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Creating a return on investment: How one EMS department used simulation to reduce liability and created systemic change in its EVOC program

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Abstract

In New York City, FDNY/EMS experienced approximately 700 collisions per year, of which 40% were at intersections. The department examined these collisions over an eight-year period and implemented simulation training into the Emergency Vehicle Operator's Course (EVOC). In the following four years intersection collisions were reduced by 50% as instructors identified key statistics regarding their student base and created training strategies to target those factors.

Introduction

New York City has a population of 7.5 million people that swells to 10 million people on a typical business day. The FDNY EMS has the responsibility of call receiving, dispatching, and responding to all medical emergencies (or other emergencies that may produce significant numbers of casualties).

More than 300 ambulances are on the road and respond to over 4,800 calls for assistance in any 24-hour period, handling over 1.2 million calls per year. It is staffed with more than 3,300 personnel, all of which maintain a state certification of EMT or Paramedic and are required to drive a department vehicle.

FDNY EMS incurs about 700 collisions per year, or roughly 2 collisions per day. They range from minor incidents, such as striking and breaking a mirror, to the more catastrophic intersection collisions that result in heavy damage, injury and/or fatality to personnel and civilians.

In NYC, a significant portion of ambulance collisions occurred in the intersection. Prior to 2004, the department's Emergency Vehicle Operator's Course (EVOC) had no discernable method of teaching collision avoidance in the intersection other than lecture. Prior to correcting this issue, the department had to first identify the type of employee most likely to have a collision.

Since 1980 the EVOC program has trained more than 300 new recruits annually with a program of didactic and practical skills sessions. During that period, collision rates remained steady even though several changes had occurred within the curriculum and the service.

In late 2003, the EVOC program received its first driving simulator to complement its existing driver training program. FDNY officials worked with the simulator manufacturer, FAAC Incorporated, to develop a simulator that would include a variety of scenarios and hazards that emergency vehicle operators were exposed to during a typical shift.

Data Sources

The data collection team consisted of one summer intern who retrieved, collated, and cataloged the data, a Lieutenant who managed the project, and a Division Chief who oversaw the project.

The team performed a retrospective study (beginning in 2000) of all data, based on the following:

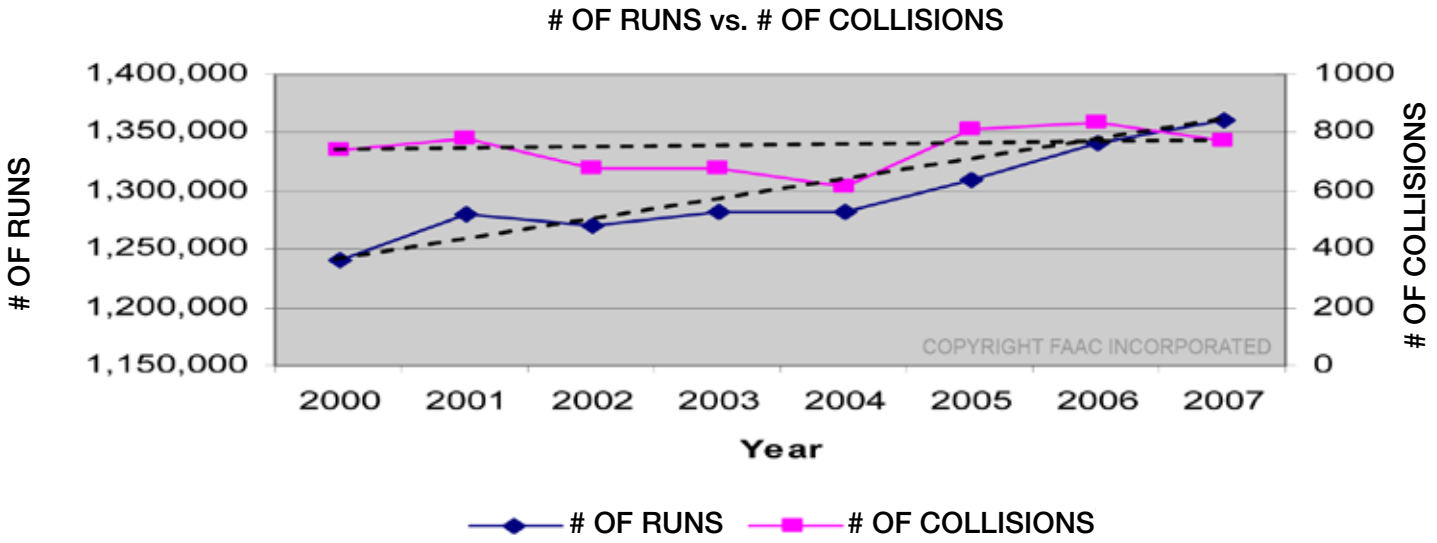
- Citywide performance indicators
  - Number of assignments
  - Number of ambulance tours
  - Response times and segment responses
- Personnel
  - Length of service of the employee
  - Original Date of Appointment (ODA)
  - Driver age
- Safety battalion citywide accident databases
  - Total collisions
  - Types of collisions (intersection vs. other)
  - Collision date and location

Study Results

The team examined 6,181 collisions that occurred from 2000-2007, then divided the information into two, four-year categories:

- 2000 – 2003 pre-simulator training
- 2004 – 2007 post-simulator training

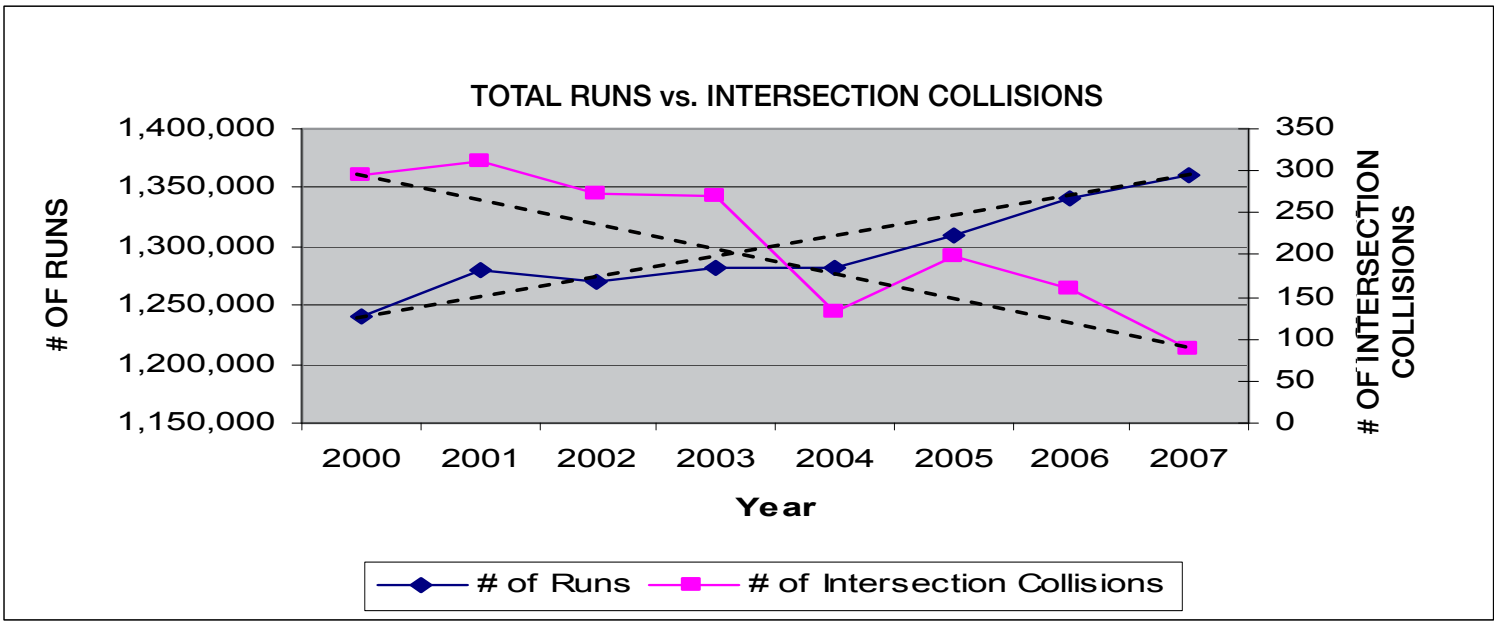
The team identified that over an eight-year period the total number of assignments (runs) increased by 16% and the number of units increased by 8%. The total number of ambulance collisions increased by a slim 5% for the eight-year period, but the number of intersection collisions declined by 50% in the second half of the study.



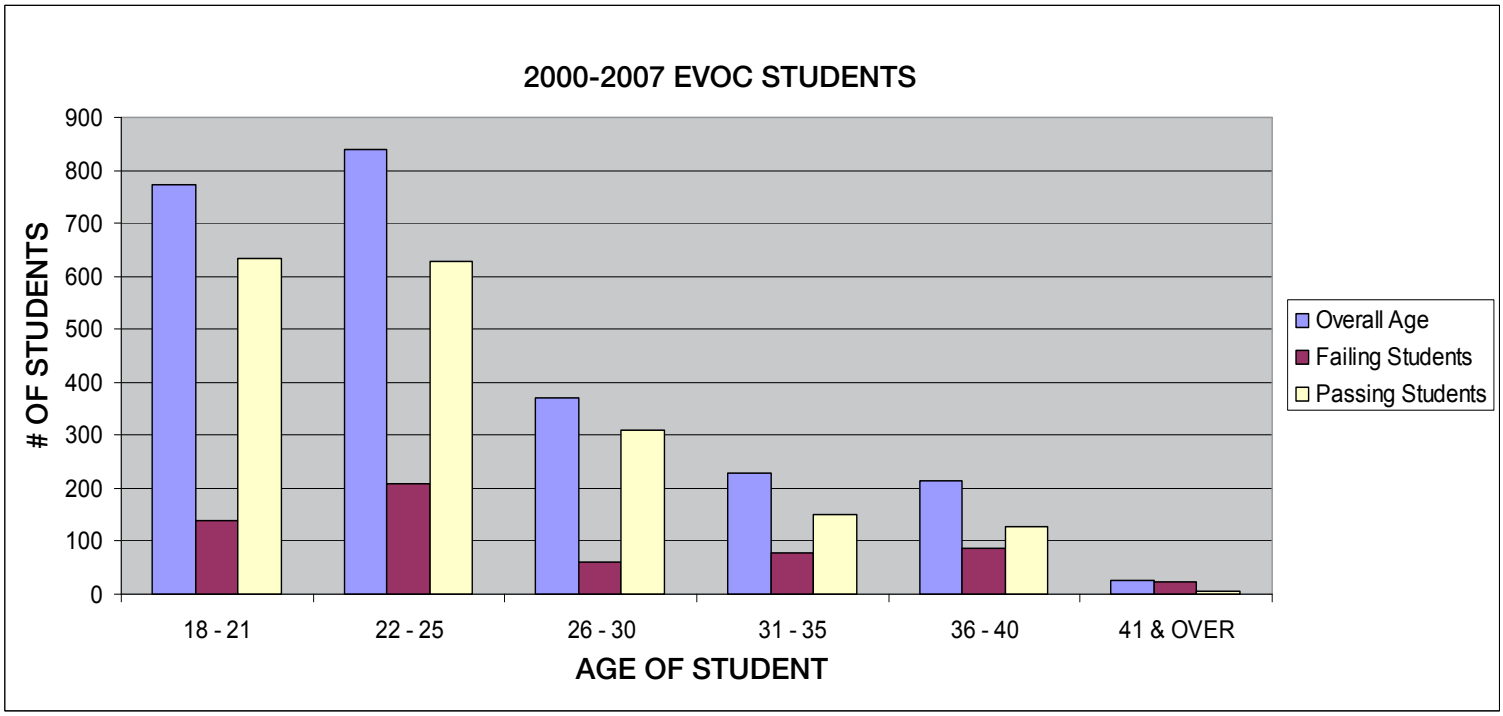
From 2000 – 2003 (without simulation training), the rate of intersection collisions hovered around 40% of the total number of collisions.

From 2004 – 2007 (with simulation training in the curriculum) the rate of intersection collisions declined an average of 16% of the total collision rate, and declined by 15% per 1,000 runs. By 2007, intersection collisions had declined to 11% of the total collision rate; nearly 75% from the first year. When comparing the first half of the study to the second half, intersection collisions declined from 40% to 20% of the overall collision rate.

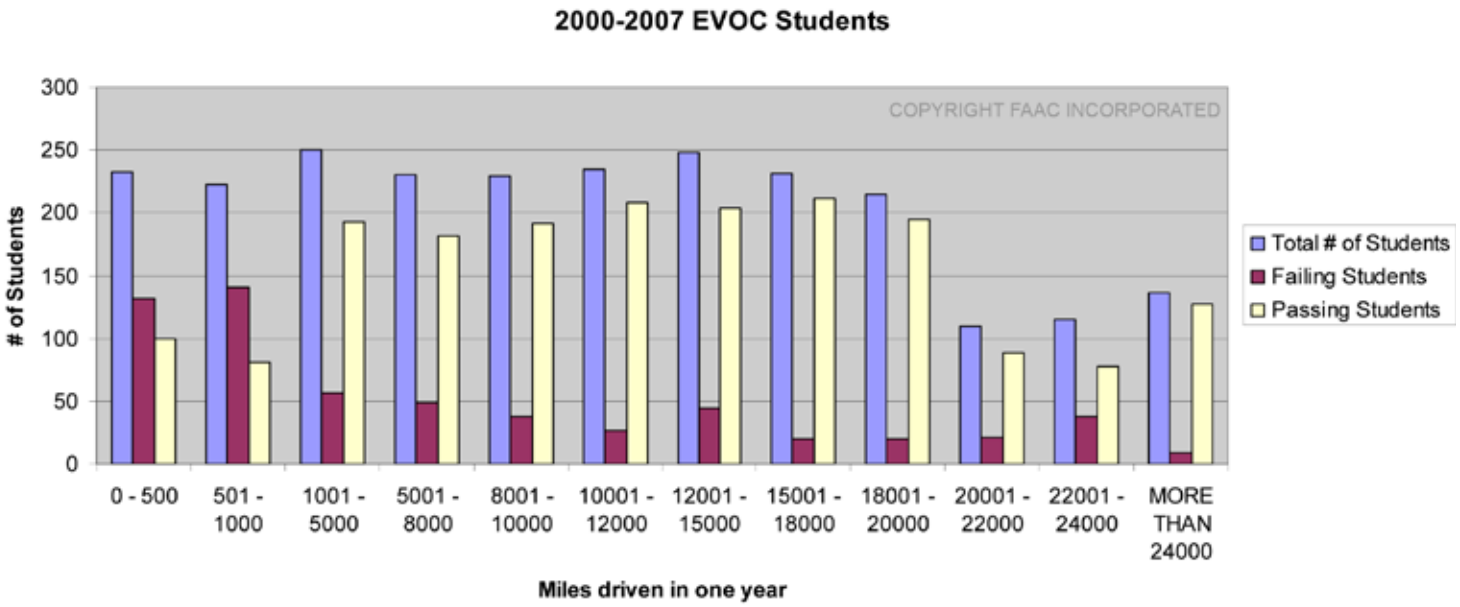
The team also compared collision rates among drivers; comparing employees with less than five years on the job (YOJ) to all other employees. The team identified that intersection collisions were three times more likely for employees with less than 5 years on the job, and that the total collision rate was nearly twice as high for the new drivers when compared to all other drivers.



57% of students going through the program were from 18-25 years of age. The remaining 43% ranged from the ages of 26 to over 41 years with 62% of those being between the ages of 26-30 years. 89% of the students never drove an emergency vehicle before coming to EMS. 26% failed the program on the first attempt, which required them to attend a remedial program that was longer in duration and smaller in class size.



30% of students attending the program averaged between 0-5,000 miles driven per year, while 31% drove 0-500 miles per year; 21% drove 501-1,000 miles per year; 48% drove 1,001-5,000 miles per year.



New drivers were 34% more likely to be involved in a non-intersection motor vehicle collision (MVC). Intersection MVC's were three times higher for new drivers. New drivers were responsible for half of the intersection collisions, but were only 35% of all EMS drivers.

Simulation Solution

In October 2003, FDNY EMS EVOC took possession of a driver training simulator from FAAC Incorporated, which was made from the cab body of a Ford F350 to resemble the fleet's ambulances. It has three rear-projection screens in front and two plasma screens mounted to the cab for visual displays of the rear mirrors, providing a 225-degree field of vision.

The student driver sits in a three-degree-of-freedom motion seat that provides momentum, inertia, and lateral movement feedback. FAAC provided high-fidelity virtual dynamics that accurately replicate the actual vehicle's handling characteristics. Feedback through the steering wheel and seat reflect the changes in various driving conditions that the student encounters. The instructor can manually change different aspects of the driving environment, such as traction, weather, visibility, and traffic congestion.

Using the Scenario Toolbox (STB) development software to create specialized training scenarios, the EVOC program developed a curriculum that allowed the student to build upon their existing training program, beginning with acclimation and vehicle dynamics and culminating with multi-tasking scenarios that included high-risk, low-frequency situations.

Some of the training content delivered included:

- Vehicle dynamics and depth perception
- Map reading and radio communications
- Roadway command
- Intersection analysis
- Vehicle placement at the scene

By introducing students to the unique hazards associated with operating an emergency vehicle in a variety of situations, the program was able to provide real-life experience in a controlled environment that is repeatable, recordable, and immediately available for playback, critique, and instruction. The student was able to apply a real-world application to theory and concepts taught in the lecture.

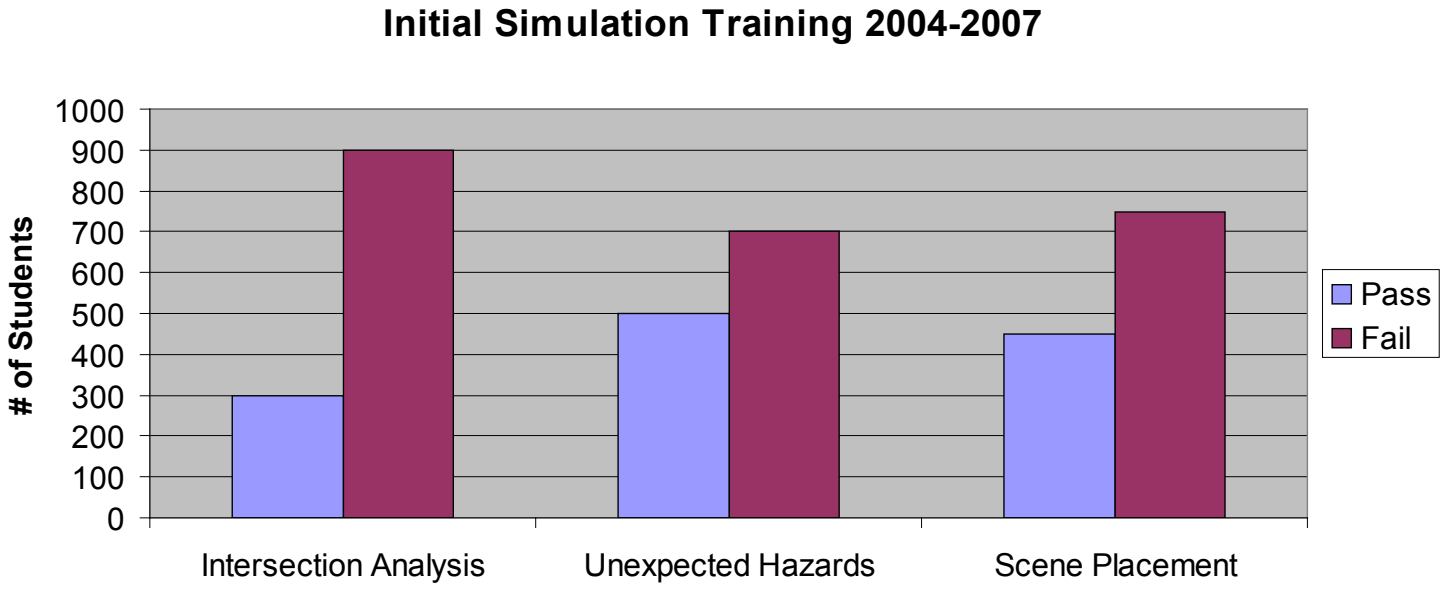
The combination of real-time driving performance and immediate reinforcement proved to be a powerful learning tool, especially for young students who are more accustomed to the dynamic virtual learning environment of the driving simulator.

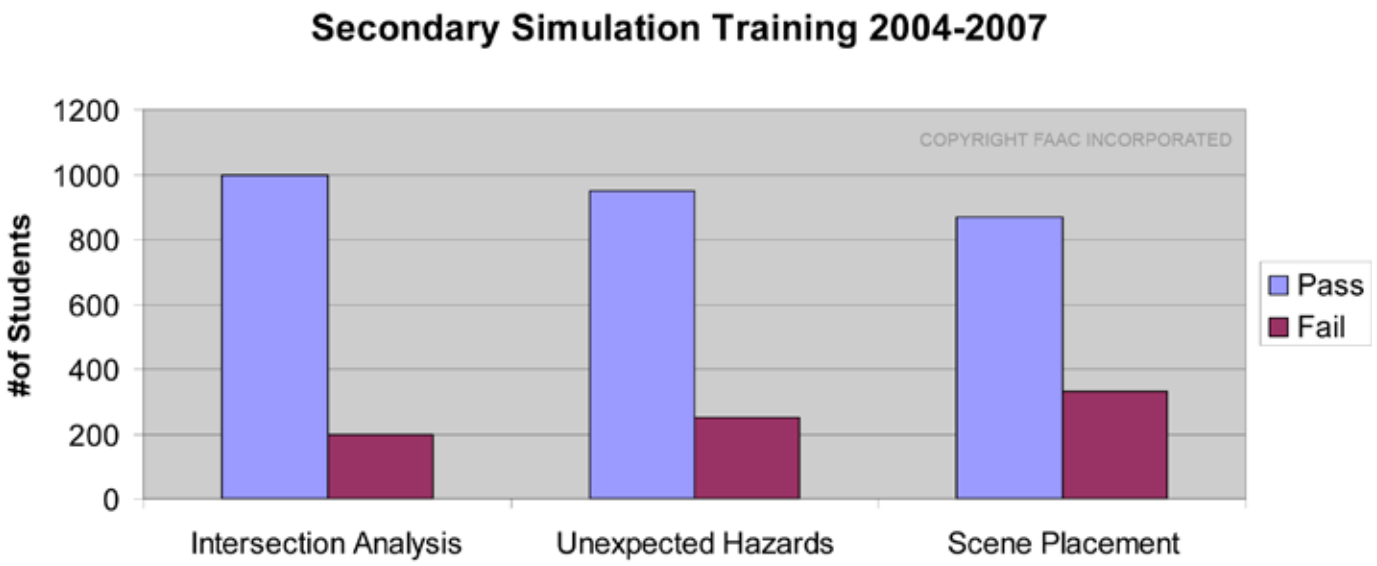
The simulator enabled instructors to be much more efficient. Lectures took up to 8 hours, but the practical application, critique, instruction, and re-driving the scenario might only take 15 minutes.

Another benefit of simulator training was the advantage of having the student crash; this may seem counter-productive, but in the simulator students learned more from their failures than from their successes.

Simulation training allowed students to immerse themselves into a virtual world and apply the theoretical concepts learned in the classroom, such as physical forces and intersection analysis, to name a few. The decision process is performed in real time with real-life situations; when students are involved in the "collision" they must report to the "dispatcher" the same information that would be required in the field.

The instructor elicits information from the student using a Socratic approach as to why the collision occurred, what were the events leading up to the collision, and the resulting short and long-term consequences. This examination brings a more tangible understanding to the student's actions.





Conclusion

Students of the 21st Century no longer depend on traditional methods of instruction, such as books and lectures. Instead, most depend on electronic media as the most efficient delivery system of information. When educators are faced with the challenge of providing simultaneous multiple inputs of information, electronic media are the optimal routes that can stimulate many of the senses and enhance the learning process.

Several studies have identified that driver behavior has a larger emotional than analytical component and that 80% of the driving experience is composed of attitude. In other independent studies documented in medical journals, they identified that the frontal lobe of the brain does not fully mature until the age of 25 years. The frontal lobe is responsible for the control of:

- Impulsive behavior
- Judgment
- Problem-solving
- Motor function
- Socialization
- Coordination
- Spontaneity
- Memory
- Executing behavior
- Working the memory
- Planning
- Self control

It is this very reason that simulation training helps in teaching the new driver; instructors are able to stimulate and enhance the learning process through a life-like, situational episode that elicits immediate action, reaction, and reinforcement.