 below in the Question Specifications section, 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 that the question falls under. Survey export filenames must begin with the string "Level #" where "#" can be either "1" or "2".

## Field Specifications

<i>Field Name</i>	<i>Data type</i>	<i>Length (chars)</i>	<i>Comment</i>
<i>Question</i>	Text	255	Question text, must be prefixed with a header like “[L#Q#]”. See footnote for more information. <sup>1</sup>
<i>Response</i>	Text	255	The users’ response to multiple choice, true/false questions.
<i>Comment</i>	Text	255	The users’ response to open-ended questions.
<i>Date/Time</i>	Date	-	The users’ response to questions regarding dates.
<i>CreatedAt</i>	Date	-	Creation date of survey question.
<i>InternalID</i>	Number	8	Uniquely identifies each survey responder.
<i>Collector</i>	Text	255	Identifies the iteration of a set of surveys. Formatted as “1.0”, “2.1” and so forth.

---

<sup>1</sup> 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 (i.e., Question 1. (a), (b), (c), etc.). For the pertinent responder questions outlined the Question Specifications section, use the header [Q#], as there is no associated Lesson.

## QUESTION SPECIFICATIONS AND SAMPLE RESPONSES

Question	Response	Comment	Date/Time	CreatedAt
[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