



Case Study – Using a Virtual Incident Management Training System for Transportation First Responders

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Overview

In this case study, we examine the initial phases of adopting a 3-D virtual, multi-player game environment to effectively and efficiently train and reinforce best incident-management practices for first responders to highway traffic incidents. While still under development, the program has already shown great promise as a way to allow thousands of transportation first responders to learn, in a safe and realistic environment, how to achieve optimum results and to avoid catastrophic mistakes.

In particular, we will look at:

- The business drivers behind adopting a new learning approach;
- Why the stakeholders decided to employ a 3-D, multi-player, game environment;
- The challenges in developing the system; and,
- The initial results and plans for the next phase of the project.

Managing the Great Asphalt Way

Interstate 95 is the major highway corridor in the eastern United States. It stretches more than 1,900 miles from Maine to Florida, and passes through nearly every major east coast city. It is a vital pathway for all kinds of commerce as it passes through 15 states with a combined population exceeding 100,000,000 citizens. The average annual daily traffic in all the highly populated locations along I-95 is nearly 5 million vehicles.



Figure 124 – Incidents like this tractor-trailer spill may involve relatively benign materials, like the trash shown here, or hazardous materials such as gas or chemicals. The cleanup of such events can be both costly and time-consuming. Photo: New Jersey DOT.²⁷

Consider these important facts:

- One-quarter of the traffic congestion in the U.S. is caused by non-recurring traffic incidents, including stalled vehicles, spilled loads, debris on the road, and crashes.²⁸
- Traffic congestion is a costly economic threat. Americans lose 3.7 billion hours and 2.5 billion gallons of fuel every year sitting in traffic. In 2004, truck traffic idled by congestion and traffic accidents costs the industry \$8 billion dollars. That cost passes on to consumers in the form of higher freight costs.²⁹
- Estimates show that secondary crashes, due to congestion caused by a previous crash, represent 20 percent of all crashes.³⁰

²⁷ Turner-Fairbanks Highway Research Center

²⁸ USDOT, Federal Highway Administration, Turner-Fairbanks Highway Research Center – <http://www.tfhrc.gov/pubrds/04nov/03.htm>

²⁹ Intelligent Transportation Systems, USDOT – http://www.its.dot.gov/jpodocs/repts_te/14288.htm#b2

³⁰ Federal Highway Administration Office of Operations Webpage, *Traffic Incident Management* – http://www.ops.fhwa.dot.gov/aboutus/one_pagers/tim.htm



- Responders to traffic incidents risk their lives to manage congestion and accidents. More than 20 percent of annual firefighter deaths occur on the roadways, as does about half of the 300 law-enforcement officers killed on duty. In the first three months of 2006, the towing and recovery industry lost five people in struck-by incidents.⁵¹

The I-95 Corridor Coalition

The I-95 Corridor Coalition is an alliance of transportation agencies, toll authorities, and related organizations, including law enforcement, from the State of Maine to the State of Florida, with affiliate members in Canada. The Coalition began in the early 1990's as an informal group of transportation professionals who work together to more effectively manage major highway incidents that impacted travel across jurisdictional boundaries. During the 1990's, the focus of the Coalition's program evolved from studying and testing intelligent transportation systems (ITS) technologies, to a broader perspective that embraced integrated deployments and coordinated operations.

In an effort to improve safety and performance on I-95, a Steering Committee of the I-95 Corridor Coalition set out to develop and test a Massively Multi-player Virtual Incident Management Training System for Transportation First Responders. The Steering Committee consists of police, fire, EMT, towing recovery, and transportation officials, and includes the U.S. Department of Transportation (USDOT) and the Federal Highway Administration (FHA).

The Steering Committee set out to establish a set of “best practices” that were to be used in the development of 3-D virtual reality scenarios that would allow first-responder learners to embrace important safety and traffic management procedures. This effort would minimize prolonged traffic congestion, enhance overall traffic incident management (TIM), and improve safety for first responders and the driving public-at-large.

⁵¹ National Traffic Incident Management Coalition – <http://www.transportation.org/?siteid=41&pageid=591>



The great promise of immersive learning simulations (ILS) is that best practices modeling is now possible in a computer-generated, 3-D, real-time, safe environment. People can test scenarios, get real-time feedback, and review and evaluate both good performance and potentially catastrophic mistakes.

Primary “best practices”

While it is readily recognized that TIM will vary from jurisdiction to jurisdiction, and that the respective agencies responsible for emergency communications, law enforcement, fire, EMS, and so on, will formulate and adopt their own methods and procedures, there are some common and effective steps that first responders can take to achieve optimal management and solutions to any particular incident. Some examples are:

- The safety of first responders is substantially enhanced when they don their reflective emergency vests as soon as they arrive at the scene;
- Placement of traffic cones and flares will help to isolate areas that must be off-limits to anyone other than first responders; and,
- An assessment of the types of responder vehicles, including appropriate size and sufficient number, is vitally important so that there is no delay in calling subsequent response vehicles to the scene.

The best-practices effort intends to ensure that the content of the 3-D, virtual reality scenarios teaches first responders to learn how to assess and implement the basic steps that will enhance TIM, and improve safety at the scene.

According to Chris Badger, Vice President of Marketing at Forterra Systems, “The great promise of immersive learning simulations (ILS) is that best-practices modeling is now possible in a computer-generated, 3-D, real-time, safe environment. People can test scenarios, get real-time feedback, and review and evaluate both good performance and potentially catastrophic mistakes.”

Phase One – Virtual Reality Scenario Development

The I-95 Corridor Coalition appropriated \$1.4 million dollars for the development of the Virtual Incident Management Training System. They chose the Center for Advanced Transportation Technology Laboratory (CATT LAB) at the University of Maryland to develop the virtual reality tools necessary to move forward with this initiative. They also selected the OLIVE (On-line Interactive Virtual Environment) platform from Forterra Systems as the foundation for their technology development.

Through the steering committee, the coalition determined what every first responder should learn to do. Their goal was to test, validate, certify, and reinforce the dissemination of best incident-management practices across the Coa-



lition region. Opinions and attitudes about what constitutes best practices vary across the wide spectrum of agencies and first-responder leaders. The steering committee maneuvered through this complicated, content development phase by receiving input from many people throughout the region, and deciding on the common themes best employed in creating an effective learning tool.

The program presents typical traffic incidents, from “fender benders” to major collisions including HAZMAT situations, and allows the participants to play out their normal roles in what is essentially a highly structured and recorded video game. In this way, traffic management personnel and incident responders can experience a wide array of realistic scenarios, analyze the impacts of their decisions, and learn appropriate responses and communication, as well as the consequences of inappropriate responses and of communication breakdowns. In essence, this learning strategy allows a real-time review of in-simulation performance and feedback to correct learning deficiencies.



Figure 2 – This is one example of an incident scenario developed by the CATT LAB for the Virtual Incident Management Training System.

The next step for the steering committee was to select the development platform that best suited their needs, at a cost level that was appropriate given the budget for the project. Several platform options were available for review, and they analyzed proposals from vendors who would provide their platforms along with additional technical support as needed. Project leadership determined



that there was a wide spectrum of technology available, and, surprisingly few similar attributes among them.

After this extensive review of computer-generated virtual environments, the steering committee selected Forterra Systems' OLIVE platform, at a cost of approximately 21% of the total budget. Also, in this selection phase, project leadership noted that the procurement process was complicated by the fact that government funding was involved, and the requirements for expenditure review and approval, prior to signing contracts, lengthened the time to make a final selection of the platform.

The team of two full-time faculty members and six undergraduate students at the CATT LAB, under the direction of principal investigator, Michael L. Pack, began the creation of an intensive training program in three-dimensional, multi-player computer gaming simulation technology. According to Mr. Pack, "OLIVE provided the greatest possibilities. It had significant first-responder content already built in, its VoIP (voice over internet protocol) was very good, and it easily handled large numbers of users at one time." In addition, OLIVE's ability to capture and record simulations for later retrieval and review made Forterra's technology especially compelling.

Phase Two – Testing with Live First Responders

Once the first set of Virtual Incident Management Training System game modules was completed, an on-site training program for first responders began. In addition to the software, they created pre-study workbooks to establish training standards and best practices. A small number of first responders were then able to experience a reinforcement of what they were to learn, using the computer-generated virtual environment as an effective reinforcement tool. By experiencing changing scenarios, the learner should be able to react and respond in appropriate ways, and understand the implications and ramifications of their responses – whether correct or flawed.



Figure 3 – First responder participating in an incident scenario



Figure 4 - Examples of how scenarios are depicted via the virtual training software.³²

³² CATT Laboratory, University of Maryland, College Park – Virtual Incident Management Training – <http://www.cattlab.umd.edu/index.php?page=research&a=00028>



Next, the project must grapple with how to expand this learning experience to encompass the thousands of first responders throughout the corridor-coalition region. One strategy calls for the use of a “rolling, 50 laptop, laboratory” where selected individuals in many locales will be able to experience this learning opportunity. This rolling lab will provide valuable information to the coalition that they will then use to formulate the next phase, including identifying appropriate funding, of this project.

Project specifications also call for the use of moderators as part of the learning design. These people are essential to the deployment, and they will provide both in-game feedback and critical technical support to first-responder learners.

In addition to evaluating the learning process, including acceptance, usability, flexibility, and effectiveness, the leaders in communities and first-responder agencies will have an opportunity to examine and evaluate this new learning technology for their first-responder teams. According to Karen Haas, a consultant and stakeholder in the Steering Committee, “This learning opportunity is intended to achieve two important goals for the first-responder agencies and the public they serve:

- Create efficiency in training and adoption of best practices; and,
- Foster the interest of public safety teams and leaders in resolving traffic incidents in the safest possible manner.

This involves the ongoing development of training content, with a critical overlay of standard operating procedures, which will be utilized across the coalition corridor region.”

What the Future May Hold

This project commenced in mid-2006, and we expect it to continue under the current level of funding, until early- to mid-2009. If the results continue to be satisfactory, we anticipate that there will be an additional round of funding that will move the project to the next phase of implementation, which presumably will reach and serve the vast majority of the first responders along the I-95 Corridor.

In addition, we expect that this successful project would lead to adoption across the nation, and that further training scenarios would most likely include



other natural and human-caused disasters, such as plane crashes, terrorist attacks, hurricanes, earthquakes, etc.

Opportunities and Obstacles

As with any project of this nature and design, there are many opportunities and obstacles. It is no small task to convince first-responder agencies and their government and political leaders, as well as first responders themselves, of the effectiveness of this project as a learning tool.

The matter of cost is always foremost in the minds of the decision makers. It is too early to calculate the cost per learner; however, an excellent learning tool is being developed and tested for a total cost of \$1.4 million dollars. While expansion will bring the total cost higher, when spread over the thousands of first responders in the 15 states of the Coalition Corridor region, the cost per learner will likely be well under \$100. This seems to confirm that this virtual immersive-learning simulation will prove to be a cost-effective way to train first responders, and to achieve more efficient, safer, and less costly results at each traffic incident.

In addition, as noted by the CATT LAB team, this technology will require many agencies to upgrade their existing technology platforms to a current level of sophistication that will support this computer-generated virtual environment. While they will see this as adding to the cost per learner, upgraded technology has many positive effects on an agency, and they should evaluate the benefits of new technology as to their total impact on operations.

One of the requirements in the deployment phase calls for moderators who have the excellent credentials that are valued and respected by first responder agencies, as well as technical competence that will be vital to successful implementation of the learning strategies. Finding moderators to fill these shoes will be challenging

In Summary

Clearly, managing the nation's highways to ensure greater safety, while keeping them clear of congestion and traffic incidents, is a high priority of government, transportation departments, and first responder agencies. Furthermore, the public expects efficient and safe travel on the highways, and the unfettered movement of commerce to provide goods and services at low prices.

While it's still too early to say for sure, the cost per learner will likely be well under \$100.



The I-95 Corridor Coalition recognized the need to undertake significant effort to reduce traffic problems and increase first responder safety on Interstate 95. To that end, the Coalition formed a Steering Committee that analyzed ways to improve traffic incident management by implementing a project to create learning tools that would teach best practices to the first responders across the region.

Employing computer-generated, 3-D, immersive learning simulations, the Steering Committee developed several scenarios and built them into a Virtual Incident Management Training System for Transportation First Responders. The CATT Lab at the University of Maryland, using Forterra Systems' OLIVE platform, designed and created a virtual reality training games module.

Next, they invited a small group of first responders to alpha-test the program. From the results of testing, the Steering Committee will move forward with deployment over the next six months, by using a rolling, 50-laptop, learning center that will allow a much larger sample of first responders across the region to use these immersive learning techniques. When this effort is completed, the steering committee expects to have fully spent the budget of \$1.4 million.

The I-95 Corridor Coalition will have to evaluate the results of this 3-year project, and decide if they will appropriate additional funds to allow expansion of the Virtual Incident Management Training System. If they decide to move forward, all first responders in the I-95 corridor will use this system to learn the best practices deemed necessary to enhance their own safety and the safety of the traveling public, while also managing traffic incidents in the most effective and efficient manner.

Project Summary

Name of Project

Virtual-Incident Management-Training System for Transportation First Responders

Description

Traffic congestion on the Interstate 95 Corridor is costing valuable time and money, due in part to ineffective Traffic Incident Management, idle freight,



and substantial delay of the traveling public. Additionally, first responders are at great risk for injury or death when traffic incidents are mismanaged. The I-95 Corridor Coalition has developed a set of best practices that, when used, increase safety to first responders and the public-at-large, while also efficiently and effectively dealing with the incident in a manner that saves time, human and equipment resources, and money.

The Coalition has designed and developed a virtual traffic-incident management training system, using Forterra Systems' OLIVE platform, as a basis for creating computer-generated virtual learning environments for first responders. These learners will be equipped with the knowledge and judgment necessary to ensure their own safety, while correctly and efficiently managing any type of traffic incident.

Links

<http://www.i95coalition.org/sp.html>

<http://www.cattlab.umd.edu/index.php?page=home>

<http://www.forterrainc.com>

Forms of Training or Learning Used

- ~ Immersive learning simulations
- ~ Print-based self-study materials

Number of Learners who will use the Training

Tens of thousands of first responders in the 15-state region covered by the I-95 Corridor Coalition

Project Cost

\$1,400,000