**Evaluation of the limitations of emergency vehicle sirens and Development of a Public Safety Awareness video**

## Overview

There is an over reliance on the ambulance sirens to alert drivers of other vehicles to the presence of emergency vehicles. As a result, collisions occur every day with tragic outcomes. This can be prevented or minimized with proper emergency vehicle operator (EVO) training. Currently, EVO training can consist of a didactic training program in a class room setting coupled with a behind the wheel session to teach vehicle dynamics.

A commonality of these training programs focus on how to physically operate the emergency vehicle, however they do not address the general motorists knowledge or ability to determine the presence of the emergency vehicle.

## Background

EMS is fundamentally a transportation-based emergency service, responding to approximately 30 million emergency calls annually and estimated at least as many routine transports. There has been much recent focus nationally, federally and academically on the issues pertaining to EMS safety both for the provider and the patient. The broader transportation safety issues in EMS, and system risks and hazards and how they are measured – as well as what can be done to optimize the safety of this system for the patient, the provider and the public, are fundamental systems safety engineering issues. These issues warrant a systems safety engineering approach similar to that which has been applied to these related fields.

Ambulance vehicle crashes have been shown to be the most likely cause of a work related fatalities in EMS and estimated to have fatality rates per mile above that of trucks and passenger vehicles

The use of lights and sirens while transporting a patient has come under scrutiny many times over the years. While this seems to still be a come practice in the year 2010, many studies have shown that this is of little value in the patient's outcome. Most of the research that has been completed on this issue dates back to the mid to late 1990s.

Hearing is considered to be a primary warning sense. Reaction time to a visual signal has been shown to improve when an audible warning signal added. Sirens and other audible warning devices have long been in use on emergency vehicles, and many state laws require their use during emergency runs.

To be effective, a siren signal must compete with the masking noise generated by the road, car radios, ventilation fans, other distracters and must overcome modern sound insulation techniques. A Department of Transportation report concluded that sirens will never become an effective warning device.

To date, there has been limited published data on the ability of the general public to detect ambulance sirens above the inherent noise and distracters in private automobiles.

We will evaluate the general public's ability to detect emergency warning devices while operating privately owned vehicles on public roadways.

**Methods**

In this study, a simple questionnaire will be given to EMS providers to gauge their perception of the efficiency of the sirens as well as the situations when it is appropriate for their use.

A sound meter will be used to identify the level of noise from a car driving down a road at 55mph. This noise will be added into the background noise through the use of a white noise generator.

A standard motor vehicle will be parked in a stationary position with the engine idling, radio on and the air conditioning running with the windows up in a location that will be selected to mimic a suburban environment. The driver in the vehicle will be talking on a hands free cell phone as a distracter. White noise will be added via a sound generator to correspond to the levels as if the car were traveling at 55mph.The. A digital handheld sound meter will be used to obtain a base line decibel level in the car.

A video camera will be mounted on the car's hood or dashboard facing the rear window with a field of vision wide enough to show the driver. The ambulance will have a video camera mounted on the dashboard facing forward out the windshield to show the stationary car.

Lines will be marked at the start point of 1500' behind the car then at 100' intervals to a point 50' behind the car and then again at a reduced interval of 10'. Spotters will be placed along the travel path of the ambulance with tape measures to obtain precise measurements.

Starting 1500 feet directly behind the car, an ambulance will drive at a 25 MPH with the siren set to the wail mode. When the driver of the stationary car hears the siren, they will raise their hand. The distance between the vehicles will be measured and recorded. This will be repeated 3 more times, utilizing the Hi-Lo, yelp and electronic air horn modes of the siren.

**Results**

Upon evaluation of the data, it was clear that even with today's siren technology, the warning ability of a siren is dramatically reduced by simply having your windows closed let alone in combination with one or more distractors. Regardless of the siren mode, the vehicle's occupant heard the siren at fifteen hundred plus feet with the window open. With the windows closed, radio on and driver talking on the cell phone, the warning distance dropped to

less than 283 feet depending on siren mode. At just twenty five miles per hour, warning time is reduced to 7 seconds, and at 45 miles per hours, warning time is reduced to 4 seconds, neither of which allows for a safe reaction by either driver.

| | Distractors | | | | |
|---|---|---|---|---|---|
| Siren Mode | Window | C - Phone | Radio | db level | Distance (ft) |
| | | | | | |
| Wail | Open | Off | Off | 30 | 1500 |
| Yelp | Open | Off | Off | 30 | 1500 |
| T 3 | Open | Off | Off | 30 | 1500 |
| Air Horn | Open | Off | Off | 30 | 1500 |
| | | | | | |
| Wail | Closed | Off | Medium | 50 | 555 |
| Yelp | Closed | Off | Medium | 50 | 450 |
| T 3 | Closed | Off | Medium | 50 | 280 |
| Air Horn | Closed | Off | Medium | 50 | 215 |
| | | | | | |
| Wail | Closed | Off | Loud | 55 | 418 |
| Yelp | Closed | Off | Loud | 55 | 390 |
| T 3 | Closed | Off | Loud | 55 | 325 |
| Air Horn | Closed | Off | Loud | 55 | 284 |
| | | | | | |
| Wail | Closed | On | Loud | 70 | 283 |
| Yelp | Closed | On | Loud | 70 | 273 |
| T 3 | Closed | On | Loud | 70 | 213 |
| Air Horn | Closed | On | Loud | 70 | 10 |

**Survey tool**

Gender

Age (range)

Level of cert (List)

Years of experience

Type of Agency (list)

How would you best characterize your agency's response area? (Urban, Suburban, Rural)

Volunteer / Career /Mix %

Does your agency require EOVC / CEVO  training (Y/N)

Is there agency policy on use of RLS (Y/N)

Does your dispatch center dictate whether you use RLS when responding?

Does your dispatch center dictate whether you use RLS when transporting?

Likert scale:

Do you believe RLS reduce response times? 1-5

Do you believe RLS reduce transport times? 1-5

How familiar are you with your local laws governing use of RLS? 1-5

Do you know how many collisions occur at your agency?

Do you know how much a collision costs at your agency?

Have you ever been involved in am ambulance collision?

Ave you ever lost time at work due to an ambulance collision?