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# Ambulance Driver Best Practices

Prepared for Department of Homeland Security

Science and Technology Directorate

First Responders Group

Contract GS-10-F-0181J

Order No: HSHQDC-11-F-00054

August 15, 2013

**Final Report**

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Prepared by:

Carlotta M. Boone, PhD

Larry W. Avery

BMT Designers & Planners

Thomas B. Malone, PhD

Carlow International, Inc.

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## Executive Summary

The emergency medical services (EMS) community faces many challenges in providing care to patients while maintaining the safety of their patients and themselves. One factor that influences patient care and safety is the ability of the ambulance driver to quickly but safely maneuver to the site of the medical emergency and subsequently transport the patient(s) to the hospital. The Department of Homeland Security (DHS) Office of Health Affairs (OHA) identified a need to research best practices for ambulance drivers and identify driver safety gaps. This guide coincides with the DHS Science and Technology Directorate's (S&T) First Responders Group (FRG) and the Resilient Systems Division 's (RSD) partnership with the National Institute of Standards and Technology (NIST), the National Institute for Occupational Safety and Health (NIOSH), BMT Designers and Planners (D&P), and Carlow International project to develop ambulance safety and design standards and recommendations. The project provides design guidance for ambulance patient compartments for crashworthiness, patient safety and comfort, and EMS provider safety and performance. This report summarizes the efforts of this team to identify and develop best practices for ambulance drivers to ensure their safety as well as their team members and patients.

A Team comprised of BMT Designers and Planners (D&P) and Carlow International used human performance requirements analysis, literature reviews, and driver interviews to identify ambulance driver tasks required in responding to an incident, transporting patients and complications that could inhibit performance and safety. This report summarizes the Team's effort to synthesize the information received and uses it to recommend best practices that address identified safety challenges. In adopting these practices, ambulance drivers will greatly improve vehicle safety and operation while enabling better patient outcomes.

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# List of Acronyms

| | |
|---|---|
| D&P | BMT Designers and Planners |
| DHS | Department of Homeland Security |
| EMS | Emergency Medical Services |
| EVOC | Emergency Vehicle Operations Course |
| FARS | Fatality Analysis Reporting System |
| FRG | First Responders Group |
| HPRA | Human Performance Requirements Analysis |
| OHA | Office of Health Affairs |
| RSD | Resilient Systems Division |
| S&T | Science & Technology Directorate |
| SME | Subject Matter Experts |
| SOP | Standard Operating Procedures |

# 1.0 INTRODUCTION

## 1.1. Background

Proudfoot (2005)[1] analyzed 27 fatalities of EMS workers contained in the Fatality Analysis Reporting System (FARS) database and found that the majority occurred during favorable weather and environmental conditions. Twenty-eight percent of the crashes occurred at an intersection, 72% occurred while the ambulance was operating over the posted speed limit or was not being operated in its proper lane. In addition, 48% of the ambulance drivers did not have a good driving record, with one driver under the influence of alcohol at the time of the crash. Seven of the drivers were not wearing seatbelts. These are just a sample of driver behaviors that have led to injury and death of the EMS team and their patients during transport.

As part of an on-going effort sponsored by the DHS S&T Directorate to develop standards, guidelines and concepts for improving ambulance patient compartment design, BMT Designers and Planners (D&P), and Carlow International were asked to perform research into ambulance driver best practices. This research effort focused on behaviors of ambulance drivers that can impact the safety of their crew in the patient compartment, the patient being transported, and the drivers themselves. Identifying and documenting best practices for improved driver performance will further advance DHS' efforts to improve EMS performance and safety. The following report documents the research performed and presents recommended ambulance driver best practices (contained in Appendix A).

## 1.2. Objective

The objective of this research was to document ambulance driver best practices to reduce the incidence and impact of vehicle accidents due to driver error, inadequate skills and abilities, or poor practice.

# 2.0 TECHNICAL APPROACH

The technical approach consisted of the following activities:

- Conduct of an ambulance driver human performance requirements analysis (HPRA)

[1] Proudfoot, S.L. (2005). Ambulance crashes: Fatality factors for EMS workers. Emergency Medical Services *34,6*, 71-74.

- Conduct of a  literature review
- Completion of user research including EMS provider interviews.

## 2.1. Human Performance Requirements Analysis (HPRA)

An HPRA was conducted to identify ambulance driver task performance requirements under a range of representative and worst case scenarios. An HPRA decomposes a mission being performed by humans into information about functions, tasks, criticality of the tasks to the success of the mission, and requirements for successful task performance. The goal of the HPRA was to analyze the tasks being performed by the driver and what factors would contribute to success or failure of those tasks. Each step in the HPRA is described below.

- Define Functions - In performing the HPRA, 14 overarching ambulance functions were identified including pre-run preparation, receiving a call, driving to the incident location (scene), and conducting operations at the location (see Table1).

**Table 1. Main Ambulance Driver Functions**

| Ambulance Driver Functions |
|---|
| 1. Pre-run preparation |
| 2. Receive a call |
| 3. Depart the station |
| 4. Drive to the scene |
| 5. Arrive at the scene |
| 6. Conduct operations at the scene |
| 7. Prepare to depart from the scene |
| 8. Drive to receiving facility with no one in the passenger seat |
| 9. Arrive at the receiving facility |
| 10. Perform operations at the receiving facility |
| 11. Depart the receiving facility |
| 12. Drive to the station |
| 13. Arrive at the station |
| 14. Conduct post run operations at the station |

- Define Sub-functions;  Sub-functions within these tasks were then derived (See Table 2) by decomposing the driver functions. For example, from pre-run preparation, the following sub-functions were derived: inspect vehicle exterior, inspect vehicle interior, verify vehicle readiness, and check inventory of medical equipment and medicines.
- Identify Tasks - Tasks were decomposed from the sub-functions to define activities at the lowest level, such as inspect tires, check fuel, and check fluids.

- Rate Task Criticality - The criticality of each task was rated, with tasks deemed to be highly critical to driver safety denoted with a checkmark.
- Identify Task Performance Requirements - For highly critical tasks, task performance requirements were identified including the information needed to conduct the task, the decisions required, and the actions needed for the task. For example, while inspecting the vehicle interior the following task performance requirements would apply:
  - Information - what items should or should not be in the cab.
  - Decision - whether or not everything is in place and secured.
  - Actions - check the working order of all items in the cab.
- Identify Perceptual and Cognitive Skills - The driver's perceptual and cognitive skills associated with task performance were identified. For example, the ability to conduct inspections in the dark, make decisions, and control the inspection process were associated with vehicle inspections.
- Identify Training Requirements - The knowledge and skills that would need to be trained for task performance were identified. For example, knowledge of how to conduct vehicle inspections and skill in performing accurate inspections would be trained for the vehicle inspection task.
- Identify and Prioritize Performance Risks - Based on the identified tasks, performance risks were identified and prioritized and potential mitigations to resolve these risks were determined. Of the 270 tasks, 235 were classified as being moderately critical. As an example, a risk for performing vehicle inspection would be failing to identify a problem, which was rated as a moderate priority. Developing driver training and procedures for conducting inspections were identified as mitigations for this risk.
- Identify Driver Interface Changes – Driver interface changes to reduce risks for each critical task were identified. A driver interface was defined as either a design modification (e.g., hardware, software, and workspace) or standard operating procedures (SOPs). An example would be developing a standard procedure for inspecting the interior of the cab, and knowing what items in the cab are needed and their location.

The identified driver performance tasks, performance risks, and their potential mitigation helped to provide a framework for the subsequent tasks of conducting a literature review and interviewing ambulance drivers. Table 2 provides an example of the HPRA form.

## 2.2. Literature Review

Literature reviews of periodical articles, conference papers, and technical reports were conducted. This provided an understanding of the challenges ambulance drivers face, potential sources of human error, and associated training and technology to address these challenges. Some of the topics examined included fatigue, communication, vehicle inspection, crossing intersections, and driver monitoring systems. Overall, the review produced an understanding of the driver environment. This information was used to inform and direct the subsequent ambulance driver interviews and form the foundation for the driver best practices.

## 2.3. User Research

Input from ambulance drivers was collected through interviews. Initially, short informal interviews were conducted with attendees at the 2012 EMS World Expo in New Orleans, LA. This provided the opportunity to discuss EMS driver policies with drivers from various U.S. geographic regions, as well as rural and private industry practices. A total of 16 attendees serving largely urban areas were interviewed. They were queried on several aspects of ambulance driving including:

- Training.
- Driving procedures.
- Use of restraints.
- Lights and sirens policy.
- Navigation resources.
- Data terminal usage.
- Performance monitoring.
- Accident history and causation.
- Driver distractions.
- Accident avoidance methods.

## Table 2. Examples from the HPRA

| Ambulance Driver Functions | Driver Sub-Functions | Driver Tasks | Criticality (impact on safety) | Task Performance Requirements | | | Driver Skill Requirements | | Training Requirements | | Risk Assessment | | | Driver Interface Changes | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Information | Decisions | Actions | Perceptual | Cognitive/ Control | Knowledge | Skills | Risk | Priority | Mitigation | SOP | Design Modifications |
| | 1.2 Inspect the vehicle interior | 1.2.1 Inspect the interior of the cab | √ | Information on what should be and what should not be in the cab for the next call; are items in the cab secured. | Everything in place and secured and nothing out of place | Identify what is needed in the cab. Note working order of all items in the cab. Items in the cab are properly secured. | Conduct inspection in the dark. | Control inspection process. | How to conduct inspections. What should be in the cab. What should be secured. | Accuracy of inspections. | Fail to identify a problem. | Moderate | Driver training and procedures for conducting inspections. | Need a standard procedure for inspecting the interior of the cab, knowing what should be where, and what should not be there. | |
| | | 1.2.2 Identify maintenance requirements | √ | Preventive maintenance activities required - cleaning, replacing. Corrective maintenance activities - remove, replace, repair | Determine what maintenance is required | Identify what maintenance actions are required, when they should be performed, and by whom. | Visual and auditory indicators. | Control identification of maintenance requirements. | How to identify maintenance requirements. | Accuracy of identifying maintenance requirements. | Fail to identify maintenance require-ments. | Moderate | Driver training and procedures to identify maintenance requirements. | Standard procedures to identify maintenance requirements. | |

Based on the feedback from the initial interviews, survey questions were reviewed and modified. The team then interviewed twenty ambulance drivers at their stations in Stafford County, VA. On an average, they had been employed as EMS professionals for 9 years and had over 7 ½ years of experience driving an ambulance. Additional telephone interviews were conducted with several providers from various geographical regions in the U.S. to collect data on these issues. Additionally, representatives from the Transportation Research Board and the National Highway Traffic Safety Administration (NHTSA) provided their insights on ambulance driving.

## 3.0 Results

All of the data from the literature review, HPRA, and interviews was aggregated to create an overall list of best practice needs. Forty-nine best practices were identified. They were distributed across driver topics in three general categories: training development, standard operating procedures (SOP) and communications, and defensive driving. Table 3 lists the best practices in each category.

**Table 3. Ambulance Driver Best Practice Topics**

| Category | Ambulance Driver Best Practice |
|---|---|
| Defensive Driving | Ambulance Handling |
| | Blind Spot Handling |
| | Changing Lanes and Passing |
| | Distraction Management |
| | Following Distance |
| | Intersection Handling |
| | Near Miss Recovery |
| | Patient Compartment Awareness |
| | Safe Presence |
| | Safe Speed |
| | Turning |
| | Weather |
| SOP and Technology | Communication |
| | Driver Compliance |

| Category | Ambulance Driver Best Practice |
|---|---|
| | Driver Qualification |
| | Encounter Accident |
| | Following Distance |
| | Lights and Siren |
| | Mirrors |
| | Navigation |
| | Parking |
| | Performance Monitoring |
| | Right of Way |
| | Rules of the Road |
| | Spotter |
| | Vehicle Readiness |
| Technology Development | Case Studies |
| | Refresher |
| | Standardization |

The following summarizes the best practices derived for improving ambulance driver performance. The best practices in their entirety are provided in Appendix A, which has been designed to be a stand-alone document.

## 3.1. Defensive Driving

Ambulance drivers must be effective at controlling their vehicle and driving environment in all situations and conditions without compromising the safety of their patient, their partner in the patient compartment, or other road users. The skills needed to achieve this level of effectiveness are subsumed under the concept of defensive driving. Defensive driving includes techniques of safe driving with emphasis on awareness of other driver's potential actions and intentions as well as driving to avoid collisions and accidents or to reduce the damage if accidents are unavoidable, regardless of the conditions and/or the actions of those other drivers. Effective defensive driving requires ambulance drivers to be able to maintain awareness of blind spots, safely change lanes, and cross intersections as well as maneuver the vehicle. Ambulance drivers must also be able to manage fatigue and other distractions while handling the ambulance in various weather conditions.

Best practices for defensive driving included:

- *Ambulance Handing* - Drivers should become familiar with ambulance handling qualities through driving the vehicle in non-emergency situations and maintain optimal vehicle handling qualities by ensuring the vehicle is kept properly maintained.

- *Changing Lanes and Passing* - Drivers should check the side view mirrors to ensure that the lane is clear and activate the turn signal when changing lanes or passing.
- *Managing Distractions*- Drivers should seek to minimize distractions from cell phones or dispatching systems and avoid tasks such as reading, writing, or looking at maps while driving.
- *Management of Driver Fatigue* - Ambulance drivers should work to reduce fatigue by getting sufficient rest and following rotating shifts with adequate off-duty time.
- *Maintain a Safe Following Distance* - Ambulance drivers must maintain a safe following distance and apply the three second rule where they pass objects three seconds after a preceding vehicle as well as maintain a safe distance between the ambulance and the vehicle in front of them.
- *Proper Intersection Transverse* - When traversing intersections, drivers should scan the intersection for possible hazards, observe traffic in all four directions, slow down if any potential hazards are detected, and avoid using the opposing lane of traffic if possible.
- *Near Miss Recovery* - Following a near miss a driver should regain control so as not to put him or herself in position for another accident risk. If a collision is unavoidable, the driver must decide what to do to reduce the risk and damage resulting from the collision.
- *Patient Compartment Awareness* - Ambulance drivers should maintain awareness of patient safety and comfort and EMS provider safety and effectiveness. They should warn the EMS provider in the patient compartment of railroad crossing, rough road or other factors. They should also convey the operation of turn signals and the presence of the driver's foot on the brake even if not fully activated.
- *Safe Presence* - Ambulances should be easily recognizable using features such as retro-reflective material, fluorescent colors, contour markings and logos and emblems.
- *Safe Speed* - EMS response vehicles should not exceed posted speed limits by more than 10 miles per hour, and EMS response vehicles should not exceed posted speed limits when proceeding through intersections with a green signal or no intersection signal control device.
- *Vehicle Turning* - When turning the vehicle, engage the turn signal 100 feet before the turn in urban traffic and 300 feet in rural or highway settings. Keep the turn signal on through the turn and verify that it is off after the turn maneuver is completed.

- *Inclement Weather* - When driving the ambulance during inclement weather, drivers should keep the windows and windshield clear, turn on low-beam headlights and windshield wipers and drive slowly and stay farther behind the vehicle ahead. They should also avoid fast turns and quick stops. They should also maintain a cooler full of energy bars, water and other snacks as well as blankets in case they become stranded or encounter stranded motorists.

## 3.2. Standing Operating Procedures (SOP) and Technology

The second category of driver best practices is SOP and Technology. A SOP is defined as the approved standard to be followed in carrying out a given operation or in a given situation. SOPs can come in the form of set rules or checklists. All SOPs should address procedures for acting in poor weather conditions when different.

Ambulance driver performance can also be significantly enhanced by the appropriate implementation of technology that supports situation awareness and encourages safe driving practices. At the same time, technology can have a negative impact on driver performance by acting as a distractor.

Best practices for SOP and Technology included:

- *Communication Devices and Protocols – When the ambulance is in motion, d*rivers should minimize communication with the EMS provider in the patient compartment as well as radio communications with dispatch or the hospital. Communications between the driver and others should employ a constrained language vocabulary that allows verbal communications to be quickly and accurately performed. Drivers should be in communication (verbal, hand and eye) with EMS providers as well as others at the scene when he/she is departing from a parked position.
- *Driver Compliance* - Drivers are expected to comply with all regulations of their department.
- *Driver Qualifications* - Drivers must meet all qualifications in order to drive an ambulance. They must have and maintain a good driving record, be physically fit, and certified to operate an emergency vehicle.
- *Encounter an Accident* - Upon encountering an accident enroute to a call, ambulance drivers should contact dispatch. If the accident involves non-life threatening injuries, proceed with response to original call. If life-threatening injuries are present, administer aid and notify dispatch to send another unit to original call.
- *Lights and Sirens* - Based on initial information from dispatch, the use of lights and sirens may be required. Upon arrival at the incident scene, drivers should determine if lights and sirens are needed when transporting the patient based on the severity of the patient’s symptoms. Use of lights

and sirens should be upgraded or downgraded as needed over the course of the transport.

- *Mirrors* - At the beginning of the shift and as necessary the driver should adjust side view mirrors. Mirrors and windows should be kept clean as dirty windows and mirrors will reduce available light and cause glare from the light of approaching vehicles or streetlights.
- *Navigation* - Drivers should learn the geographic and local conditions, individual characteristics of the area, and their organization's procedures to map out the most efficient route to the emergency scene. They should also maintain awareness of changes to their routes, procedures to identify local information, and consideration of height restrictions. A GPS navigation system can also be used to develop accurate and efficient routes to the incident scene and hospital.
- *Parking* - Drivers should always park the ambulance in a hazard-free area to protect the crew, patient, and the ambulance. When parking in a parking space or driveway, drivers should back into the parking area so that they have a safe and efficient exit.
- *Performance Monitoring* - Drivers are to comply with all required behaviors within the vehicle (wearing seatbelts and complying with traffic laws regarding speeding). No attempts will be made to turn off or disable video performance or speed regulation and monitoring systems.
- *Right of Way*- On a multilane highway, drivers should not enter an opposing traffic lane until it is safe to do so and all other oncoming vehicles are aware of the ambulance's presence. Similarly, drivers should not enter a one-way street against traffic until all opposing traffic is aware of the ambulance's presence and has yielded the right of way.
- *Spotter* - When backing out of a parking space, a spotter should be used. The vehicle should not be backed until the spotter is in position in the safe zone and has communicated his/her approval to begin backing by way of a hand signal, and voice, when possible.
- *Vehicle Readiness* - Ambulances must be kept fully stocked and in operational condition. EMS personnel shall conduct inspections at the beginning of each shift, to ensure that they have all of the supplies they need to respond to calls and perform patient care. Any maintenance issues should be promptly noted and reported to maintenance so that they can be resolved in a timely manner.

## 3.3. Training Development

The third category is training development. A training program is most effective when best practices are used to guide the development effort. If executed well, a training program should maximize efficiency, safety, job satisfaction, and foster a culture of innovation.

The following best practices should be considered for the development and regulation of EMS driver training.

- *Training Requirements* - The Emergency Vehicle Operations Course (EVOC) should be mandated for all drivers. Drivers should also complete supervised on the job training. Refresher training should be provided at least annually. Drivers should have multiple opportunities to learn and practice common driving maneuvers such as braking, stopping, making lane changes, driving, backing, and parking. These driving skills should further be solidified by on-the job training.
- *Course Development* - Training should be standardized but also tailored to the needs of the department. Technology should also be used to supplement the training.
- *Interactivity* - Courses should also be interactive using real world examples, case studies, quizzes, and feedback.
- *Refinement of Training Course* - Courses should be updated regularly based on feedback from students and subject matter experts (SMEs).

# Appendix A – Ambulance Driver Best Practices

# Ambulance Driver Performance Best Practices

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## List of Acronyms

| | |
|---|---|
| AED | Automated External Defibrillator |
| AHA | American Heart Association |
| AVOC | Ambulance Vehicle Operators Course |
| CB | Citizens' Band |
| CEVO | Coaching the Emergency Vehicle Operator |
| CPR | Cardiopulmonary resuscitation |
| EMS | Emergency Medical Services |
| EMVC | Emergency Medical Vehicle Collisions |
| ESC | Electronic Stability Control |
| EVOC | Emergency Vehicle Operations Course |
| FARS | Fatality Analysis Reporting System |
| FEMA | Federal Emergency Management Agency |
| FMCSA | Federal Motor Carrier Safety Administration |
| GPS | Global Positioning System |
| MPH | Miles Per Hour |
| NFPA | National Fire Protection Association |
| NHTSA | National Highway Traffic Safety Administration |
| NTSB | National Transportation Safety Board |
| O2 | Oxygen |
| SIPDE | Scan, Identify, Predict, Decide and Execute |
| SME | Subject Matter Experts |
| SOP | Standard Operating Procedures |

## 1.0 Introduction

An Ambulance Driver Performance Best Practice is one in which (1) the described method is an essential contributor toward maintaining ambulance driver performance and safety, (2) the method has been formalized and standardized through replicated and successful application, and (3) the application of the method has been demonstrated to significantly enhance the performance and safety of the ambulance driver. The purpose of this document is to identify ambulance driver performance areas of concern and for each area, describe best practices based on accepted practice and/or research findings which can be incorporated into an EMS organization's procedures definition and training development activities and products. The best practices are addressed within the following three main areas:

- *Defensive Driving* – The Defensive Driving section describes practices for handling blind spots, changing lanes, and avoiding distractions to reduce the probability of getting into an accident.

- *Standard Operating Procedures (SOP) and Technology* – The SOP and technology section discusses procedures for maintaining safety such as driver qualification, vehicle readiness, and communication. It also discusses the technology used to maintain EMS and patient safety such as mirrors and performance monitoring.

- *Training* – The Training section discusses practices to ensure EMS drivers are adequately trained to operate the ambulance.

## 2.0 Defensive Driving

Driving an ambulance requires above average driving capabilities. As the lives of patients in critical condition often depend upon immediate medical attention, emergency vehicle operation is time-sensitive work. Thus an ambulance driver must have an exhaustive knowledge of the geography of the work region. The driver must also be able to quickly devise alternate routes should the path be blocked by something like a train or a construction project. In some cases the driver will be required to navigate swiftly through heavy traffic. Although working under a great deal of pressure, the driver must always seek to preserve the safety of passengers, the driver, and the other drivers on the road by being effective at controlling their vehicle and driving environment in all situations and conditions. The skills needed to achieve this level of effectiveness are subsumed under the concept of defensive driving.  Defensive driving includes techniques of safe driving with emphasis on awareness of other driver potential actions and intentions and driving to avoid collisions and accidents, or to reduce the damage if accidents are unavoidable, regardless of the conditions and/or the actions of those other drivers.

A good approach to defensive driving is to remember SIPDE, which stands for: Scan, Identify, Predict, Decide and Execute.

- Scan means moving your eye point every two seconds or so and keeping your head on a swivel. Do not rely on your peripheral vision alone to locate potential hazards because you can't react to what you don't see, so scan, scan and keep scanning.

- Identify means recognizing any potential hazard that might cause you some peril, from other vehicles to roadway conditions, weather and obstacles.

- Predict means that once you've identified any potential hazards, you anticipate what could happen that would cause you to take action to avoid a crash.

- Decide means that based on those predictions, you determine what the best course of action might be, whether it's slowing down, changing lanes, "covering" the brake pedal or something else.

- Execute means that if that predicted hazard becomes reality, execute your decision to maximize your safety and minimize the chances of a crash.

Of course, you could have numerous SIPDE strategies going on in your head that basically address the "if this, then that" factors. SIPDE is simple, and it works, so it makes sense to make it a part of your daily driving protocols.

The following sections describe best practices associated with the elements of defensive driving, namely safe ambulance handling, blind spot handling, changing lanes and passing other vehicles, managing distractions, managing fatigue, maintaining a safe following distance, safely traversing an intersection, recovering from a near miss, maintaining patient compartment awareness, maintaining a safe speed, safely turning the ambulance, and dealing with adverse weather conditions.

## 2.1. Ambulance Handling

The Code of Federal Regulations Section 177.816 on driver training (Office of the Federal Register, 2012) requires that commercial drivers be trained in the operation of the vehicle including maneuvers such as turning, backing, braking, parking, handling, and vehicle characteristics. This includes those that affect vehicle stability, such as effects of braking and curves, effects of speed on vehicle control, dangers associated with maneuvering through curves, and high center of gravity, and procedures for maneuvering tunnels, bridges, and railroad crossings. The skills associated with safe driving in response to vehicle characteristics such as those listed above are collectively described as responding to vehicle handling qualities.

According to a Transportation Research Board simulation study (Swets and

Zeitlinger, 1983), there are three aspects that are the most important handling qualities of the vehicle in cruising on the roads; (1) keeping the vehicle with ease on the centerline of the road in fast straight running, (2) conducting lane-changing maneuvers quickly and safely, and (3) making a rapid 90 degree turn smoothly at the corners. No doubt the first of them is mainly concerned with the directional stability and both the second and the third are closely related to the controllability of the vehicle.

Factors that impact a vehicle's handling qualities include:

- The driver‘s skills, experience, competency, attitudes, and maturity.

- Driver familiarity with the vehicle. A driver learns to control a vehicle through practice and the more the driver has driven a vehicle the better it will handle for him or her. One needs to take extra care for the first few months after beginning to drive a vehicle, especially if it differs in handling qualities from those he or she is used to. Other things that a driver must adjust to include changes in tires, tire pressures and load. That is, handling is not just good or bad; it is also the same or different.

- Weather. Weather affects handling by making the road slippery. Different tires do best in different weather. Deep water is an exception to the rule that wider tires improve road holding.

- Road conditions. Vehicles with relatively soft suspension and with low unsprung weight are least affected by uneven surfaces, while on flat smooth surfaces the stiffer the better. Unexpected water, ice, oil, etc. are hazards.

- Center of gravity height. The center of gravity height, relative to the track (distance between wheels along the same axle), determines load transfer from side to side and can cause body lean. Centrifugal force acts at the center of gravity to lean the car toward the outside of the curve, increasing downward force on the outside tires. Height of the center of gravity relative to the wheelbase (distance between axles) determines load transfer between front and rear. The vehicle's momentum acts at its center of gravity to tilt the vehicle forward or backward, respectively during braking and acceleration. Since it is only the downward force that changes and not the location of the center of gravity, the effect on over/under steer is opposite to that of an actual change in the center of gravity. When a car is braking, the downward load on the front tires increases and that on the rear decreases, with corresponding change in their ability to take sideways load, causing oversteer.

- Center of gravity location. In steady-state cornering, because of the center of gravity, front-heavy cars tend to understeer and rear-heavy cars to oversteer, all other things being equal.

- Suspension. Vehicle suspensions have many variable characteristics, which are generally different in the front and rear and all of which affect handling. Some of these are: spring rate, damping, straight ahead camber angle, camber change with wheel travel, roll center height and the flexibility and vibration modes of the suspension elements. Suspension also affects unsprung weight.

- Tires and wheels. In general, larger tires, softer rubber, higher hysteresis rubber and stiffer cord configurations increase road holding and improve handling. On most types of poor surfaces, large diameter wheels perform better than lower wider wheels. The fact that larger tires, relative to weight, stick better is the main reason that front heavy cars tend to understeer and rear heavy to oversteer. The depth of tread remaining greatly affects hydroplaning (riding over deep water without reaching the road surface). Increasing tire pressures reduces their slip angle, but (for given road conditions and loading) there is an optimum pressure for road holding.

- Track and wheelbase. The track provides the resistance to sideways weight transfer and body lean. The wheelbase provides resistance to front/back weight transfer and to pitch angular inertia, and provides the torque lever arm to rotate the car when swerving. The wheelbase, however, is less important than angular inertia (polar moment) to the vehicle's ability to swerve quickly.

- Vehicle weight. A Type I ambulance is a Cab Chassis with modular body and a Gross Vehicle weight over 10,001 pounds but less than 14,000 pounds. The major feature of a Type I ambulance is that it is based on a truck style body with a separate driver compartment. Most heavy duty ambulances are of this type. There is a subclass to this ambulance type, Type I AD (Additional Duty) with a gross vehicle weight of 14,001 pounds or more with extra cargo capacity. Type II ambulances are a long wheelbase van type with an Integral cab design. The gross vehicle weight is between 9,201 pounds to 10,000 pounds. Many long-distance transport services use Type II ambulances because of their increased fuel efficiency. In general they do not make for practical emergency services because of their cramped spaces. Type III ambulances are based on van chassis rather than truck chassis. The cab is an integral part of the ambulance. The gross vehicle weight is the same as for type I ambulances: 10,001 pounds to 14,000 pounds. Advanced Duty (AD) ambulance types are also available with gross vehicle weights over 14,001 pounds.

- Aerodynamics. Aerodynamic forces are generally proportional to the square of the air speed, therefore vehicle aerodynamics become rapidly more important as speed increases.

- Delivery of power to wheels and brakes. The effect of braking on handling is complicated by load transfer, which is proportional to the (negative) acceleration times the ratio of the center of gravity height to the wheelbase. The difficulty is that the acceleration at the limit of adhesion depends on the road surface, so with the same ratio of front to back braking force, a vehicle will understeer under braking on slick surfaces and oversteer under hard braking on solid surfaces. Most modern vehicles combat this by varying the distribution of braking in some way.

- Position and support to the driver. Having to take up "g forces" in his/her arms interferes with a driver's precise steering. In a similar manner, a lack of support for the seating position of the driver may cause them to move around as the vehicle undergoes rapid acceleration (through cornering, taking off or braking). This interferes with precise control inputs, making the vehicle more difficult to control. Being able to reach the controls easily is also an important consideration, especially if a vehicle is being driven hard. In some circumstances, good support may allow a driver to retain some control, even after a minor accident or after the first stage of an accident.

### 2.1.1. Achieving Familiarity with Ambulance Handling Qualities

Many emergency vehicle products come in a variety of configurations and designs. Ambulances are no exception. They can be built or altered to fit single or twin cots depending on the need of the customer. Off road applications can also be added to ensure that the proper handling of the vehicle is never an issue. Customization on standard, internal configurations can be optimized to provide the best in operational requirements and proper patient care. Specialized vehicle manufacturers are the most equipped to provide customers with the best in ambulance design and construction. A EMS organization may have multiple varieties of vehicles that an EMS provider will be required to drive.

The best way for a driver to become competent in dealing with an ambulance handling qualities is to spend time driving the vehicle in non-emergency situations. Through such familiarization, the driver acquires the feel for vehicle handling qualities such as responsiveness, maneuverability, and sensitivity to control inputs.

### 2.1.2. Maintaining Optimal Vehicle Handling Qualities

Two major requirements for ambulance effectiveness are ride quality and reliability. Ride quality is the direct result of ambulance handling qualities and is directed at providing a smooth ride for patients and EMS providers in the patient compartment. Both ride quality and ambulance reliability are the direct result of effective ambulance maintenance. The maintenance actions that directly impact ride quality are as follows:

- Inspect for damaged, leaking or loose shock absorbers. Ensure that shocks stabilize the vehicle. Worn shocks can cause the vehicle handling to become erratic and hard to control.

- Visually check and lubricate all steering, suspension and driveline components.

- Check tires. Visually inspect tires (include spare tire). Adjust tire pressure to specification and record pressure of all tires. Record tread depth of all tires. Check jack, jack handle and wheel wrench (proper location & operation).

- Check and adjust front-end alignment specifications as required.

- Check for fluid leaks. Visually inspect under the vehicle for fluid leaks. If fluid leak is noted, investigate cause and immediately check all the fluids.

#### 2.1.3. References

Swets & Zeitlinger (1983). *A Simulation Study of Vehicle Maneuverability,* Vehicle System Dynamics, 12, Taylor and Francis.

Office of the Federal Register (2012) Code of Federal Regulations, Title 49: Transportation, Part 177 – Carriage by Public Highway, Subpart A – General Information and Regulations, 177.816 Driver Training. U.S. Government Printing Office, Washington, D.C.

### 2.2. Blind Spot Handling

Blind spots for an ambulance are of two kinds:

- Blind spots in mirrors that obscure the presence of a vehicle.

- Hidden exits where a vehicle might suddenly emerge in the path of the ambulance.

An ambulance typically has blind areas at the sides near the rear of the vehicle meaning the driver cannot see anything in these areas by looking in the correctly adjusted mirrors. Other vehicles may be blind to anything that is directly behind them. Ambulance vehicles in which the driver sits very high may have forward-quarter blind spots where they may not be able to see anything low to the ground in front or to the sides near the front. Also while driving in city traffic a driver must be on the alert for blind spots such as concealed alleys or side streets, or even parked cars, from which children may dart into traffic.

Another blind spot risk for ambulances is a “sideswipe” collision, which involves drivers who are changing lines that have a blind spot and do not check and/or fail to see the other vehicle. According to the National Highway Traffic Safety Administration, 18% of US traffic crashes involve drivers that were changing lanes but did not see that there was a motor vehicle next to them.

In addition to sideswipe collisions, blind spots can be to blame for back-over accidents. Back-over accidents occur when a vehicle backs over someone, usually a child, due to the rear blind spot on most vehicles. Rear blind spots are directly behind a vehicle and are typically 23 feet wide for a sport utility vehicle.

Blind spots can come in other forms as well. Objects such as large trees, bus stops, signs and other stationary objects in the visual field as you approach an intersection can create blind spots for drivers. The blind spot created by a stationary object actually shifts as the motorist continues down the road and creates a dangerous condition that drivers must be aware of and must always check in order to be safe, especially at intersections and cross walks.

Best practices for handling blind spots include the following.

### 2.2.1. Enhancing the Field of View

The mirrors on the driver's side of every modern car have a field of view of about 15 to 17 degrees wide, the angle between two adjacent numbers on a clock face, offering a narrow slice of what's going on behind the car. It's easy enough to make a mirror that curves for a wider field of view, as passenger-side mirrors do, but that curve distorts the image, which is why passenger side mirrors always warn riders that objects are closer than they appear.

The practices for reducing blind spot hazards include enhancing the driver’s field of view by:

- Turning one's head briefly (risking rear-end collisions).
- Installing mirrors with larger fields-of-view.
- Reducing overlap between side and rear-view mirrors by adjusting side mirrors so the side of the car is barely visible when your head is between the front seats (for the right side mirror) and almost touching the driver’s window (for the left side mirror), then checking to be sure you can see cars approaching from behind on either side when on the highway.

### 2.2.2. Use of Spotters

The risk of striking something or someone in the rear blind spot while backing up the ambulance can be effectively reduced through the use of a spotter positioned at the rear of the vehicle to monitor the safety of the back up maneuver.  There needs to be a mechanism for unambiguous communication between driver and spotter which may be based on verbal interaction or at greater distances, on hand signals. The driver and spotter must agree on the meaning of hand signals (see paragraph 3.1.3) or voice commands before initiating the back-up maneuver. The steps required for a safe back-up maneuver are as follows:

- Take a visual inventory of the area.
- Locate the relevant landmarks.
- Adjust mirrors properly.
- Roll window down to hear spotter.
- Use emergency lights.
- Use your back up alarm.
- Position the wheels before stopping completely in the direction of your exit.
- Do not start backing if you are unsure of your area.
- Be aware of the location of the rear tires since they are considered the pivotal reference point to begin the turn. Remember the vehicle height when backing.

#### 2.2.3. Maintain Vigilance for Hazards Associated with Forward Blind Spots

The ambulance driver should drive through city traffic with an expectancy that a vehicle, pedestrian or children will suddenly appear directly in the path of the ambulance. The distinguishing feature of defensive driving is to be on the alert for unexpected responses or behaviors of other drivers and pedestrians, and maintaining readiness to respond effectively to the unexpected.

### 2.3. Changing Lanes & Passing

An ambulance on the way to the scene or transporting a critically injured patient to a hospital may be required to execute frequent lane change and passing maneuvers to complete the trip in the required time. With lights and siren on, the driver will need to be extra vigilant as to how other drivers will respond since that response is not always predictable. Clawson et al (1997) describe an emergency roadway accident phenomenon that might redefine the actual scope of effects caused by lights and siren responses and transports as the wake-effect accident. This appears to be caused by the passage of an emergency vehicle but does not actually involve the emergency vehicle. These authors conducted a survey of paramedics in the Salt Lake City area on their experience with emergency medical vehicle collisions (EMVCs).  Of the 73 respondents, 78% reported either being involved in an EMVC personally or witnessing at least one wake-effect collision. Of that group, 55% reported wake-effect collisions as occurring more frequently than actual EMVCs; 4% reported that wake-effect collisions occurred in equal numbers to EMVCs; 19% indicated that these collisions occurred less often than did actual EMVCs; and 22% did not report either.

The results validate the occurrence of wake-effect collisions and report their frequency relative to actual EMVCs. The subsequent finding that wake-effect collisions may occur five times more than actual EMVCs is the antithesis of the most basic premise of medical care: "First, do no harm." Although the seriousness of wake-effect collisions was not determined in this study, even small, fender-bender collisions without injuries have other community and economic repercussions that should be considered in evaluated the costs and benefits of a lights and siren policy. Levick (2008) also reported that wake-effect crashes occur with a frequency of 5 times greater than accidents involving the ambulance itself.

### 2.3.1. Lane Change Safety

Sanddal et al (2010) recommend checking the side view mirrors to ensure that the lane is clear, and activating the turn signal at least 100 feet prior to the lane change in the city, and 300 feet on a highway, maintaining the turn signal activation through the lane change maneuver.

### 2.3.2. Passing Safety

Sanddal et al (2010) recommend checking the side view mirrors to ensure that the lane is clear, and activating the turn signal at least 300 feet before passing, maintaining the turn signal activation through the passing maneuver.

### 2.3.3. References

Clawson, J.J., Martin, R.L., Cady, G.L. and Maio, R.F., (1997).The Wake Effect: Emergency Vehicle Related Collisions. *Prehospital and Disaster Medicine, 12,* No 4.

Levick, N., (2008)., *Emergency Medical Services: A Unique Transportation Safety Challenge.* Transportation Research Board Annual Meeting.

Sanddal, T., Ward, N., and Stanley, L., (2010). *Ambulance Vehicle Operator: Driver Behavior and Performance Checklist.* U.S. Department of Transportation, Research and Innovative Technology Administration.

## 2.4. Distraction Management

According to the National Highway Traffic Safety Administration’s (NHTSA) website Distraction.Gov, in 2011 3,331 people were killed in crashes involving a distracted driver, compared to 3,267 in 2010. In 2011, an additional 387,000 people were injured in motor vehicle crashes involving a distracted driver. A total of 18% of injury crashes in 2010 were reported as distraction-affected crashes. Drivers who use hand-held devices are 4 times more likely to get into crashes serious enough to injure themselves. Text messaging creates a crash risk 23 times worse than driving while not distracted. Sending or receiving a text takes a driver's eyes from the road for an average of 4.6 seconds, the equivalent, at 55 miles per hour (mph), of driving the length of an entire football field blind. Headset cell phone use is not substantially safer than hand-held use.

The Federal Motor Carrier Safety Administration (FMCSA) conducted a study of the impact of distractions on commercial vehicle drivers which is applicable to ambulance drivers. This study (Olson et al, 2009) described driver distraction as occurring when inattention leads to a delay in recognition of information necessary to accomplish the driving task. The FMCSA study recorded a total of 4,452 safety critical events (i.e., crashes, near-crashes, crash-relevant conflicts, and unintentional lane deviations) in the data set, along with 19,888 baseline (uneventful, routine driving) non-safety critical events. Key findings were that drivers were engaged in non-driving related tasks in 71 percent of crashes, 46 percent of near-crashes, and 60 percent of all safety-critical events. Also, performing highly complex tasks while driving led to a significant increase in risk. Eye glance analyses examined driver eye location while performing tasks while operating a commercial motor vehicle. Tasks associated with high odds ratios (increased risk) were also associated with high eyes off forward road times. This suggests that tasks that draw the driver's visual attention away from the forward roadway should be minimized or avoided. Based on the results of the analyses, a number of recommendations are presented that may help address the issue of driver distraction in ambulance operations.

These include:

- Fleet safety managers engage and educate their drivers, and discuss the importance of being attentive and not engaging in distracting tasks or behaviors. Even routine types of behaviors (e.g., reaching for an object, putting on sunglasses, or adjusting the instrument panel) can distract and may lead to a safety-critical event.

- Fleet safety managers develop policies to minimize or eliminate the use of in-vehicle devices while driving. The authors also urge fleet safety managers to be cognizant of devices that drivers may bring in the truck cab and use while driving. These may seem innocuous (e.g., calculator), but may increase crash risk, if used while driving.

- Drivers should not use the radio while driving and fleet safety managers should educate drivers on the danger of interacting with these devices while driving. Similar to manually dialing a cell phone, if drivers must interact with a radio, the authors recommend that drivers do so only when the ambulance is stopped.

- Drivers should not manually dial cell phones while driving. If a call must be made, drivers should pull off the road to a safe area, and then dial to make the phone call. Another option, requiring further study, is the use of voice-activated, hands-free dialing, which would allow the driver to maintain eyes on the forward roadway. However, this approach may have implications for "cognitive distraction" (though visual distraction would be expected to be reduced).

- Drivers should not read, write, or look at maps while driving. What may seem like quick, commonly performed tasks, such as reading, writing, and looking at maps, were found to significantly draw visual attention away from the forward roadway. These activities, which may be integral to the driver's job, are not integral to operating the vehicle and the authors recommend that such tasks never be performed while the vehicle is in motion.

- Designers of radios and other communication devices should consider the increased risk associated with using their devices and work to develop more user-friendly interfaces that do not draw the driver's eyes from the forward roadway. Possible solutions include a hands-free interface and/or blocking manual use while the vehicle is in motion.

- Designers of ambulance driver compartment instrument panels should consider the increased risk of adjusting panel controls. The designs should be intuitive, user-friendly, and not require long glances away from the forward roadway.

### 2.4.1. References

Olson, R.L., Hanowski, R.J., Hickman, J.S., and Bocanegra, J., (2009). *Driver distraction in commercial vehicle operations*.

## 2.5. Management of Ambulance Driver Fatigue

Many of the 6,500 ambulance crashes a year that injure an estimated 10 people a day and kill at least two people a month are due to unnecessary speeding, insufficient driver training, driver exhaustion from long work hours, and inadequate dispatch procedures. EMS was built largely on the model of fire departments, which often allow workers to pack all their hours into two or three long shifts. It tends to work with firehouses because many of them only get a few calls and the employees can sleep when they're not fighting fires. Nonemergency transports, such as patients who need to be moved from one hospital to another in a reclined position, have appointments stacked the entire shift, and offer little opportunity for sleep for their employees.

As stated by Aimee (2004), little data exist on the role of fatigue in ambulance accidents or its impact on medical service delivery. The anecdotal accounts of ambulance drivers falling asleep at the wheel and employee complaints about excessive overtime that have appeared in newspapers across the country should serve as a warning to the industry to look at the effects of fatigue on EMS employees' health and safety (Zagaroli, 2003).

The National Transportation Safety Board (NTSB) estimates that 100,000 crashes and about 1,500 fatalities annually are caused by driver fatigue, and the development of effective fatigue countermeasures has been on the Board's "Most Wanted" list of safety improvements since the list was developed. (Ellingstad, 1998)

Fatigue is a shorthand reference to a general state of decreased mental and physical capacity resulting from a lack of sufficient restorative sleep or a disruption of the circadian rhythm, the natural biological clock that drives the body's cycle of sleeping at night and waking at daylight. This can often be exacerbated by on-the-job stress and poor personal habits. Working night shifts, running double shifts and often "sleeping with one eye open" while anticipating the next emergency call are part of the normal work environment of EMS professionals. Such conditions place them at high risk for experiencing the detrimental impact of fatigue on their job performance and personal health.

The following best practices can reduce the impact of fatigue on driver performance.

### 2.5.1. Provide Education

Education is the first step taken in each program developed to address job-related fatigue. Knowledgeable employees are more likely to embrace change, especially change that affects off-duty behavior, if they understand and appreciate fully the effect of fatigue on their work and in their lives. Training programs are most effective when the countermeasures to be implemented are specifically tailored to the workplace and can be linked to how they will provide relief from specific aspects of fatigue. Most education programs are mandatory for all employees, including management, and include lectures by experts, brochures and other reference materials, websites, videotapes to disseminate information and an employee hotline.

### 2.5.2. Design Rotating Shifts to Reduce Fatigue

Consideration should be given to developing rotating shifts to avoid a permanent night shift workforce and provide for adequate recovery time for employees between shift changes. While many workers prefer a fixed shift schedule due to family responsibilities, research indicates that most permanent night shift workers rarely get used to their schedule. Several reasons could account for this. Daytime sleep has been found to be less restorative than nighttime sleep, so regular night shift workers never catch up on deep sleep. In addition, most companies report that their night shift workers say they return to a day schedule on their days off, and their sleep patterns are disrupted again. Rotational shifts have been found helpful in solving the problems caused by permanent shifts if the shifts are rotated forward, from a day to an evening to a night shift. A comparison of shifts of six, eight and 12 hours, found that 12-hour shifts seem to be the best compromise between productive work and making sure employees are rested.

### 2.5.3. Avoid Quick Shift Changes

In order to help maximize the amount of restorative sleep employees can obtain, avoid quick shift changes, long work shifts, and overtime, when possible. Keep night shifts to a minimum of two to four consecutive nights. At the end of a night shift, allow at least 24 hours before scheduling employees for their next shift.

### 2.5.4. Provide Appropriate Length Off-Duty Shifts

Additionally, providing for off-duty shifts of more than eight hours will give employees time to get the full 6-10 hours of sleep they need. The Federal Motor Carrier Safety Administration (FMCSA) standard for long-haul drivers extended off-duty shifts to 10 hours to give operators time to travel to their homes, eat and unwind before bedtime.

### 2.5.5. Provide Appropriate Workplace

Maintaining comfortable temperature, controlling excessive noise and providing well-lit duty areas and dark, quiet sleeping facilities are steps companies have taken to make the workplace more comfortable and reduce employee fatigue. Some companies provide recreational areas with comfortable furniture, television and other leisure pursuits to provide temporary relief to employees. Exercise equipment has been purchased by some companies to encourage a break from work and physical activity on the job, which has been shown to help enhance alertness and efficiency temporarily.

### 2.5.6. Provide Appropriate Fatigue Preventative Strategies

The only cure for fatigue is sleep. Sleep as much as possible before or between duty days to avoid beginning a shift already tired. Developing a regular sleep routine, going to bed and waking up at the same time each day has been found to make it easier to fall asleep. Relaxing prior to going to sleep will improve the quality of sleep on a regular basis.

Techniques for helping someone sleep include reading or taking a warm bath before bedtime and keeping room temperatures cooler in order to promote restful sleep. Other preventative strategies for reducing fatigue include:

- Taking naps can provide a temporary boost to alertness and relief from fatigue but do not compensate for long-term sleep loss, so they are best used in addition to sufficient sleep. Naps should last about 20 minutes. Napping longer than 45 minutes allows you to enter a deep sleep that usually results in grogginess and disorientation when interrupted by a duty call and should be avoided.

- Conversely, sleeping for two hours is usually enough to permit one complete cycle through the different stages of sleep and can be beneficial.

- Eating too much, too little or certain kinds of food is likely to interfere with the ability to fall and remain asleep. Caffeine, alcohol and nicotine all stimulate the nervous system and can provide some measure of temporary relief from the effects of fatigue. All of the stimulants also impair the ability to fall asleep and maintain the deep level of sleep necessary to provide restorative benefits, and are best used early in a shift and not at all three hours before bedtime is planned. To avoid headaches, irritability and other symptoms that affect heavy caffeine consumers who try to reduce their intake, begin to cut down on caffeine by one-half or one cup every couple of days.

- Avoid using alcoholic drinks to help unwind after work. While alcohol promotes relaxation and drowsiness, it suppresses the deeper levels of sleep needed to restore the body. It is best to avoid drinking two to three hours before bedtime. Heavy drinking will impair alertness the following day and possibly contribute to long-term health problems.

- Participating in a regular exercise routine of about 30 minutes daily helps to maintain health and fight the effects of fatigue. Overall physical fitness helps the body cope with stress and resist illness and disease, and promotes a deeper, more restful sleep. Exercising before the start of a shift, if not overdone, can invigorate one and could provide a healthy way to stimulate oneself for work. Because of this stimulating effect, studies recommend avoiding strenuous exercise three to six hours prior to bedtime.

### 2.5.7. Incorporate the Components of a Successful Program

Adopting a fatigue countermeasure program will not ensure that employees receive sufficient sleep and develop healthful personal habits. Employees are likely to resent suggestions that affect their off-duty personal time, particularly those who have to juggle family demands while recovering from long shifts. Furthermore, many people suffer from sleep disorders and require individualized interventions to help them avoid sleep disruptions. But all of the successful fatigue countermeasure programs have included the following:

- Commitment by management to address workplace practices that most contribute to fatigue.

- Involvement of all employees directly in the process of developing strategies and programs were the most frequently cited elements of successful alertness programs. Employees were found to be more supportive of changes in the workplace when a strong fatigue education and training component was included as part of the program, and when employees at all levels within the company participated.

- Involvement by the families of employees in education and training programs on the effects of shift work and fatigue. This was found to reduce stress within the home and contribute to employees' ability to obtain sufficient uninterrupted sleep while off duty. If family members know what the work and sleep schedule will be, and the importance of sufficient undisturbed sleep, activities and chores can be scheduled accordingly.

### 2.5.8. References

Aimee, F.J. (2004). *Fatigue Management,* EMS World.

Antone R. *Ambulance crews piling up overtime.* Star Bulletin, July 11, 2001, at http://starbulletin.com/2001/07/11/news/story1.html.

Collins E. *Paramedics: Long shifts put public at risk.* The Capital, June 8, 2003.

Ellingstad, V.S., Director, Office of Research and Engineering, National Transportation Safety Board. "Testimony regarding Fatigue in the Trucking and Rail Industry," September 16, 1998 before the Surface Transportation and Merchant Marine Subcommittee, Senate Commerce Committee, U.S. House of Representatives at www.ntsb.gov/speeches/s980916.htm; Chairman Marion Blakey. *Remarks for the United Transportation Union,* Washington, DC, July 30, 2002, at www.bmwe.org/nw/2002/04APR/24.htm; "NTSB Chairman Highlights Fatigue as Major Cause of Transportation Accidents" at www.ntsb.gov/speeches/blakey/mcb020730.htm.

Frank AJ. (2003). Two-Hatter Controversy Revisited in Hartford, *Best Practices in Emergency Services,* 6, August, p. 2.

Zagaroli L, and Taylor A. (2003). *Ambulance driver fatigue a danger.* Detroit News, Retrieved January 27, at www.detnews.com/2003/specialreport/0301/27/a01-69705.htm.

## 2.6. Maintaining a Safe Following Distance

Maintaining a safe following distance will help prevent accidents. Based on the weight of the ambulance and the speed at which it's travelling, the driver needs a certain amount of distance to stop. By maintaining a safe following distance, the driver will be able to bring the ambulance to a stop safely without the possibility of rear-ending another vehicle or possibly swerving into another lane and being hit by other drivers.

### 2.6.1. Follow the Three Second Rule

The driver should watch the vehicle in front pass an object (bridge, pole, etc.) then start counting. It should take 3 seconds for the driver’s ambulance to past the same object. This period should extend to 6 seconds in bad weather.

#### 2.6.2. Keep Separation from the Vehicle in Front when Stopped

When stopped at an intersection the driver should leave enough space between the ambulance and the vehicle in front for an escape route. This way if a call is received, the driver can get the ambulance out of the traffic line.

Based on the ambulance speed, the driver should be able to safely brake at the specified distances below should the preceding vehicle abruptly stop (See Table 1).

**Table 1. Vehicle Speed and Stopping Distance**

| Vehicle Speed | Stopping Distance |
|---|---|
| 10 MPH | 18 ft |
| 20 MPH | 52 ft |
| 30 MPH | 100 ft |
| 40 MPH | 169 ft |
| 50 MPH | 280 ft |
| 60 MPH | 426 ft |

#### 2.6.3. References

Buncombe County EMS. (2008). *Defensive Driving Course.* Retrieved March 5, 2013 from http://emsstaff.buncombecounty.org/inhousetraining/drivingpart1/driving_overview3.htm.

Pro EMS. *Policy and Procedure Manual.* (2008). Retrieved March 15, 2013 from http://www.proems.com/v2/employment_pnp2.cfm?title=38&titleName=Introduction.

Widmeier, K. (2011). *Driving Procedures Keep Providers Safe on the Road.* JEMS. Retrieved March 13, 2013 from http://m.jems.com/article/vehicle-ops/driving-procedures-keep-providers-safe-r.

### 2.7. Intersection Handling

According to Levick (2008) there have been extensive studies that have identified that intersections are responsible for many ambulance crash fatalities and injuries. It has also been demonstrated that for each ambulance occupant killed in an adverse event involving an ambulance vehicle, that there are 3 bystanders killed, either in an unrelated passenger vehicle or pedestrians being struck. Also the rear patient compartment has been identified as the most dangerous part of the ambulance for its occupants, yet this part of the vehicle is currently not regulated by the Federal Motor Vehicle Standards. Unfortunately also, no reporting system or database exists specifically for identifying ambulance crash related injuries and their nature, so specific details as to which injuries occurred and what specifically caused them are extremely scarce. While some crashes may not have been preventable, many fatal and injurious ambulance crashes are related to risky driving practice by EMS personnel. One paper cites that 80% of the crashes are caused by 20% of the drivers determined to be high risk drivers. Failure to stop at intersections has been identified as an extremely high risk behavior. Some of the larger EMS services have clear policies in place requiring ambulances to come to a complete stop at a red light or stop sign. However there is no national requirement for such transportation safety policies.

### 2.7.1. Proper Intersection Traverse

According to Sanddal et al (2010), the procedure for traversing an intersection is to take the foot off gas and position it over the brake on approaching the intersection. If the light is green, slow the vehicle to normal posted speed or less, visually scan all directions and proceed through the intersection. If the light is red, slow down approaching intersection, bring the vehicle to a complete stop, visually scan in all directions and proceed with caution through the intersection.

The following guidelines should be followed for intersection traverse:

- EMS response vehicles shouldl not exceed posted speed limits when proceeding through intersections with a green signal or no control device.
- When an EMS response vehicle approaches an intersection, with or without a control device, the vehicle must be operated in such a manner as to permit the driver to make a safe controlled stop if necessary.
- When an EMS response vehicle approaches a red light, stop sign, stopped school bus or a non-controlled railroad crossing, the vehicle must come to a complete stop.
- The driver of an EMS response vehicle must account for all lanes of traffic prior to proceeding through an intersection and should treat each lane of traffic as a separate intersection.

According to Patrick (2012), any intersection controlled by a stop sign, yield sign, yellow traffic light or red traffic light requires a complete stop by the emergency vehicle driver if all visible traffic in all lanes cannot be accounted for. In addition, these steps must be followed:

- Do not rely on warning devices to clear traffic.
- Scan the intersection for possible hazards (right turns on red, pedestrians, vehicles traveling fast, etc.), as well as driver options.

- Begin to slow down well before reaching the intersection and cover the brake pedal with the driver's foot, continue to scan in four directions (left, right, front, and back).

- Change the siren cadence not less than 200 feet from an intersection.

- Scan the intersection for possible passing options (pass on right, left, wait, etc.).

- Observe traffic in all four directions (left, right, front, rear).

- Avoid using the opposing lane of traffic if at all possible.

- If the driver proceeds past a control device with a negative right-of-way without coming to a complete stop, both the driver and partner should be required to complete an incident report providing an explanation of the circumstances that permitted them to do so.

- Establish eye contact with other vehicle drivers; have your partner communicate all is clear; then reconfirm all other vehicles are stopped.

- Slow down if any potential hazards are detected, and cover the brake pedal with the driver's foot where the intersection does not have a control device (stop sign, yield or traffic signal) in the direction the vehicle is traveling, or where the traffic control signal is green as approached.

### 2.7.2. References

Levick, N., (2008). *Emergency Medical Services: A Unique Transportation Safety Challenge.* Transportation Research Board Annual Meeting.

Patrick, R.W., (2012). *Safe Intersection Practices.* EMS World.

Sanddal, T., Ward, N., and Stanley, L., (2010). *Ambulance Vehicle Operator: Driver Behavior and Performance Checklist.* U.S. Department of Transportation, Research and Innovative Technology Administration.

## 2.8. Near Miss Recovery

Near miss recovery is the effectiveness with which the driver recovers control of the ambulance after a near miss.

### 2.8.1. Regaining Control

In making a split second response to avoid an accident it is critical that the driver is fully familiar with the handling qualities of the ambulance, including its capabilities and limitations. In addition, it is always easier to regain control after a near miss if the speed is not excessive, and the driver had been driving to allow for weather, traffic, and roadway conditions.

Although a near miss implies that an accident has been avoided, it is still an accident avoidance situation in that, in recovering from a close call, the driver must not put himself or herself in position for another accident risk. Accident avoidance training must stress not simply avoiding a collision, but also ensuring that the actions to avoid the initial accident do not lead to a second accident situation.

### 2.8.2. Dealing with an Unavoidable Collision

If, in avoiding a collision, the driver is placed in a position where impact with a second vehicle or fixed obstacle in inevitable, the driver must be aware of the fact that a collision is about to happen, and then decide what to do to avoid it or reduce the risk and damage resulting from the collision. The driver should have received training on procedures to avoid or mitigate the damage associated with a collision.

## 2.9. Driver Actions for Safe Patient Care

The driver's actions with the ambulance can have a significant impact on ease and safety of patient care. To facilitate patient care, the driver should:

- Accelerating at a gradual rate avoiding jack rabbit starts.
- Changing speed as gradually as possible.
- Easing into turns to reduce forces on personnel in the patient compartment.
- Avoiding sudden directional changes.
- Avoiding high rates of speed to the extent possible consistent with patient medical needs.
- Warning the EMS provider in the patient's compartment of railroad crossing, rough road or other factors that will disrupt patient comfort and EMS provider effectiveness.
- Identifying bumps in the road or potholes visually or from a leading vehicle and adjusting steering and speed accordingly.
- Convey to the EMS providers in the patient compartment the operation of turn signals and presence of the driver's foot on the brake even if not fully activated.

## 2.10. Safe Presence

In 2009 Federal Emergency Management Agency (FEMA) undertook an assessment of requirements for color coding and marking of emergency vehicles. The FEMA study reported that previous studies conducted across the United States and in other countries suggest that steps to improve emergency vehicle visibility and conspicuity hold promise for enhancing first responders' safety when exposed to traffic both inside and outside their response vehicles (e.g., patrol cars, motorcycles, fire apparatus, and ambulances). The report's major finding is the urgent need for additional research specific to emergency vehicle visibility/conspicuity in the United States. A number of other key findings were discussed with implications for deploying existing conspicuity treatments, as well as developing future technologies, standards, and safe operating procedures.

### 2.10.1. Enhancing Ambulance Conspicuity

Ambulance Conspicuity should be enhanced by the following:

- *Retro-reflective materials* – properly applied/maintained retro-reflective sheeting materials can effectively increase the night-time visibility and conspicuity of treated objects, as frequently used across the United States in a wide range of traffic control applications. Research performed by NHTSA suggests retro-reflective conspicuity treatments applied to U.S. heavy truck trailers since 1992, with a retrofit requirement in 1999, have been "quite effective" at reducing side-/rear-impact crashes at night.

- *Visibility and Recognition* – A wide range of factors affect the visibility and recognition of emergency vehicles, including the presence/ operation of active warning devices such as lights and sirens; retro-reflective conspicuity treatments (at night); lettering and graphics; and color scheme(s).

- *Contrast* – The use of contrasting colors can positively affect conspicuity by assisting drivers with locating a hazard amid the visual clutter of the roadway. There are basically two types of contrast: 1) luminance contrast— the degree to which an object is brighter than its background, and 2) color contrast—the difference in an object's color(s) and those found in its background. Contrast is enhanced by using colors not normally found in the environment, including fluorescents.

- *Fluorescent Colors* – The specific color choice may or may not be important with respect to fluorescents, perhaps depending on background characteristics. Studies have indicated that fluorescent yellow was found to be best detected and fluorescent orange was found to be best recognized against a number of backgrounds. A recent study of traffic safety garments showed no statistical difference in the daytime conspicuity of fluorescent red-orange and fluorescent yellow-green, although fluorescent yellow-green had a significantly higher luminance value, compared to the background, than the fluorescent red-orange.

- *Contour Markings* – Outlining vehicle boundaries with “contour” or “edge” markings, using retroreflective material, is expected to help enhance emergency vehicle visibility/conspicuity. A Canadian study of large truck trailers identified continuous contour markings, made with white retroreflective tape, on the sides and rear of trailers to be more visible under varied weather conditions than the standard FMVSS 108 (Office of the Federal Register, 2012) conspicuity treatment required by U.S. regulations.

- *Placement* – Studies of recent changes in headlamp illumination suggest it might be efficacious to concentrate retroreflective material lower on emergency vehicles to optimize interaction with approaching vehicles’ headlamps. This opportunity does not replace, but rather complements, the anticipated positive effects of contour markings outlining an emergency vehicle’s overall size and shape.

- *Logos and Emblems* – Applying distinctive logos or emblems made with retroreflective material could improve emergency vehicle visibility and recognition. European studies on the use of retroreflectorized logos and graphics found the application of simple designs made from retroreflective sheeting markedly improved the visibility/conspicuity of heavy trucks. The use of clearly identifiable logos or graphics specifying the affiliation, and therefore function, of an emergency vehicle can be reasonably expected to aid recognition and help surrounding drivers better anticipate its behavior.

### 2.10.2. References

FEMA, (2009) “Emergency Vehicle Visibility and Conspicuity Study”, FA-323.

Office of the Federal Register (2012) Code of Federal Regulations, Title 49: Transportation, Part 571 – Federal Motor Safety Standards, 571.108 Lamps, Reflective Devices, and Associated Equipment. U.S. Government Printing Office, Washington, D.C.

## 2.11. Safe Speed

Meisel and Pines (2010) describe the "golden hour," a concept of emergency care that is so deeply held and widely disseminated that they named a British TV show after it. The theory of the golden hour proposes that patients with serious trauma who get to the hospital within 60 minutes of injury are far more likely to survive. On its face, this rule makes sense: If you are bleeding internally, a surgeon can stop the hemorrhage as long as she can get to the source of the bleeding quickly enough. While the golden hour has become dogma, it turns out not to be backed by good science.

A recent study reported by Newgard et al (2010) in the Annals of Emergency Medicine casts further doubt on the concept of the golden hour for patients with severe injury. The authors studied more than 3,000 trauma patients, those with low blood pressures from bleeding, head injuries, and difficulty breathing, and looked at various time intervals after a 9-1-1 call. The times were compared with outcomes for the patients in the hospital. The result: shorter intervals did not appear to improve survival. These results are fascinating, in part because the principal question, how important is speed in the care of trauma patients before they get to the hospital?, has never been so elegantly explored. Previous efforts to measure the effect of ambulance time on survival have been plagued by the fundamental problem that medics may behave differently, like driving faster or spending more time working on patients, depending on the severity of the condition, making it impossible to tease out the effect of time on survival. While some of these biases remain, the authors of this study used sophisticated methods to account for many of these problems, allowing the reader to reasonably conclude that for ambulance care, a few minutes either way neither saves nor costs lives for patients with severe trauma.

Meisel and Pines do state that it would be wrong, and irresponsible, to claim that time doesn't make a difference in the delivery of emergency care. Some medical conditions are truly time-sensitive, such as episodes of choking, in which performing the Heimlich maneuver can be life-saving, and cardiac arrest, in which medics can shock and restart a heart. But as new and better evidence suggests that very small differences in time may not be as important as other factors in the delivery of care for seriously ill patients, we should be clear about policies that may save minutes but not lives. This is important, because many ambulance services are benchmarked for quality on response time, which in turn may encourage ambulances to continue to speed.

### 2.11.1. Ambulance Speed Guidelines

Best practice guidelines for ambulance speed include the following:

- Ambulances should not exceed the posted speed limit by more than ten (10) miles per hour.
- Ambulances should not exceed posted speed limits when proceeding through intersections with a green signal or where there is no stop sign or other controlling signage or device.
- Speed should be moderated to avoid roll over in a turn or curve.
- Speed should be reduced when the curbside tires leave the paved and/or elevated surface of a road to reduce the likelihood of improperly bring the vehicle back onto the paved surface.

#### 2.11.2. References

Meisel, Z., and Pines, J., (2010), “High Speed Care: How Fast Should Ambulances Go?, Slate magazine, May, 2010.

Newgard, C.D., Schmicker, R.H., Hedges, J.R., Trickett, J.P., Davis, D.P., Bulger, E.M., Aufderheide, T.P., Minel, J.P., Hata, J.S., Gubler, K.D., Brown, T.B., Yelle, J.D., Bardarson, B., Nichol, G., (2010), “Emergency Medical Services Intervals and Survival in Trauma: Assessment of the Golden Hour in a North American Prospective Cohort”, Annals of Emergency Medicine, Mar, 55(3), 235-246.

### 2.12. Turning Vehicles

For turning ambulances, the driver should check the side view mirrors to determine that it is safe to turn. The turn signal should be engage 100 feet before the turn in urban traffic and 300 feet in rural or highway settings and kept on through the turn. The driver should verify that it is off after the turn maneuver is completed.

Hard turns at high speeds will cause the ambulance to push outward, onto the shoulder or into the oncoming lane.

### 2.13. Weather

Modern day EMS vehicles have a tremendous amount of technology packed into the chassis and drive systems that are designed to keep them safe on the road during adverse weather conditions. However, the driver should take time to understand its capabilities in order to take advantage of this technology. For example, if the vehicle has traction control, the time to find out how it works is not in the middle of a snowstorm. The same goes for four-wheel drive and all-wheel drive systems. There is a difference between the two. The driver should know which one he or she has. Other questions that the driver should know the answers to include:

- If the ambulance has four-wheel drive, does it have a full transfer case allowing 4-HI and 4-LOW operation, and does it have manual or automatic locking differentials or center-locking differentials?
- Does the driver know what each mode does and why?
- Is it full-time or part-time four-wheel drive?
- Does it have a limited slip?
- Has the driver tried the various operating modes before heading out into winter conditions to know which mode works best for a given traction condition?

EMS vehicles are subject to the same physical constraints as other production vehicles, and that includes the opportunity to get stuck or stranded. There's a real chance that the driver might get stuck where it might take hours for a plow or tow truck to reach. So in addition to checking the vehicle for the usual medical and technical supplies, when driving in winter the driver should include a cooler full of energy bars, water and other snacks in case he or she gets stranded. The driver should make sure that they have a few space blankets too and keep in mind stranded motorists may seek refuge in the ambulance as well and they probably won't have water or food with them. Also, a spare set of windshield wipers should be included in case the wipers are damaged in the storm.

### 2.13.1. Guidelines for Driving in Adverse Weather

Adverse weather conditions include rain, snow, wind, fog, and dust.

- When operating on icy or other conditions where the coefficient of friction is reduced, or where visibility is impaired by snow, rain, or smoke, the driver should slow to a speed that will allow for safe response or transport.

- If the vehicle begins to skid, the driver should let up on the accelerator and turn the front wheels in the direction of the skid.

- In purchasing an ambulance, consider the use of electronic stability control (ESC) systems, which are a computerized technology to detect and mitigate skids. When an ESC system identifies a loss of steering control, it automatically applies the brakes, and may cut engine power, to help control and direct the vehicle. According to NHTSA and the Insurance Institute for Highway Safety, up to a third of fatal accidents might be prevented this way. ESC is increasingly featured in EMS apparatus, particularly modern van-type units, and could be especially beneficial in rural areas, where single-vehicle crashes produce so many ambulance-related injuries.

- If the driver feels like the tires have lost traction with the surface of the road and the vehicle is hydroplaning, he or she should take their foot off the accelerator and let the vehicle slow down. The driver should not try to stop until the tires are gripping the road again. To reduce the chances of hydroplaning, tires should be used that have adequate water-channeling treads and they should be checked often. The driver should always slow down when water is on the road.

- The driver should make sure he or she is able to see and be seen. If driving in rain or snow, make sure to stop sometimes to wipe mud or snow off the windshield, headlights, and taillights. In any case, even in excellent weather, the headlights should be on so as to be seen by other drivers.

- The driver should slow down at the first sign of rain, drizzle, or snow on the road. This is when many road surfaces are most slippery because moisture mixes with oil and dust that has not been washed away. Low-beam headlights should be turned on. Heavy rainfall can reduce visibility to zero, therefore the driver should pull over and wait for the rain to subside, or until visibility is restored if the call allows.

- Slow down when driving in fog. Fog makes it very difficult to judge speed.
- Following distance should be increased in fog and the driver should be prepared to stop within the space that can be seen in front of the vehicle. Watch for slow moving vehicles. Check rearview mirrors for vehicles approaching from behind. Slow down in patchy fog conditions, and be sure to turn on the vehicle's low-beam headlights.
- The driver should pull safely and completely off the road if the fog becomes so thick that he or she can barely see. Do not continue driving until the fog lifts and visibility improves.
- Visibility is usually limited in adverse weather conditions such as rain, fog, ice, snow, and dust. The most effective defensive driving techniques in these conditions are to slow down and drive at speeds safe for the weather or to delay departure until conditions improve.
- Streets and highways covered with snow, snow pack, or ice are extremely hazardous. They are most hazardous when the snow or ice begins to melt. The slush or wet surface acts as a lubricant and traction is reduced.
- Wind creates additional problems for drivers. It can be especially dangerous for vehicles like ambulances that have a high profile. The best defensive driving technique one can use for wind is driving at slower speeds. Wind generally reduces steering control. Tail winds push a vehicle, increasing speed. Head winds slow a vehicle down.  Crosswinds may cause the ambulance to swerve. Be prepared to make adjustments in speed and steering to compensate for wind conditions or safely pull over to allow gusty winds to subside. The driver should be prepared if the ambulance is suddenly be hit by a gust of wind as it crosses a culvert or bridge, or drives through mountain passes and ravines. Wind gusts occur suddenly and can cause total loss of vehicle control, requiring an adjustment in speed and steering. The driver should be alert when being passed by a large truck or bus since these may create a small gust.

### 2.13.2. Extreme Weather Condition Equipment

Extreme weather conditions may require special equipment (e.g., tire chains) and/or special skills by the driver (e.g., slow starts and stops). Here are some guidelines for driving in snow or icy conditions:

- Keep the windows and windshield clear.

- Obtain maximum visibility by turning on low-beam headlights and windshield wipers.
- Drive slowly and stay farther behind the vehicle ahead. Slow to a crawl on ice. Slow down as you approach curves and intersections.
- Avoid fast turns.
- Avoid quick stops.

## 3.0 Standard Operating Procedures (SOP) and Technology

This section presents driver best practices that address the use of standard operating procedures (SOPs) as well as performance aiding technology.

A SOP, for the purposes of this document, is defined as the approved standard to be followed in carrying out a given operation or in a given situation. SOPs can come in the form of set rules or checklists. All SOPs should address procedures for dealing with poor weather conditions.

Ambulance driver performance can also be significantly enhanced by the appropriate implementation of technology that supports situation awareness and encourages safe driving practices. At the same time, technology can have a negative impact on driver performance by acting as a distractor.

### 3.1. Communications Devices and Protocols

Communications between the ambulance driver and others within and without the ambulance is critical but, at the same time, can become a significant source of distraction to the driver leading to a higher likelihood of an accident. Communications devices that might be used by the driver include radios, company cell phone, personal cell phone, intercom between the driver and the patient compartments, laptops, and pass-through window or walkthrough opening between the driver and patient compartments. In addition, there might be a visual display in the patient compartment to communicate the driver’s use of brakes and turn signals. The following presents best practices associated with communications devices and protocols.

#### 3.1.1. Communications While Moving

A potential key distraction for a driver is the use of communications devices such as cell phones and radios. Having to reach for, activate, and use a communications device can lead the driver to take his/her eyes off the road and reduce attention to the primary task of driving. This can be minimized by:

- To the extent possible, the driver’s partner should always perform communications between the ambulance and other stakeholders such as the dispatcher and hospital.

- When the ambulance is in motion and the driver's partner is in the patient compartment, the driver should limit communications to only that which is essential and can be performed with one hand and minimal eyes off the road.

### 3.1.2. Use of Constrained Language

Communications between the driver and others should employ a constrained language vocabulary that allows verbal communications to be quickly and accurately performed. Constrained language consists of concise, well defined phrases or terms that convey a specific meaning to others. This allows for more effective communication between two or more individuals in noisy or stressful environments and reduces the chances of miscommunications or misinterpretations. Training should be conducted between all those involved in communications to ensure that they understand the constrained language vocabulary.

### 3.1.3. Communications Prior to Departure and During Transport

As the ambulance departs a location, there are certain critical communications that need to occur to ensure that the departure and subsequent travel is as risk free as possible. Departing a parked location has a number of risks associated with it due to poor visibility and high levels of activity. These include backing into objects, colliding with other vehicles or people at the scene, or injury to EMS providers and/or patients in the patient compartment. To reduce risk, the driver should adhere to the following:

- Prior to departing a parked position regardless of where it is (accident scene, hospital, station), the driver should communicate with others at the scene to ensure that it is safe to pull out into the roadway. Communication can be direct verbal through an open window, by using a device, or by using hand signals.  Hand signals should be consistent with industry standards as illustrated in Figure 1.


**Figure 1.  Typical Hand Signals**

(From Alton Fire and Rescue Department Standard Operating Guidelines
http://www.altonfire.org/SOG_1.3.4_Backing-Up_Apparatus.pdf)

- Prior to moving, the ambulance driver should verify that those in the patient compartment are ready to leave, which includes being seated and restrained.

- During patient transport, the ambulance should have a device that communicates to the driver when EMS providers in the patient compartment are not restrained.

- Communication between the driver and those in the patient compartment should follow all the best practices cited above.

### 3.1.4. Driver Compliance

Drivers are expected to comply with all regulations of the department including the following:

- All drivers and passengers are to be seated and restrained while the vehicle is in motion.

- Drivers are to follow minimum rest requirements for shifts to reduce fatigue as discussed in Section 2.4.
.
- EMS personnel are to ensure that vehicle, staff, and equipment are ready to respond to calls at the beginning of each shift.
.
- Drivers are to follow all vehicle operation regulations regarding backing, turning, passing other vehicles, following the speed limit, etc.

- Drivers are to comply with all required training and retraining.
- Any driver impairment due to 24-hour shifts, medications, alcohol, drugs, illness or fatigue should be promptly reported to the supervisor.

### 3.1.5. Driver Qualification

Ambulance drivers should be adequately qualified to drive. Ambulance drivers are often required to make vital and timely decisions while responding to an emergency call or effectively transporting patients to a hospital without risking the lives of the medic team or other civilians or causing further injury to their patient. They must have knowledge of driving rules and regulations as well as the skills and ability to implement those rules appropriately. Failure to be properly trained and qualified can lead to injury or death to themselves, their passengers, and other motorists. Studnek and Fernandez (2007) analyzed 27 fatalities of EMS workers from the Fatality Analysis Reporting System (FARS) database and found that the majority occurred during favorable weather and environmental conditions. However, 48% of the ambulance drivers involved in the crashes had a poor driving record prior to the crash. Several practices should be implemented to ensure that drivers are properly qualified including maintaining a good driving record, maintaining proper physical health, and obtaining emergency vehicle certification.

### 3.1.6. Maintain a Good Driving Record

Drivers should have no recorded incidence of DUI, suspended license, vehicular manslaughter or other infractions that could jeopardize the public's welfare**.** Driver records should be examined for the number of accidents the driver has been involved in within the previous three years prior to hire.

### 3.1.7. Maintain Proper Physical Fitness.

All ambulance drivers should complete a physical exam prior to hire. Medical conditions such as loss of consciousness, cardiovascular disease, neurological/neurovascular disorder, mental illness, substance abuse/dependency, insulin-dependent diabetes, or any other rheumatic, arthritic, orthopedic, muscular, neuromuscular, or vascular disease which interferes with driving a vehicle must be noted in the exam. The presence of a medical condition alone may not disqualify a driver. However, it can identify an area for consideration in determining driver's medical fitness. Once hired there are several practices that should be followed to maintain physical fitness.

- Drivers should complete a physical annually.
- A standardized physical fitness program should be provided.
- A physical fitness assessment should be implemented to monitor the level

of fitness at least biannually.

- At least an hour per duty day should be allotted for physical fitness.

### 3.1.8. Complete Emergency Vehicle Certification

All drivers should be required to obtain certification from an Ambulance Vehicle Operators Course (AVOC), Emergency Vehicle Operator Course (EVOC) or Coaching the Emergency Vehicle Operator (CEVO) course. In addition, drivers should:

- Pass visual acuity, glare recovery, and reaction time tests.
- Demonstrate proficiency on the regulations and procedures addressed during classroom training.
- Demonstrate proficiency in driving skills such as braking, backing up, turning, parking, and crash avoidance through the hands on portion of the class. (See Training 4.0 for additional information.)

### 3.1.9. Complete Emergency Vehicle Operations Check-off

All new hires should be required to be checked off in all vehicles they will be operating to ensure familiarity with controls and equipment.

### 3.1.10. Complete Driver Qualification Card

A driver qualification card (See Table 2) should be completed for each driver and placed in his/her record before they are allowed to operate the vehicle.

**Table 2. Example Driver Qualification Card**

| **Driver Qualification Card** | |
|---|---|
| **I. Prerequisites** | Sign Off:<br>Name/Date |
| A. Candidate must have completed one of the following:<br>1. AVOC Course<br>2. CEVO Course<br>3. EVOC Course | |
| B. Candidate should have completed one of the following:<br>1. Red Cross CPR (cardiopulmonary resuscitation) For the Professional Rescuer | |

| | |
|---|---|
| 2. American Heart Association (AHA) Healthcare Provider (CPR & AED (Automated External Defibrillator))<br>3. AHA Heartsaver AED (CPR & AED) | |
| **II. Knowledge Requirements:** | |
| A. Candidate must have general knowledge of the roads and house numbering system within the Ambulance District. | |
| B. Candidate must have a working knowledge of routes to all local hospitals (including alternative routes). | |
| C. Candidate must have knowledge of emergency driving SOPs. | |
| D. Candidate must have knowledge of all gauges, switches, and controls in the cab and in the patient compartment. | |
| **III. Knowledge and Location Requirements:** | |
| A. Candidate must demonstrate knowledge and location of the<br>following equipment:<br>1. Main Oxygen Tank and Valve<br>2. Helmet & Fire Coat<br>3. Portable Radio<br>4. Spotlight<br>5. Fire extinguisher<br>6. Hazmat Response Guidebook<br>7. Injury Report clipboard<br>8. Winter Weather Equipment<br>9. Multiple causality incident kit<br>10. Extrication Equipment (Splints, Hare traction splint)<br>11. Backboards, Headblocks, & Collars<br>12. Portable Suction<br>13. Portable Oxygen Tanks<br>14. BLS Medic's Bag | |
| **IV. Skill Requirements:** | |
| A. Candidate must demonstrate their ability to complete the following ambulance driver operations:<br>1. Start the engine<br>2. Stop the engine | |

| | |
|---|---|
| 3. Engage the parking break<br>4. Disengage the parking break<br>5. Proper use of lights, sirens, and public address system<br>6. Operate both high band & low band radios (in cab & box)<br>7. Turn on/off main oxygen tank<br>8. Read pressure in main oxygen tank<br>9. Operate the gurney (demo all adjustments)<br>10. Operate the stair chair (demo all adjustments)<br>11. Operate the GPS units (demonstrate address searches) | |
| B. Candidate must complete the driving course with ambulance:<br>1. Straight line driving forward<br>2. Straight line driving reverse<br>3. Alley Dock<br>4. Serpentine<br>5. Confined Space<br>6. Offset<br>7. Diminishing clearance<br>8. Stop | |
| **V. Practice:** | |
| A. Candidate should practice driving non-emergency back from the hospital 2-3 times (with a driver trainer). | |
| B. Candidate should practice driving emergency mode to the scene<br>3-4 times (with a driver trainer). | |
| **VI. Approval:** | |
| A. Instructor's signature and date: | |

### 3.1.11. References

Sanddal, T.L., Sanddal, N. D., Ward, N. & Stanley, L. (2010). *Ambulance Vehicle Operator: Driver Behavior and Performance Checklist (D1).* Washington DC: U.S. Department of Transportation.

Studnek, J.R., and Ferketich, A. (2007). Organizational policy and other factors associated with emergency medical technician seat belt use. *Journal* *of Safety Research, 38,* 1-8.

Walworth Ambulance Inc. (2009). *Driver Qualification Card.* Retrieved March 22, 2013 from www.walworthfire-ems.org.

## 3.2. Encounter Accident

In the course of responding to a call, ambulances may encounter another accident along the way. There are several steps that should be taken to ensure that the best outcome is achieved for all involved. These include:

- Unless responding to a life-threatening call, stop and investigate immediately.
- Check for injuries.
- Notify dispatch with location, number, type and extent of injuries, and any need for additional units and police.
- Protect the incident scene with warning devices (ex. cones) to prevent additional damages or injuries.
- Do not move the vehicles until the police have arrived.
- If accident involves non-life threatening injuries, proceed with response to original call. If possible, one person from the medic team should remain at accident site.
- If life-threatening injuries are present, administer aid and notify dispatch to send another unit to original call.

### 3.2.1. Reference

McNeil and Company (n.d.). *Ambulance Driving Policy Guidelines.* Retrieved March 3, 2013 from **http://www.mcneilandcompany.com/?s=sample+policy**.

## 3.3. Lights and Sirens

Accident reports have indicated that most emergency vehicle accidents occur when the vehicles are running lights and sirens. Sanddalet al (2008) examined 112 rural crashes involving ambulances and 86 occurred while the ambulances were running lights and sirens. All of the 86 resulted in injuries and 23 resulted in fatalities. Although studies such as Addario, et al.(2000) and Kupas et al (1984) have confirmed that response times are slighter faster when lights and sirens are run, they indicate that this had no significant impact on patient recovery with the exception of cardiac arrest and obstructed airway.

The decision to run lights and sirens must be made cautiously. Depending on the nature of the patient call being responded to, running lights and sirens may not significantly affect patient outcome and could result in higher risk of injury or death for the medic team. The following guidelines should be followed when making the determination to run lights and sirens.

### 3.3.1. Perform Risk Assessment

Dispatch should conduct a risk assessment using risk matrix like that presented in Figure 2. Based on information received from the caller, dispatch should determine the frequency and severity level of the incident. For incidents determined to be of high frequency and severity, lights and sirens should be run. For incidents with low frequency but high severity, lights and sirens should also be run. For incidents with low frequency and severity, no lights and sirens should be run.

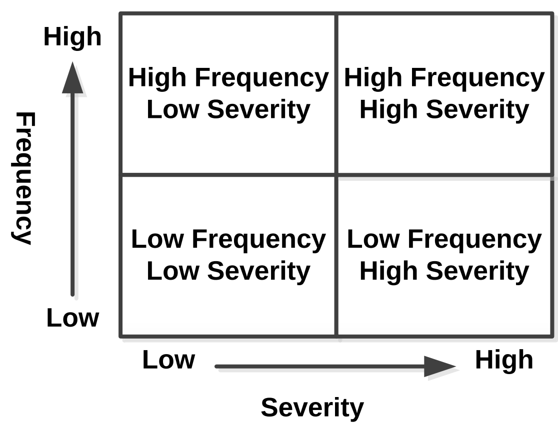


**Figure 2. Risk Level Matrix**

### 3.3.2. Respond Cautiously to Patient Call

The driver should:

- Read back dispatch information to ensure understanding.
- Downgrade as needed upon receipt of additional information from first responders at the scene.
- Not proceed more than 10 MPH above posted speed limit.

### 3.3.3. Cautiously Conduct Patient Transport

The driver should:

- Determine if lights and sirens are needed based on severity of patient's symptoms and the risk matrix above. Another general rule should be that lights and sirens should only be used when the required patient care is greater than the ability of the ambulance to provide.

- Upgrade or downgrade as needed over the course of the transport.
- Not proceed more than 10 MPH above posted speed limit.

### 3.3.4. References

Addario, M., Brown, L., Hogue, T., Hunt R. C., & Whitney, C. L. (2000). Do warning lights and sirens reduce ambulance response times? *Prehospital Emergency Care, 4,* 70-74.

Federal Emergency Medical Agency. (2004). *Emergency Vehicle Safety Initiative* (FA-272). Department of Homeland Security: Washington DC.
Hunt, R.C., Brown, L.H., Cabinum, E.S., Whitley, T.W., Prasad, H., Owens, C.F., & Mayo, C.E. (1995). Is ambulance transport time with lights and siren faster than that without? *Annals of Emergency Medicine, 25,* 507-511.

Kupas, D., Dula, D., & Pino, B. (1994). Patient outcome using medical protocol
to limit "lights and siren" transport. *Prehospital and Disaster Medicine, 9,* 226-229.

Sanddal, N.D., Albert, S., Hansen, J.D. & Kupas, D.F. (2008). Contributing factors and issues associated with rural ambulance crashes. *Prehospital Emergency Care, 12*, 257-267.

## 3.4. Mirrors

Mirrors are an important tool to ensure that the driver has an accurate view of his/her surroundings and can use that information to make safe decisions.

### 3.4.1. Mirror Maintenance and Alignment

Mirrors should be properly aligned and maintained using the following guidelines:

- At the beginning of a shift and as necessary, the driver should adjust side view mirrors.
- Mirrors should be kept clean as dirty mirrors will reduce available light and cause glare when the light of approaching vehicles or streetlights.
- Mirrors should not be located and mounted where door pillars or other obstructions block their view.
- The location and mounting of the mirrors should prevent warning lights from reflecting in the mirror to blind the driver's view.

### 3.4.2. Mirror Purchase Considerations

The following guidelines should be considered when determining what type of mirrors should be included when purchasing a new apparatus:

- Remotely controlled mirrors should be considered, especially on the curb side.
- Convex and other secondary mirrors should be considered to eliminate blind spots not covered by primary mirrors.
- Where necessary, heated mirrors should also be considered.

## 3.5. Navigation

Whenever an ambulance goes on a call, the driver must determine a route that is quick and avoids potential hazards or delays. Effective route selection considers procedures such as route planning and operator familiarization.

### 3.5.1. Route Planning

Route planning involves learning the geographic and local conditions, individual characteristics of the area, and your organization's procedures to map out the most efficient route to the emergency scene.

- When planning routes, primary and alternate routes should be identified.
- Alternate routes should be available in case of bad road conditions, weather, or other situations that effect primary routes.
- Navigation at night can be difficult, especially if the street signs, hazards, or other problems are difficult to see, so the driver should keep this in mind when determining primary and alternate routes.
- Communicate as a team and follow the EMS organization's standard procedure for giving directions.
- Map out the local areas commonly used and refer to these maps when deciding which way to go to the scene.
- When planning a route, think about the geographic and local conditions affecting the roads you will be using.
- Add useful information that is not included on the map, such as dirt roads, dangerous intersections, very steep grades, roads or lanes on roads that change direction according to the time of day.

- Be aware of and prepare for the conditions in the type of area in which the ambulance will be driving.

- When heading out to the emergency scene, the driver should communicate with dispatch or directly with the first responder.

- Choose routes that minimize stops and turns, avoid intersections, and avoid residential streets to the extent possible.

- Routes should be developed and maintained by the EMS organization or coordinated with other emergency services in the area.

- Practice communicating navigating directions with the team during a practice run or when returning to the station.

### 3.5.2. Operator Familiarization

Operator familiarization involves the driver's awareness of changes to the route, procedures to identify local information, and consideration of height restrictions.

- Keep in mind special events that are occurring on the primary and alternate routes (ex. parades).

- Find out if there are new developments and buildings under construction on the primary and alternate routes.

- Keep in mind weather conditions, road conditions, and typically congested traffic times such as the beginning and end of the work and school day and shift change times at factories and determine if an alternative route needs to be taken to respond to a call.

- If in an area with limited road and street signs, the driver should learn the local references, such as buildings, farms, gas stations, and so on.

- Keep the ambulance height posted in the vehicle where it can be quickly see it during the call. The dashboard or visor would be good places to post it.

- Keep height restrictions in mind when planning routes that include passage through bridges, tunnels, and parking ramps.

### 3.5.3. Navigation Systems

Depending on the EMS department, a GPS (global positioning system) navigation system may be provided. GPS can be an effective and easy to use tool to further assist the driver in quickly and safely transporting the patient. It can quickly calculate step-by-step directions that provide routes to multiple destinations. If the driver deviates from the planned route, the navigation system will automatically recalculate the route to determine a new one from the current location. Some GPS systems even include a mode for emergency vehicles. The following guidelines describe ways to maximize the effectiveness of this tool:

- Prior to using the system on a run, the driver should ensure that he or she is familiar with the features and know how to operate the system.
- If the vehicle is in motion, only a passenger should program the unit. The driver should not program the unit unless the vehicle is parked in a safe location.
- Depending on the capabilities of the navigation system, it may provide information on suggested routes without regard to factors that may affect the driving experience or the time required to arrive at the destination, such as congestion or road closure.
- The navigation system is not a substitute for driver judgment. The route suggestions should never supersede any local traffic regulation or driver personal judgment and /or knowledge of safe driving practices.
- Up-to-date maps or map books should still be consulted to ensure an appropriate route is being followed.

## 3.6. Parking

When EMS drivers position emergency vehicles in response to a call on any street, road, highway, or expressway, they should park in a manner that best protects the incident scene and the work area. All EMS providers should understand and appreciate the high risk that personnel are exposed to when operating in or near moving vehicle traffic. Always consider moving vehicles as a threat to safety. The following guidelines should be followed when parking the ambulance:

- Always park the ambulance in a hazard-free area to protect the crew, patient and the ambulance (e.g., at a motor vehicle accident pull past the accident, avoiding fuel spills, and park the vehicle off the road on the shoulder).
- When parking to the driver's blind side a spotter should be used.
- When parking in a parking space or driveway, back into the parking area so that the ambulance can have a safe and efficient exit.

## 3.7. Performance Monitoring

The NFPA 1901 2009 requires a video data recording device (called a black box) on all apparatus purchased after January 1, 2010. Variables such as vehicle speed, acceleration, deceleration, engine throttle position, antilock braking system, whether a seat is occupied, if the occupant is seat belted will be monitored. Software to produce reports on these behaviors is also required. The black box is a commonly used electronic device that monitors driving factors such as speed, acceleration, braking and cornering. It provides auditory warnings when the threshold for these behaviors has been breached as well as records them for performance reports. The following guidelines should be followed for compliance with performance monitoring:

- All EMS providers in the ambulance should comply with all required behaviors within the vehicle (wearing seatbelts and complying with traffic laws regarding speeding).

- No attempts should be made to turn off or disable performance monitoring system.

- Any member of the EMS provider team who observes dangerous driver behavior (ex. reckless or erratic driving) or attempts to disable the performance monitoring system should promptly report the incident to the supervisor.

## 3.8. Right of Way

It is important to determine which vehicle has the right of way to minimize potential injury to the medic team and civilians.

### 3.8.1. Right of Way Guidance

The following guidance should be followed to handle right of way situations:

- Don't assume civilians see or hear the ambulance. And even if they do see and hear the ambulance, don't assume that they will give it the right of way.

- Use warning lights to inform civilians of the presence of the ambulance. Civilians are more likely to realize the ambulance is there, have sufficient time to make a decision as to what to do, and have sufficient time and space to carry out that decision.

- On a multilane highway, do not enter an opposing traffic lane until it is safe to do so and all other oncoming vehicles are aware of the ambulance's presence.

- Similarly, do not enter a one-way street against traffic until all opposing traffic is aware of the ambulance's presence and has yielded the right of way.

### 3.8.2. Reference

U.S. Department of Transportation. (1995). Emergency Vehicle Operator's Course Manual. National Highway Traffic Safety Administration: Washington DC.

## 3.9. Spotter

Ambulance drivers should perform backing or any other maneuver where their view is obstructed with the support of a spotter. A spotter is responsible for guiding the driver and ensuring that any potential hazards are avoided. The spotter should direct the driver to stop at any time the backing maneuver cannot be completed safely. There are several guidelines that should be followed to ensure safety of the EMS providers and reduce damage to the vehicle.

### 3.9.1. Backing the Ambulance

Where backing is unavoidable:

- A spotter or an assistant outside the vehicle should be used.

- In addition, a spotter should be used when vehicles must negotiate forward turns with restrictive side clearances and where height clearances are uncertain. The purpose of the spotter is to expand the driver's sense for the right, left, front and rear space cushions.

- Under circumstances where the ambulance is staffed by only the driver (e.g., all other personnel are inside the residence with the patient), the driver should attempt to utilize any available emergency services personnel to act as spotters. Where no personnel are available to assist, the driver should park the vehicle, get out, and make a complete survey of the space cushion around all four sides of the vehicle to determine if any obstructions are present before proceeding to back the ambulance.

- Spotters are never permitted to ride the tailboard or running boards while the vehicle is in motion. The spotter should be in a visible safe zone positioning him or herself ten (10) to fifteen (15) feet at the left rear of the ambulance.

- The vehicle should not be backed until the spotter is in position in the safe zone and has communicated his/her approval to begin backing by way of a hand signal, and voice, when possible.

- Spotters should remain visible to the driver in the safe zone. Anytime the driver loses sight of the spotter, the vehicle should be stopped immediately until the spotter is again visible and the communication to continue backing is processed. This is definitely not a high-speed maneuver. It should be done very slowly and cautiously.

- Make sure the window is down and audio systems are off during backing.

### 3.9.2. Standard Signals

There are several standard signals for spotters (See paragraph 3.1.3 and Figure 1). They are described as follows:

- *Straight Back* – One hand above the head with palm toward face, waving back. Other hand at your side.

- *Turn* – Both arms pointing the same direction with index fingers extended.

- *Stop* – Both arms crossed with hands in fists. Be sure to reinforce the signal by yelling the stop order loud enough so the driver can hear.

- *Night Backing* – Signals are the same. The spotter should assure that the *spotlights on* the rear of the ambulance are turned on before allowing the vehicle to be backed. A flashlight, wand type is useful, maybe carried but at no time will it be directed towards the mirrors.

## 3.10. Vehicle Readiness

Ambulances must be kept fully stocked and in operational condition. EMS providers should conduct inspections of the ambulance at the beginning of each shift, to ensure that they have all of the supplies they need to respond to calls and perform patient care. Any maintenance issues should be promptly noted and reported to maintenance so that they can be resolved in a timely manner. EMS providers should also keep track of supply levels and any vehicle operation issues that occur over the course of their shift so that any items needing to be resupplied can be ordered and restocked and any nonemergency vehicle repairs scheduled. Table 3 provides a sample of a vehicle readiness checklist.

**Table 3. Example Vehicle Readiness Checklist**

| Vehicle Readiness Checklist |
| --- |
| If the category meets expectations place a check mark in the box unless otherwise noted. If the category does not meet expectations the crewmembers will immediately correct the problem if possible. If the crewmembers are unable to correct the problem, a minus will be placed in the column. If a crewmember feels the truck needs to be taken out of service due to the deficiencies a supervisor will be notified immediately. |

| | |
|---|---|
| 1. Mileage<br>Obtain the mileage from the odometer. | |
| 2. Fuel<br>Place a check mark in the box if fuel level is above ¾ of a tank. If level is below ¾ mark the designated level with ¼, ½, or ¾. If below ¾ fuel it up. | |
| 3. Tire Checks<br>Visually check all tires for defects. Tires are also to be thumped to insure they are inflated. If tires pass the inspection place check mark in the box. If tires do not pass inspection call a supervisor and place the truck out of service. | |
| 4. No fluid leaks<br>Visually inspect under the vehicle for fluid leaks. If fluid leak is noted investigate cause and immediately check all the fluids. Call supervisor or base maintenance person. If no fluid leaks are noted or fluids are in safe range if a leak was noted place a check mark in the box. | |
| 5. Exterior Clean<br>Examine exterior of the ambulance if the exterior passes the inspection place a checkmark in the box. | |
| 6. Exterior equipment<br>Check all exterior cabinets for appropriate equipment levels. If cabinets pass inspection place a check mark in the box. | |
| 7. Radio/Cell phone<br>Power up all cell phones and radios. Key up the mic and listen to the repeater activate. If radio/cell phones pass inspection place a check mark in the box. | |
| 8. All Lights<br>With the ambulance running check all interior, exterior, and emergency lights. If any lights are out put note on the maintenance board. If the lights pass inspection place a check mark in the box. | |
| 9. Interior Clean<br>Examine interior of the ambulance if the interior passes inspection place a check mark in the box. | |
| 10. Suction<br>Inspect portable and in-house suction units for any defects. Turn suction on and kink suction hose and watch gauge. The unit should reach 300mmhg quickly. If the suction units pass the inspection place a check mark in the box. If unit fails notify a supervisor. | |
| 11. Cardiac Monitor<br>Inspect the monitor and cables for any defects. If the monitor | |

| | |
|---|---|
| passes inspections place a check mark in the box. If unit fails notify the supervisor. | |
| 12. Portable Oxygen (O2)<br><br>Record 02 level. If below 500 psi change the tank and record the new level. | |
| 13. Main O2<br><br>Record 02 level. If below 500 psi change the tank and record the new level. | |
| 14. Interior Equipment<br><br>Check all interior cabinets for appropriate equipment. If the cabinets pass inspection place a check mark in the box. | |
| 15. First in Bag<br><br>Inspect bag for proper equipment. If bag passes inspection place a check mark in the box. | |
| 16. Paperwork<br><br>Check clipboards for adequate amount of paperwork. If adequate amount of paperwork noted place a check mark in the box. | |
| Crew member's signature and date: | |

## 3.11. Reference

Hunter Ambulance (2007). *Driver Training Review.* North Star Emergency Medical Services. (n.d.) Daily Ambulance Checklist. Retrieved March 25, 2013 from **http://www.fchn.org/docs/northstar/Daily%20Checklist%20Instructions.pdf**.

# 4.0 Training Development

This category is reserved for parties with authority to create and regulate EMS driver training. A training program is most effective when best practices are used to guide the development effort. If executed well, a training program should maximize efficiency, safety, job satisfaction, and foster a culture of innovation. The following best practices should be considered for the development and regulation of EMS driver training.

## 4.1. Training Requirements

While training should embody teaching of the SOPs mentioned in section 3, the following SOPs should be considered for training requirements.

### 4.1.1. Mandated Driver Training

All EMS organizations should adopt and mandate training procedures concerning vehicle operations. Courses such as EVOC provide training and skill building opportunities, however only 31 of 50 states, as illustrated in Table 4, require EVOC prior to operating an ambulance.

**Table 4. States Requiring EVOC**

| State | EVOC Required? | State | EVOC Required? |
|---|---|---|---|
| Alabama | Yes | Montana | No |
| Alaska | No | Nebraska | Yes |
| Arizona | No | Nevada | No |
| Arkansas | No | New Hampshire | No |
| California | No | New Jersey | No |
| Colorado | No | N. Mariana Islands | Yes |
| Connecticut | Yes | New Mexico | Yes |
| Delaware | Yes | New York | No |
| District of Columbia | Yes | North Carolina | No |
| Florida | Yes | North Dakota | No |
| Georgia | No | Ohio | No |
| Hawaii | Yes | Oklahoma | Yes |
| Idaho | No | Oregon | Yes |
| Illinois | No | Pennsylvania | Yes |
| Indiana | No | Rhode Island | No |
| Iowa | Yes | South Carolina | No |
| Kansas | No | South Dakota | No |
| Kentucky | Yes | Tennessee | No |
| Louisiana | No | Texas | No |
| Maine | No | Utah | No |
| Maryland | No | Vermont | No |
| Massachusetts | No | Virginia | Yes |
| Michigan | No | Washington | No |
| Minnesota | Yes | West Virginia | Yes |
| Mississippi | Yes | Wisconsin | No |
| Missouri | Yes | Wyoming | Yes |

### 4.1.2. Mandated Behind-The-Wheel Training

Ambulances tend to be larger and more difficult to maneuver than other conventional vehicles. Drivers need in-depth training and practice to obtain the skills needed to operate these vehicles. Drivers should have multiple opportunities to learn and practice braking, stopping, making lane changes, driving, backing, and parking. These driving skills should further be solidified by on-the job training.

### 4.1.3. Mandated On-The-Job Driver Training

Students should be mandated to complete a certain number of on-the-job training hours before he/she can drive without a supervisor. Training students by making them perform "real" tasks while on-the-job is important. The maintenance of new skills and knowledge once training has been completed is crucial.

### 4.1.4. Mandated Refresher Training

Refresher training should be mandatory for all drivers at a minimum of once per year. The same best practices for training should be applied to refresher training

## 4.2. Training Course Development

Learning objectives, class skill level, and the teaching organization's technology and logistics resources heavily drive the course design and technology selection. All of the following course elements should be considered when developing a training course.

### 4.2.1. Standardize Training

Training courses should be standardized as much as possible. Currently there are three primary EVOC training programs  in use across the United States. These are based off of documents produced by the U.S. Department of Transportation (DOT), the United States Fire Administration (USFA), and the National Safety Council (NSC). All three courses vary in content and approach to training. Based on training documentation, the USFA places more emphasis on the consequences of unsafe driving, reviewing incidents reports and the motivation to drive safely, and the legal regulations in place, while it gives a cursory overview of vehicle maintenance and operation. The DOT course discusses the legal aspects of safe driving as well but more of its modules deal with the actual aspects of driving the vehicle, including vehicle inspection, navigation, route planning, and vehicle handling during emergency situations. The NSC also focuses more on general vehicle handling as well as defensive driving. Thus ambulance drivers are receiving emphasis on difference aspects of ambulance operation depending on which course they received. Training needs to be standardized so that all drivers nationwide are aware of the legal aspects of operating an ambulance safely but also aware of the mechanical techniques involved in operating the vehicle and avoiding accidents. The Table below illustrates course differences.

**Table 5. EVOC Curriculum Content & Time Allocation Comparison**

| Lesson # | DOT | Hrs | USFA | Hrs | NSC | Hrs |
|---|---|---|---|---|---|---|
| 1 | Introduction | 1 | Introduction | .5 | Self-Appraisal | NS |
| 2 | Legal Aspects | 1.5 | The Problem | 1.5 | Inspection | NS |
| 3 | Communication | 1.5 | Motivation | .5 | Safety Cushion | NS |
| 4 | Amb. Ops | .5 | Personnel | 1 | On the Road | NS |
| 5 | Inspection | 2 | Legal Aspects | 1 | Spec. Considerations | NS |
| 6 | Navigation | 2 | Physical Forces | 2 | Emergency Driving | NS |
| 7 | Maneuvers | 3 | Maintenance | .5 | Final Test | NS |
| 8 | Special Issues | 3 | SOP | 1 | | |
| 9 | Safety | 1.5 | | | | |
| 10 | The Run | 1 | | | | |
| Total Hrs | (Estimated) | 17 | (Estimated) | 8 | (Estimated) | 4 |

NS = Not Specified

### 4.2.2. Tailor Courses

Training should be tailored to cover topics that are particularly important to certain regions (i.e., driving in the snow for the north, or driving amongst a lot of pedestrians in cities) or EMS providers. This may include guidance for how to determine training time allocation (i.e., if a driver is especially poor at backing up, more time should be spent on that portion of training). For example, all course content on weather should be standardized but more time may be spent on training within a certain topic per regional needs (i.e., real world driver training in the snow for a Northern region).

### 4.2.3. Develop Meaningful Learning Objectives

Learning objectives should be documented and reviewed so that they are clearly understood by the student. Develop clear, meaningful, performance-based objectives that are achievable in the allotted time and make sure these objectives are understood by the class.

### 4.2.4. Organize Course Content Logically

Well-designed courses should include a timed agenda, learning objectives, instructional content, and examples. Thoughtfully chosen graphics and animation convey learning points, further detail content and help enhance recall.

#### 4.2.5. Use Tested Teaching Methods

Training courses should implement tested processes. Implementation of tested processes leads to high-quality training that minimizes challenges and maximizes success.

#### 4.2.6. Choose Appropriate Technology to Supplement Training

Technology and its features can be engaging to some learners but frustrating to others, so selecting technology that is suitable for the intended audience is critical and should be done carefully. Selection of the appropriate technology supports the learner's ability to demonstrate repeated successful integration of the training information into their knowledge base, improvement in their relevant skills and/or positive change in their attitudes.

### 4.3. Interactivity

Effective “interactive” learning uses various methods to engage the learner with the content while decreasing passive reception of information from an instructor. Additionally, careful design of content layout, overviews, summaries and information sequence can improve learner engagement.

#### 4.3.1. Make Course Interactive

Training should help students retain information and make learning fun and interactive. Group work, quizzes, and other activities can help make training programs less lecture-based and more interactive.

#### 4.3.2. Provide Real World Training

Real world training opportunities, such as supervised driving, should be provided to students. One of the most important elements of training development is that it is easily transferred back to the work environment. This method of training is much more effective than teaching theory and expecting students to apply it in the real world. It also provides a safe environment for students to make mistakes and be given feedback.

#### 4.3.3. Use Case Studies to Teach Decision Making

Training should incorporate teaching via case studies/scenarios and lessons learned training. This type of teaching is much more effective at increasing learner attention and critical thinking than standard multiple-choice questions.

#### 4.3.4. Ask Interim Quiz Questions

Interim quiz questions should be offered throughout the course to create a method for providing immediate, detailed feedback to the learner on his/her performance. Objective questions (i.e., those with one correct answer that minimizes use of forced choice, e.g., true/false) are most effective. Varying the types of questions also enhances interactivity.

#### 4.3.5. Provide Student's with Feedback

Feedback should be provided in real time as often as possible. Make sure to clearly explain why the answer given was right or wrong. If the wrong answer is given, encourage the learner to try again and/or provide the correct answer with an explanation for why the correct answer is more appropriate than the original answer given.

### 4.4. Continuously Refine Training Course

Training course development is never done. To maximize the effectiveness of new information and technologies, training courses should continuously be refined.

#### 4.4.1. Update Course Content Regularly

Courses should be reviewed at least annually to ensure that the most current information is presented. A group of SMEs should review learning objectives and course content for technical accuracy and relevance.

#### 4.4.2. Evaluate Training Course Effectiveness/Seek Student Satisfaction with Course

Student course evaluation should be taken into consideration for course refinement. Timely and accurate learner feedback is an essential component of training development. For maximum accuracy, feedback should be obtained as soon as each course session is complete. Immediate learner feedback improves the overall course because instructors can integrate quality suggestions into future editions of the training.

### 4.5. References:

ABC LifeLiteracyCanada (n.d.). *Workplace literacy and essential skills: Benefits of training.* Retrieved March 11, 2013 from http://abclifeliteracy.ca/benefits-training

Brown, T. (2008). *Top 10 training best practices for effective learning and development programs.* Retrieved March 11, 2013 from http://www.articlesbase.com/management-articles/top-10-training-best-practices-for-effective-learning-and-development-programs-376420.html

Defense Centers of Excellence (n.d.). *Best practices for developing eLearning courses.* Retrieved March 11, 2013 from http://www.dcoe.health.mil/Content/navigation/documents/Best%20Practices%20for%20Developing%20eLearning%20Courses%20Fact%20Sheet.pdf.

Sanddal, T.L. et al (2010). *Ambulance vehicle operator: Driver behavior and performance checklist.* Western Transportation Institute. Retrieved March 11, 2013 from http://www.westerntransportationinstitute.org/documents/reports/4W2008_Final_Report_D1.pdf