Essential Components for an Operational Safety Guideline to Address Working in or Near Moving Traffic.

Brian Cudaback, Battalion Chief

Arlington Fire-Rescue

Arlington, Texas
ABSTRACT

Arlington Fire-Rescue (AFR) experienced an increase in accidents when apparatus are parked in or near moving traffic. Descriptive research was used to identify department/industry standards and recommendations regarding safety. This was accomplished through literary reviews of standards, articles, and a feedback instrument.

The research questions included; What are the current policies/procedures in place that address safety in or near moving traffic? How do current policies/procedures compare to industry standards? How are comparable departments addressing roadway incident safety? What are the applicable standards currently in place that address firefighter safety while working on roadways? What safety devices can be utilized to increase visibility of both apparatus and firefighters? The results provided recommendations for changes in policy, procedures and training.
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Essential Components for an Operational Safety Guideline to Address Working in or Near Moving Traffic.

INTRODUCTION

Arlington Fire-Rescue (AFR) has a long history of protecting its members with policies and training designed to enhance safety in all aspects of service delivery. The past three years have provided an adaptive challenge that has motivated the department to seek new solutions and apply new knowledge in order to solve it. The criticality of the problem and the potential frequency of the occurrences demanded an aggressive change in the departments approach to freeway incidents and the protection of firefighters and apparatus. The problem is that AFR has experienced an increase in the number of accidents involving fire apparatus while parked at freeway incident scenes since 2002. While the department has implemented several changes thought to decrease those accidents while increasing firefighter safety, there may be other critical elements that could further enhance safety in these incidents. The purpose of this research is to identify all of the major components critical to increasing safety while working in or near moving traffic and make changes based on the findings.

Descriptive research was used to describe a current situation and to study current policies and procedures to develop a recommendation for change in the future (National Fire Academy [NFA], 2004, p 4-17).
This applied research project will address the following questions:

1. What are the current policies/procedures in place that address safety in or near moving traffic?

2. How do current policies/procedures compare to industry standards?

3. How are comparable departments addressing roadway incident safety?

4. What are the applicable standards currently in place that address firefighter safety while working on roadways?

5. What safety devices can be utilized to increase visibility of both apparatus and firefighters?

BACKGROUND & SIGNIFICANCE

The City of Arlington is an urban community located in the heart of the metroplex between Dallas and Fort Worth in North Central Texas. Arlington is the home of the Texas Rangers baseball club, Six Flags over Texas and Hurricane Harbor Water Park that in 2001 entertained over 6.8 million visitors. (COA, 2004, p. 11). The city occupies over 100 square miles, has a population of 355,500 and in 2004, was identified as the fifth fastest growing city in the metroplex (NCTCOG, 2005, p. 4).

Arlington is bordered on three sides by major freeways that include I-20 to the south, I-30 to the north, and SH 360 to the east. Both interstates I-30 & I-20 are major arteries to not only east & west Texas but also carry people, goods and services to the east and west coast of the
United States. Every day more than 450,000 vehicles travel on all three of those freeways combined (M. Peters, personal communication, June 8, 2005). In 2004, those 3 freeways contributed 5633 incidents or 7% of the total calls for service (D. Crawford, personal communication, June 3, 2005). On top of those freeways, Arlington has more than 1480 miles of roadways within its city limits (D. Allard, personal communication, June 29, 2005). Because of the strong entertainment component and a significant increase in growth in the metroplex, we have also seen an increase in traffic on our major roadways.

AFR is a career department with 262 members staffing 16 fire stations utilizing a 24/48-shift schedule. The department provides fire protection, emergency medical, hazardous material, technical rescue, swift water, and fire prevention services within the city limits and mutual aid to six cities that border our city limits.

Each year, the incidents of firefighter fatalities after being struck by a motor vehicle while working on an incident scene, is a constant reminder of the dangers of these types of responses. In 2003, six firefighters were killed after being struck by motor vehicles (Fathy & LaBlanc, 2004, p. 46). AFR has experienced two LODD’s in its history, one from electrocution during training in 1985 and another from a heart attack in 1992.

On New Years Eve 2002, while working a Motor Vehicle Accident (MVC) on SH 360, an intoxicated driver struck a firefighter while working with his engine crew on an incident
scene. Wearing his department issued winter jack and his turn out pants, the firefighter was struck by a pickup truck and thrown onto the hood and then to the ground. He suffered a fractured femur and a closed head injury and did survive but was forced to medically retire due to his injuries. At the time of the incident, the engine crew was working approximately 30-40 feet away from the apparatus and had been on scene approximately 1 hour waiting on a wrecker to turn over the original accident vehicle. The traffic had been reduced to one lane by cones and flares distributed by the police (M. Englehart, personal communication, June 4, 2005).

In 2002, AFR did not have a formal guideline or provided no specialized training regarding incident management on our roadways. At the time of the incident, the engine crew was working within established department guidelines and considered the incident “ops normal” as they had many times before (M. Englehart, personal communication, June 4, 2005). There was no addition apparatus on scene with the first due engine and the incident scene was not protected from oncoming traffic.

This incident provided a wake-up call for the department and challenged its leaders to re-evaluate the safety procedures as they relate to all aspects of freeway incident management. In late 2003 Operations Assistant Chief Larry Brawner along with Training Lieutenant David McMullin began researching the fire service for a recognized set of standards that could serve as the department’s guidelines for freeway incidents. In early 2004, the department adopted SOP
204.05 Freeway Incidents that specifically dealt with the response, placement and procedures when working on our major freeways (Appendix A). The implementation component provided education on every aspect of the new procedure to everyone in the organization (D. Crowson, personal communication, June 2, 2005). The new guideline was created using guidance from, for the most part, The National Institute for Occupational Safety and Health (NIOSH), Manual on Uniform traffic Control Devices (MUTCD), The American National Standards Institute (ANSI) and The United States Fire Administrations (USFA) Emergency Vehicle Safety Initiative (EVSI).

That same year, the apparatus specification team added an expanded emergency lighting and graphics package to the 2003 order of new fire apparatus. The expanded emergency lighting included changing from strobe lighting on all lights to light emitting diodes (LED). The desired outcome of the enhanced lighting was to provide the apparatus with the most effective and earliest warning to upstream traffic.

The expanded graphics package included adding an inverted chevron on the back of the apparatus and to the front bumper and adding reflective STOP signs to the inside of all cab doors. The signs are visible to traffic when someone is exiting the cab of the apparatus. Both enhancements utilize 3M Scotchlite Diamond Grade Reflective Sheeting to provide the most visibility in both day and night applications. The chevrons were applied according to the Manual
on Uniform Traffic Control Devices and mimic applications on European fire apparatus. They are designed to provide upstream traffic with an early warning that fire apparatus are ahead.

Moore featured the concept of the inverted chevron in his Safe Parking series of articles in Firehouse magazine later that year.

In August of 2004 while parked on scene at an MVC on the western end of Interstate I-20, an intoxicated driver that was traveling at a high rate of speed struck a parked engine company from behind. The vehicle struck the engine with such force that it moved the 39,000lb apparatus four feet. The Apparatus Operator had positioned the apparatus for a “block right” according to the newly established freeway incident guidelines and all three crew members had exited the apparatus and were providing medical attention to the original victim when the accident occurred (T. Hixson, personal communication, June 10, 2005). This apparatus did not have any of the enhanced emergency lighting or graphics at the time of the accident and the assigned “blocking” apparatus had not yet arrived on scene. Because of the crew’s compliance with the new freeway guideline, no AFR personal were injured however; the engine was a total loss.

Again in 2004, another engine was struck from behind by an inattentive driver while on the scene of an MVC on the eastern end of Interstate I-20. Although no one was injured, a firefighter had just retrieved equipment from the compartment that sustained the most damage in
the accident (C. Simms, personal communication, June 9, 2005). This apparatus did not have any of the enhanced emergency lighting or graphics at the time of the accident. The apparatus was out of service for 4 weeks while the damage was repaired.

In 2005, another engine was struck from behind while approaching an incident scene on a major interior divided highway. The engine had not yet stopped on the scene when an impatient driver struck it. The engine company has not enacted the freeway guideline because it had not come to a complete stop. This apparatus did not have any of the enhanced emergency lighting or graphics at the time of the accident. No one was injured but the apparatus was out of service for 3 weeks while the damage was repaired.

In all, these four incidents resulted in $450,000.00 in damage and the loss of an experienced firefighter. The events also occurred at a time when the city was already financially strapped and was left to shoulder the burden of the repairs. AFR was tasked with reacting to an emerging issue and rapidly developing a guideline that would work to minimize firefighter injuries and reduce damage to apparatus while being sensitive to its impact on the movement of vehicles through Arlington. But while the human and monetary damage was great, the department reflected on what might have been if any of these incidents resulted in the vehicles having made it into the working area of the incident. The resulting injuries to firefighters and potential loss of life would have certainly been much greater.
This author is now concerned that the current *Freeway Incident* guideline was developed in a manner that took into consideration current incident management and safety techniques, but allowed the final version to be stripped of some significant details. In other instances, the guideline might have been watered down and does not address all of the potential hazardous situations faced by firefighters working on non-freeway incidents.

This research describes what steps the AFR has taken to reduce if not eliminate freeway incidents involving firefighters and apparatus while examining how those steps relate to industry standards or recommendations. It looks at other departments with similar demographics and local departments that share the same problem and how they address roadway incident safety. It also looks at different devices designed to enhance safety that can be applied to our human and hard assets. The result of this research may provide recommendations for change developed to enhance safety during all roadway incidents.

This applied research project related to one of the United States Fire Administration (USFA) Operational Objectives “to respond appropriately in a timely manner to emerging issues” (NFA EFOP ARSSC, 2004, p. 3-4).

LITERATURE REVIEW

The purpose of this literary review is to identify all of the major components critical to increasing firefighter safety while working in or near moving traffic. The review includes the
findings of other researchers in the fire service, public and private sectors along with industry standards. The literature provided information pertaining to all facets of roadway incident safety and included procedural, apparatus, equipment, and human elements.

The literary review was organized around five specific research questions that were developed to help facilitate answers about the research topic. Those questions included (1) What are the current policies/procedures in place that address safety in or near moving traffic? (2) How do current policies/procedures compare to industry standards? (3) How are comparable departments addressing roadway incident safety? (4) What are the applicable standards currently in place that address firefighter safety while working on highways, freeways or roadsides? (5) What safety devices can be utilized to increase visibility of both apparatus and firefighters?

1. What are the current policies/procedures in place that address safety in or near moving traffic?

The department currently has in place SOP 204.05 *Freeway Incidents* (Appendix A) designed to enhance safety when working at freeway incidents. The purpose statement of the guideline identifies that “This policy identifies procedures and parking practices for Fire Department apparatus and other emergency vehicles that will provide maximum protection and safety for personnel operating in or near freeway traffic” (Arlington, 2004, p. 1). It was established after the accident that severely injured a firefighter in 2002 and has only gone
through one modification in 2005. The guideline does include recommendations by Moore and
does contain some of the elements in SOP’s developed by the Phoenix Arizona and Plano Texas
fire departments. The Phoenix document appears to this author to be ground breaking in both
content and scope and is featured as a sample guideline on safety when working in or near
moving traffic in the United State Fire Administrations (USFA) Emergency Vehicle Safety
Initiative EVSI (Appendix B). Freeway Incidents also has some of elements featured in the
(EVSI) even though it was developed prior to its publication.

The guideline was developed after AFR Training Lieutenant David McMullin attended a
Freeway Incident Management in the Dallas-Fort Worth Area course sponsored by the North
Texas Council of Governments (NTCOG) in April 2004. That course provided information from
several resources and from all areas of freeway incident management including law enforcement,
State, local and Federal Government entities. The department believes that the final guideline
and procedural training has had an effect on these types of incidents and offers both incidents in
2004 as evidence.

Significant components of the Freeway Incident guideline includes a dual apparatus
response to help facilitate the establishment of a TTC zone. It also provides for the creation of
an incident safety officer and recommends that all ancillary fire-rescue vehicles will position
themselves in the shadow area. During the implementation stage of the guideline, all fire-rescue
personal were issued American Nation Standards institute (ANSI) Class III safety vests and under the guideline, are required to wear them and their structural helmet anytime they are working in or near moving traffic. Modifications to the guideline in 2005 made it mandatory for members to wear the vest at all times even over their structural coat, when it is utilized, as an added layer of safety. Other significant components include a standardized vocabulary and recommendations on what steps can be taken to protect firefighters when working in these types of incidents.

2. How do current policies/procedures compare to industry standards?

Research found that the industry standards are hard to define and most only provide certain segments of what could be considered to be safety guidelines. Although there are some documents that could be interpreted as adopted standards, the majority of the research and the developed practical recommendations have been introduced by industry leaders. Other research provided post incident reports by NIOSH and their findings and recommendations.

There are numerous articles written by industry leaders that address safety while working in or near moving traffic. Research determined that literature by Austin (2001), Wilbur (2001), Goldfeder (2005), and NIOSH (2001) all detail a general list of recommendations that should be included when developing a roadway safety program (Appendix C). Those recommendations
are offered as key and can provide any organization with the beginnings to developing their own roadway safety guideline.

A review of the web site Respondersafety.com revealed that it is a comprehensive web site dedicated to providing information and educating responders to the dangers of working in or near moving traffic. Research found that the site provided a sample operational guideline that addresses all aspects of safety when working in or near moving traffic (Appendix D). The sample document *Safe Positioning while Operating in or Near Moving Traffic* can be downloaded and adapted to fit any department. The document appears to incorporate recommendations from the EVSI, MUTCD and the appropriate NFPA standards.

A review of other fire departments guidelines on working in or near moving traffic revealed that some departments experienced catastrophic events that launched them into developing their own roadway incident SOP. The research indicates that the catalyst to a nationwide initiative seems to be the Midwest City Oklahoma incident in which one fire fighter was killed and another seriously injured. A majority of the research would establish the importance of implementing a standard operating procedure that addresses emergency operations for roadway incidents.

In the post incident report on the Midwest City incident, NIOSH would provide two recommendations that would resonate throughout this research. In the report, NIOSH (1999)
recommended “Fire departments should ensure that fire fighters responding to a scene involving a highway incident or fire must first control the oncoming vehicles before safely turning their attention to the emergency in the event police have not arrived” (p. 4). In that same report NIOSH would also stress “fire departments should ensure that fire apparatus is positioned to take advantage of topography and weather conditions (uphill and upwind) and to protect fire fighters from traffic” (p. 4). Those recommendations would lead to the review of articles written by Austin (2001), Solomon (2002), Wilbur (2001), Moore (2003) and, Cumberland Valley Volunteer Firemen’s Association White Paper (CVVFA) (1999). Those articles would also stress the importance of first controlling traffic with the initial block and the establishment of a work zone by apparatus not only to control traffic by to take advantage of topography in order to pre-warn upstream traffic about the incident.

A review of information provided by The National Fire Protection Associations (NFPA) standard 1521 *Standard for Fire Department Safety Officer* provided other information on the importance in establishing a dedicated Incident Safety Officer when working in or near moving traffic. NFPA 1521(2002) addresses scene safety by establishing that “the incident safety officer shall evaluate motor vehicle scene traffic hazards and apparatus placement and take appropriate actions to mitigate hazards” (n.p.). A review of the MUTCD (2003) provides loose language on this position but uses the term “Flagger” to describe what the fire service would consider to be a
Safety Officer. This led to a review of *The Traffic Incident Management Handbook* (TIMH) to review what recommendations they provide on establishing an Incident Safety Officer. The TIMH (2000) identifies “effective incident site management can be facilitated by an incident command system (ICS)” (p. 1-9). A look back at NFPA 1521 would confirm that the ICS system must provide for an incident safety officer position in these types of incidents.

The review of other articles discovered the importance of common language during these incidents. In his *Safe Parking* series of articles in *Firehouse* magazine, Moore (2003) established that common terminology is essential and will “reduce confusion; improve the safety of responders and make operations at the scene more efficient” (p. 27). A list of the common terminology is listed in the definition of terms. This author could find no other research that discussed terminology as an important component to working in or near moving traffic.

A review of *The Manual on Uniform Traffic Control Devices* (MUTCD) (2003) found that “anytime an incident affects the normal flow of traffic, a TTC zone should be created to protect firefighters working on the scene” (p. 6A-1). The MUTCD explains “the primary function of TTC is to provide for the reasonably safe and efficient movement of road users through or around TTC zones while reasonably protecting workers, responders to traffic incidents, and equipment” (2003, p. 6A-1). This finding led to the review of articles by Rubin (2003) who added “to protect our most precious resource, our members, we must provide and
maintain physical barriers between firefighters at work and the vehicles” (p. 90). In an interview with Moore he eluded that firefighters that work out of the TTC zone are “stepping out of the protective envelope” (R. Moore, personal communication, June 26, 2005).

Further review of MUTCD (2003) specifically details the components of a TTC zone to include an advanced warning area, transition area, activity area, and a termination area (Appendix E). This led to a review of NIOSH (1999) where it recommended “firefighters must first control the oncoming vehicles before safely turning their attention to the emergency” (p. 4). That literature also established that anytime one of these zones is established, “Individuals who are knowledgeable (for example, trained and/or certified) in the principles of proper temporary traffic control should be assigned responsibility for safety in temporary traffic control zones” (MUTCD, 2003, p. 6B-3). This parallels the research found in the review of NFPA 1521 and the TIMH that established the importance of establishing an Incident Safety Officer.

More questions on establishing a TTC zone led me to review other related articles by Moore. According to Moore (2004) “when a call is received for an incident on a limited-access highway, an additional apparatus should be dispatched along with the first due companies” (p. 27). He explains that a “tandem axle ladder truck is preferred due to its long length and heavy weight” (2004, p. 27). He goes on to say that the primary function of the second crew is to establish an upstream block as far ahead of the incident as possible (2004).
The recommendation by Moore led to the review of the Phoenix Fire Department guideline *Safe Parking while Operating in or near moving traffic*. The research found that the document addresses any incident that includes working in or near moving traffic. The guideline also provides diagrams of different traffic control scenarios utilizing multiple apparatus to help users visualize the incident scene and how to control it. The review discovered no mention of a dual apparatus response during these incidents. In a telephone interview with Training Section Chief Sandulak he explained “It is not normal procedure for two apparatus to be dispatched just because they involve incidents that are in or near moving traffic”. He went on to say that “Company Officers that feel they need additional help are encouraged to call for additional apparatus” (Personal communication, August 16, 2005). The document does include a detailed list of safety benchmarks that provide crews with “approaches that can be taken to protect yourself and all crew members” (2003, p. 1). This author could find no other research that recommended the use of two apparatus when setting up a TTC zone.

As part of controlling traffic, the EVSI (2004) provided guidelines for highway operations and recommends “positioning an apparatus at a 45-degree angle to the lanes as an important step in controlling traffic” (p. 39). Moore (personal communication, June 26, 2005) would clarify “it is not the angle that gets the job done”. “The angle is more about what you
want to get done, how many lanes you want to block”. Other articles contained verbiage establishing the importance of blocking with apparatus but did not provide many specifics.

Other research indicates that another key component in reducing the exposure of firefighters and apparatus to the hazards of working in or near moving traffic is the duration of time spent at the scene. The research indicates that MUTCD divides the amount of traffic control measures into time durations (Appendix F). The longer the duration of the incident, the more traffic control devices that are needed to increase the amount of safety to those who are working in or near the moving traffic. Further research found that the SOP’s developed by Phoenix (2003) and Plano (1999) both stress the importance of “terminating the incident with the same aggressiveness as initial actions” (p. 3). They also both go on to say “crews, apparatus and equipment must be removed from the highway promptly, to reduce exposure to moving traffic” (Plano, 1999, p.3). A review of the CVVFA white paper (1999) would also establish that “understanding when to decommit personal and apparatus and how to expeditiously reopen roadways, are vital parts of traffic management” (p. 7). A review of the EVSI would conclude that it did not offer any information on the importance time plays when working in or near moving traffic.

Other research by Moore (2003) identifies the positioning of the front wheels as critical when parked at an incident scene. He uses the term “critical wheel angle” to describe the turning
of the wheel to the extreme right or left and explains that “in the event the vehicle is struck from behind, the critical wheel angle should move the colliding vehicles away from the rescuers” (Moore, 2003, p. 38). Price (1998) also identifies the importance of “turning the front wheels away from firefighters so the apparatus will not be driven into the accident scene if struck from behind” (p. 9). This author could find no other research that identified this as a critical component.

Research did indicate that a majority of the fire service leaders believe that there needs to be re-current training on the policies and procedures when working in or near moving traffic. Articles by Moore (2003) stressed that each member should receive training but that “supervisors should have a more extensive understanding of the principles and guidelines established by the MUTCD for section and placement of traffic control devices” (p. 29). Moore (2004) also offers a set of exit protocols that should be used when exiting a vehicle and suggests providing them during training (p. 26). Research found that an Applied Research Project by Price (1998) would also identify the importance of the “safe crew activities” when exiting the apparatus (p. 19). They appear to be similar to that recommended by Moore. Both recommendations appear to be critical in enhancing safety and are designed to increase safety when moving from you vehicle out into moving traffic (Appendix G).
Another review of the MUTCD (2003) found that it also stressed the importance of training and that “all workers should be trained on how to work next to motor vehicle traffic in a way that minimizes their vulnerability” (p. 6D-4). Other research indicated that NIOSH (2001) established that in order to prevent such incidents fire departments should “ensure that firefighters are trained in safe procedures for operating in or near moving traffic” (n.p.). Research revealed that according to Price (1998) “It is essential that every member of the team know how to safely operate at the scene and this may be accomplished through awareness, training and discipline in any on-road call” (p. 7). An Applied Research Project by Laird (2003) would conclude that “more comprehensive training” should be included in an operational guideline (p. 21).

Other research also found that the CVVFA White Paper (1999) also recommended different levels of training depending on your responsibilities on scene. In addition, the CVVFA provided the only literature that identified public education as another key factor to increasing safety. They identified a comprehensive program the utilized both pro-active and re-active approaches to educating the public on driving in proximity to emergency scenes.
4. What are the applicable standards currently in place that address firefighter safety while working on roadways?

This author’s research has determined that in recent years the MUTCD has moved from strictly a Department of Transportation document to one that has wide reaching implications in the fire service. The MUTCD document covers all aspects of controlling traffic in emergency situations and provides detailed guidance in developing and maintaining a TTC zone.

The research has also determined that The National Fire Protection Association’s [NFPA] Standards for Automotive Fire Apparatus 1901, Standard for Fire Department Safety Officer 1521 and Fire department occupational health and safety program 1500 and, the Emergency Vehicle Safety Initiative all contribute industry standards in several different aspects of firefighter safety when working in or near moving traffic. Articles by Moore and the Phoenix Fire Department Safe parking while operating in or near vehicle traffic guideline also provides what could be considered industry standard guidelines. All of those sources provide recommendations regarding personal, apparatus, and scene safety components involving working in or near moving traffic.

Other research found that in Texas, State law addresses a vehicle operator’s responsibility when passing an authorized emergency vehicle that is stationary on the roadway (Appendix H).
The Passing Authorized Emergency Vehicle Act (2003) provides penalties for those who violate it and up to a Class B misdemeanor if the violation results in bodily injury.

5. What safety devices can be utilized to increase visibility of both apparatus and firefighters?

The research indicates that the inverted chevron striping, as a traffic control device, has become prevalent in the U.S. fire service. First introduced in Europe, the concept has recently taken off in the fire service. The inverted chevron utilizes a diagonal pattern, angled at 45 degrees on the rear of the apparatus toward the ground (resembling an upside down “V”), and uses highly reflective tape (Appendix I). The European’s use the lime-yellow tape as the base color with red stripes. Moore (2004) and the EVSI (2004) provided the only information on the use of the inverted chevron as a safety device on fire apparatus when setting up a TTC zone. Moore (2004) points out that “the inverted chevron provides approaching traffic with remarkably improved visibility of the apparatus ahead” (p. 34). The EVSI (2004) provides technical information on the 3M Scotchlite Diamond Grade Reflective Sheeting used by the Plano Fire Department for their inverted chevron graphics. The MUTCD (2003) describes this pattern as “barricade” and recommends its use on all vertical panels, which the rear of the fire apparatus is considered, and should be used as channelizing devices when setting up a TTC zone (p. 6F.61).

Other research would find that Solomon (2002) stresses that “before we can detect and plan to avoid any hazard, we must see it” (p. 111). Solomon adds “what we see first is what we
react to first” (2002, p. 111). Solomon goes on to describe an alternating lime yellow and black “diagonal stripes” pattern on the back of apparatus as an expanded application of retro-reflective/fluorescent tape can help the apparatus be seen from long distances but does not use the term inverted chevron (p. 111).

Other Research determined that other recommendations from Moore (2004) and the EVSI (2004) include extinguishing all forward-facing emergency lighting, especially on divided highways and the reduction of the use of all lighting as much as possible at the scene. Moore (2004) explains that this will “reduce rubbernecking and prevents secondary crashes, especially in the opposing lanes of traffic on the other side of a divided highway” (p. 34). Solomon (2002) stresses the importance of turning off all flashing lights and strobes except for amber lights facing the rear of the apparatus (p. 102). Solomon goes on to say that only amber emergency lighting should be “directly exposed to oncoming traffic” (2002, p. 102). He also recommends that they be placed as high as possible on the apparatus and should not be used in conjunction with any other lighting combinations (p. 102). This will reduce the confusion by drivers as they struggle to make sense of what they are about to be required to react to.

Other information by MUTCD (2003) identifies “the use of emergency vehicle lighting as essential in the initial stages of a traffic incident but provides no effective traffic control” (6I-4). Moore (2003) would also stress the importance of shedding headlights and all white strobe
lighting once on scene again to keep from blinding oncoming traffic (p. 28). NFPA 1901 (2003) also provides a recommendation that apparatus manufactures are to design and manufacture apparatus that automatically shut off white warning devices when the parking brake is enacted or the transmission is in neutral (n.p.). While the standard allows for the use of white lights to the front of the apparatus while calling for the right of way, it recommends that all white lights be turned off with the parking brake or transmission in neutral when blocking the right-of-way (n.p.). By contrast, amber lights are allowed by the standard to be used in any location and during either call for or blocking of a right-of-way.

The research also provided information on the lighted arrow panel. The arrow panel device can be used to direct approaching traffic in the desired direction to avoid the TTC zone. The MUTCD provided specifications on minimum sizes and light travel patterns but was mostly geared toward larger panels that would be cumbersome when used on fire apparatus. The MUTCD (2003) also went on to stress that “if used, an arrow panel should be used in combination with appropriate signs, channelizing devices, or other TTC devices” (p. 6F-56). Moore (2004) identified that the effective use of the lighted panel is dependant on compliance with the MUTCD standard regarding size requirements and adds that “without the proper size, all oncoming motorists can see is a confusing array of lights” (p. 34).
Other research has determined that The American National Standards Institute/International Safety Equipment Association [ANSI/ISEA] standard 107-1999 specifies the minimum amount of fabric and reflective material to be worn while working in or near moving traffic. The highest current standard for reflective safety vests in the Class III. The ANSI/ISEA standard for Class III reflective vests provides for a minimum square inch of both background and reflective material (Appendix J). Moore (personal communication, June 26, 2005) would point out that NFPA certified turnout gear only receives a Class I certification under the ANSI/ISEA standard and that Class III vests should be worn over structural turn out gear when working in or near moving traffic. Goldfeder (2005) would also provide that “full protective clothing plus the safety vest should be worn between the hours of dusk to dawn or whenever lighting levels are reduced due to inclement whether conditions” (p. 22).

Other research into articles by Moore (2004), Weaver (2001), Cincurak (2004), Sullivan (2001) and, the EVSI (2004) support the importance of providing and wearing a high visibility vest when working in or near moving traffic as critical to firefighter safety. Moore (2004) and Goldfeder (2005) would also stress the importance of wearing structural firefighting helmets while in or near moving traffic.

NFPA 1500 (2002) requires the deployment of a “retro-reflective sign stating “Emergency Scene” to warn oncoming traffic when fire responders are operating at the incident”
Moore (2004) also identified the sign as an important part of the special safety equipment that should be carried on the apparatus and deployed when working in or near moving traffic.

In addition, information by Moore (2004) and MUTCD (2003) would provide detailed specifications on traffic cones and would stress their importance in establishing a TTC zone (Appendix K). The MUTCD (2003) identifies that in order to be compliant; cones must be orange and at least 28” tall and have two reflective bands around their tops and mid-sections. Moore (2004) would also provide detailed information on the safe deployment of cones when establishing a TTC zone (Appendix L). Laird (2003) suggested minimums for placing cones upstream from the incident according to speed as; “35mph = 100 feet; 45 =150 feet; 55 = 200 feet; 65+ = 250+ feet” (p. 41). Cones help call attention to the TTC zone and also call attention to apparatus working on scene.

Summary

This research paper's purpose was to focus on identifying all of the major components critical to increasing safety while working in or near moving traffic. This author is confident that the research cited contains significant findings and has identified multiple human, physical, and procedural components that will translate into recommendations for change.

The literature review was successful in uncovering a set of essential components to an operational safety guideline to address working in or near moving traffic. Those essential
components include a clear and complete policy addressing crews working in or near moving traffic, the establishment of a temporary traffic control zone, apparatus positioning, multiple apparatus to establish a block, reduced emergency lighting, enhanced graphics, a clear incident management system including a Safety Officer position, expansive and recurrent training, and cooperation between other responders.

PROCEDURES

Research began at the National Fire Academy’s Learning Resource Center (LRC) in Emmitsburg Maryland on May 23, 2005. The STAR card catalog system helped this author find articles from fire and emergency service periodicals, technical references and current fire service standards regarding incident safety as it relates to all types of roadways. The search included using the key words freeway, highway, roadway, incident safety, apparatus placement, reflective vests, and reflective striping/tape to produce a literature reference list. Other searches included using specific references that this author was familiar with including the Manual on Uniform Traffic Control Devices (MUTCD), the United States Fire Administration’s Emergency Vehicle Safety Initiative (EVSI) and specific authors Wilbur, Moore, and Solomon who have contributed numerous articles and opinions on the subject of incident scene safety on roadways.

The periodical search provided the most up-to-date information on this subject written by Moore, a fire service leader and author of the University of Extrication for Firehouse magazine.
Another large contributor to the content of this research is the USFA’s *Emergency Vehicle Safety Initiative* (EVSI) FA-272. A search of historic Applied Research Projects (ARP) was also conducted and produced papers from Price and Laird. Both of these resources were found to contain some information that was useful in this research.

Other information was collected from Arlington Fire-Rescue documents including current *Freeway Incident* standard operating procedures (SOP) and historical information from the departments Information Analyst Desiri Crawford including incident statistics and freeway incident specifics.

This author also contacted the Texas Department of Transportation (TXDOT) to help with information about the freeways. Michael Peters from TXDOT provided statistical information on the number of vehicles that travel over the three major freeways that pass through Arlington.

This author also conducted interviews with several Company and Chief Officers of the AFR and industry topic experts in an effort to provide first-hand information about the events that lead up to the development of the guideline and the change in apparatus standards.

The “Conducting Interviews” Section of the *EFOP Applied Research Self-Study Course* provided guidance when speaking with the individuals consulted (NFA, 2004). Each was asked
key questions specific to their areas of knowledge but most also supplied additional insight into the problem either by posing related questions or expanding on the information provided.

The feedback instrument was used to solicit feedback from departments with similar demographics and local departments that provided service the same major highways that Arlington does (Appendix M). The purpose of the feedback instrument was to gain information on how other departments have reacted to firefighter safety concerns when working in or near moving traffic. The feedback instrument was developed using questions that would help this author not only address the research question but would also help to determine what others used to develop their guideline.

The sample size was determined by using demographic guidelines based on population and type of department and produced a sample framing of 108 departments. The goal was to solicit information from cities similar in structure and size to Arlington. The population size used in the instrument was 200,000-400,000 and only combination career/volunteer fire departments were used. The feedback instrument was also provided to departments in the Dallas-Fort Worth metroplex that also provided service to the same freeways that the AFR did. Those cities included Dallas, Fort Worth, Grand Prairie, and Mesquite. The instrument was addressed to the Chief of the Department in hopes that he/she would use the appropriate resource within their department to complete it.
The cover letter and feedback instrument was sent out to potential respondents on August 26, 2005 using department information provided by SPAN publishing, a company that specializes in contact information for the fire service. SPAN is a pay service that provides names and addresses of fire departments using criteria that you provide to them.

The definition of descriptive research is “the collection of data to answer questions concerning the current status of the subject of the study” and the focus is “on determining and reporting the present status of something to clarify and report on the way things are at the present time” (NFA, EFOP ARSSC, 2004, p. 14).

Limitations

One limitation placed on this research was the age of the references used. There has been a lot of new information developed regarding the safety of firefighters and fire apparatus while working in or near moving traffic in the last 5-10 years. Using what this author thought was outdated information would have only served to cloud the research and would not take advantage of current standards in protective clothing, apparatus lighting, reflective striping and, industry recommended policies or procedures.

Another limitation placed on this research was the demographics used to select the participants for the feedback instrument. That limitation included a population spread of
200,000-400,000 and only career or combination departments. This would most likely represent a sample of similar department to Arlington.

**Definition of Terms**

**Block** – The positioning of Fire Department apparatus at an angle to the lanes of traffic creating a physical barrier between upstream traffic and the work area. Includes “block to the right or block to the left.”

**Upstream** – The direction that traffic is traveling from as the vehicles approach the incident scene.

**Downstream** – The direction that traffic is moving as it travels away from the incident scene.

**Shadow** – The protected area at a vehicle-related roadway incident that is shielded by the block from apparatus and other emergency vehicles.

**Work Zone** – The physical area of a roadway within the shadowed area where emergency personnel perform their fire, EMS, and rescue tasks at a vehicle-related incident.

**Flagger** – An individual who is trained in traffic-control techniques, proper use of signaling equipment and placement of advanced warning devices.

**Patient loading zone** – The rear of a medic unit where a patient on a stretcher will be placed into the vehicle.

**Right & Left** – Orientation as one faces the direction of travel on a roadway.

**Advanced warning** - Visual indication to approaching motorist that a roadway hazard exists ahead.

**Transition area** – Section of a roadway where normal traffic flow is reduced, altered, merged or redirected.

**Buffer zone** – A safe space or distance between the protected work zone and moving traffic.

**Taper** – The action of merging several lanes of moving traffic into fewer moving lanes.
Lanes of the Roadway – The lanes of a street, road or highway can be identified by a number, beginning with the number 1. When facing in the direction that traffic is flowing, the traveled lane of the road furthest to the right is identified as lane 1. If there are two or more lanes traveling in the same direction, the lane to the immediate left of lane 1 is identified as lane 2, followed by lane 3, the next lane to the left and so on. The way to remember this is the lower lane number is typically the slower vehicle speed lane.

RESULTS

1. What are the current policies/procedures in place that address safety in or near moving traffic?

   The information establishes that the department currently has in place SOP 204.05 Freeway Incidents. This is a guideline that was created after an accident that resulted in a serious injury to one firefighter. The SOP provides the fire department with a clear guideline on working on freeway incidents.

   The policy addresses terminology and gives examples and definitions of the terms that are used throughout the guideline. The terminology is designed to familiarize everyone with each term and specifically define the terms to give the reader a clear picture of its impact on the operation.

   It also clearly details the initial companies’ actions from size up through approach and placement including the responsibilities of the second apparatus. The policy provides guidance to medic units and their placement when responding to one of these incidents.
The policy also covers personal safety and provides specific guidelines on the wearing of department issued safety vest and bunker coats during traffic incidents. It also provides recommended general safety techniques for working around moving traffic and the placement of cones. It also addresses the department’s interaction with the police department and their possible responsibilities.

2. How do current policies/procedures compare to industry standards?

The AFR policy does contain portions of what was found to be industry standards. It does provide an established guideline for the department to use when working on freeway incidents. The research concludes however that there are some elements from industry standards that are missing.

The sample guideline *Safe Positioning while Operating in or Near Moving Traffic* retrieved from the Respondersafety.com web site does compare somewhat to the AFR policy. Key components in the “safe positioning” guideline includes the sections terminology, apparatus, Incident Command, crew and safety benchmarks, and highway operations. Although the AFR guideline does contain most of them along with their recommendations, the benchmarks sections and their recommendations are not addressed.

There was also information discovered on the importance of first controlling traffic before turning attention to the emergency and taking advantage of topography as critical to an
operational guideline. There were also several articles written by industry leaders that would also establish the importance of these two components. This author believes that these are critical to increasing firefighter safety. While the AFR document does establish the importance of safety and the adherence of the policy, it does not address the importance of either of these two recommendations in relation to the rest of the incident.

The importance of the Incident Safety Officer was also recognized in the research in not only the fire service but in all areas where humans are exposed to traffic. It was established that the incident safety officer shall evaluate motor vehicle scene traffic hazards and apparatus placement and take appropriate actions to mitigate hazards. The AFR policy does address incident safety but established the position as a consideration by Command but not a mandatory function of these incidents.

Other information, although limited, established the importance of common terminology as a critical component to working in or near moving traffic. It was established that the use of common terminology will reduce confusion; improve the safety of responders, and make operations at the scene more efficient. AFR also found this to be true and included it in the current policy and initial training.

Information was also found on the importance of setting up a TTC zone as early in the incident as possible. This also provided detailed information on the components of a TTC zone
and how critical that step is to working in or near moving traffic. Positioning an apparatus to establish a TTC zone was identified as a 45-degree angle to the lanes but this information was also found not to be hard and fast. Clarification would establish that the angle depends on the number of lanes to be blocked by the apparatus. Limited information was also found on the use of a second piece of apparatus to help establish the TTC zone. While this information was limited and was not mutually accepted, it was a potential critical component when working on a limited access highway. The AFR document does provide language that establishes a TTC zone but lacks detail in how important it is and how exactly to accomplish the task. It also provides for the second apparatus but does that only for freeway incidents.

Information determined that the amount of TTC zone measures were directly related to the amount of time the incident would require. The longer the incident the more extensive the control measures should be. The information also stressed the importance of terminating the incident as aggressively as possible as a key component to enhance safety. The AFR guideline does not address any long-term traffic TTC zone concerns and provides no direction to establishing long-term zones. It also does not provide the Company Officer with direction on making a quick exit from the roadway.

Information gathered on the training needs of personnel either initial or re-current was plentiful. The majority of the information would present the importance of training for everyone
on working in or near moving traffic but would recommend more extensive training for Company Officers to ensure the understanding of the principles and guidelines for establishing a TTC zone. Either way the importance of comprehensive training was established as a critical component. Information also provided a set of exit protocols that should be included in the initial and any re-current training sessions. Those protocols provide information on safe dismounting and operating techniques when working in or near moving traffic. Limited information was also determined to establish the importance of the public’s education on their responsibilities when approaching one of these incidents. The AFR guideline provided initial training and although it was complete in regard to the current SOP, it does not provide for any re-current training or any language that provides the reader with recommendations on dismounting. The guideline does however; does provide limited recommendations in on scene operations.

3. How are comparable departments addressing roadway incident safety?

A sample framing of 108 Feedback instruments were sent out for completion. The sample framing produced a sample size a 55 or 51% return over a six-week period. It was determined through the feedback instrument that out of the fifty-five returned, twenty-one or 38% of the departments did not have any kind of policy dealing with incident safety while working in or near moving traffic while thirty-four or 62% of the departments did. Out of the twenty-one departments without a policy one, Grand Prairie, provides mutual aid to AFR and
services all three of the major freeways that AFR does. In contrast, Fort Worth and Dallas both indicated that they have a policy in place and provide similar documents to that of AFR. They also incorporate similar enhanced lighting and graphics packages on the apparatus.

Another interesting fact that the feedback instrument provided was out of the twenty-one departments without an in or near moving traffic policy, fifteen or 72% would be what this author considered “large departments”. Those fifteen had average department strength of 428 and an average population of 254,000. It was also obvious that out of all of the twenty one departments without a policy, all but one could be considered in the eastern half of the United States.

Question four asked, “What, if anything, caused your department to develop this policy?” 61% indicated that the development of their policy was in response to safety concerns within their department. Another 16% indicated that the policy was in direct response to a “struck by” incident in their department while 6% indicated that it was in response to their department having a major freeway within their jurisdiction. Also, 61% of those departments indicated that the development of the policy was a proactive response and a desire to keep their people safe.

Question five asked, “How long has your policy been in effect?” 6% indicated their policy had been in effect less than one year, 41% indicated theirs had been in effect from 1-5 years, 25% indicated that theirs had been in effect from 5-10 years and 19% indicated that their
policy had been in effect between 10-20 years. There were 6% of the respondents did not answer the question.

Question six asked, “Has there been any updates to the policy?” 49% indicated that there had been an update to their policy while 51% indicated that there had not. The second part of the question asked, “If yes, what caused the changes?” 53% indicated that it was in response to their regular standard operating procedure update process, 26% indicated that it was because of an update in national standards while 13% indicated that it was because of a struck by incident in their department or because of safety concerns.

Question seven asked, “Does your policy include recommendations from any recognized industry standard(s), please list?” 58% of the respondents did not indicate any standard. The remaining 41% indicated a combination of ANSI, DOT, NFPA and OSHA while only 3% indicated that their policy included recommendations from the Emergency Vehicle Safety Initiative from the USFA. None of the respondents indicated the MUTCD as an included component to their policy.

Question eight asked, “What personal safety equipment does your department provide for working in or near moving traffic?” 100% indicated that they provided a combination of cones, safety vests (a variation of class II & III), flares and stripes on the bunker clothing.
Question nine asked, “What safety enhancements do you provide on your apparatus to increase visibility when working in or near moving traffic?” 70% indicated that they incorporate enhanced lighting packages into their apparatus. Another 35% use lighted arrow devices while another 3% used a message board. Another 29% also included enhanced striping packages on their apparatus. 19% indicated that they provide cones and an enhancement while 10% use flares. 17% indicated that they used a variation of the “inverted chevron” of “European” striping on the back of the apparatus.

Question ten asked, “What are some key components identified in your procedures?” 51% indicate that they used cones a key component. 64% uses a blocking procedure while 10% used a secondary apparatus to block. Another 32% indicated that personal protective equipment was a key component to their policy while 12% indicated lights were key.

Question eleven asked, “Has there been any positive results from the implementation of the policy?” and solicited a wide array of answers most of which did not provide any meaningful data to this research. For that reason, this author disregarded those results.

4. What are the applicable standards currently in place that address firefighter safety while working on roadways?

It was determined that there are multiple standards that address safety when working in or near moving traffic. The MUTCD provided extensive information relative to establishing a TTC
zone including specifications on cones and channelizing devices. Information gathered from the EVSI provided recommendations on guidelines NFPA 1901, 1521 & 1500 and, the TIMH also provide recommendations that are considered industry standards. A series of articles by Moore provided the most up-to-date information on the topic with his Safe Parking articles that addressed all aspects of safety when working in or near moving traffic. It appears to this author that based on Moore’s writing; the industry has adopted and implemented them as a standard that should be considered when developing a guideline. Other writings and lectures by Goldfeder, Solomon, Sullivan and Wilbur all provide additional recommendations. Standard Operating Procedures by Phoenix and Plano combine all of these recommendations and can also be considered to provide an industry standard document.

It was also found that in Texas, the Passing Authorized Emergency Vehicles Act (2003) was established to identify an operator’s responsibility when passing authorized emergency vehicles that are stationary on the roadway. The act provides penalties to drivers that violate the statute that range from a class C misdemeanor to a class B when injuries result for the violation of the law.

5. What safety devices can be utilized to increase visibility of both apparatus and firefighters?

The results indicate that in order to be safe, both apparatus and firefighters must be able to be visible during both the day and night. While emergency lighting can increase the ability of
oncoming traffic to see apparatus from long distances, the research indicates that there are times when too much can be counter productive. The research provided information that the limited use of emergency lighting and headlights, especially when directed at oncoming traffic, will actually increase safety when working in or near moving traffic. This reduction will reduce the confusion oncoming traffic might feel when looking at a sea of lights. The results also indicate that the use of just a lighted arrow device and amber lighting on the rear of an apparatus can help pre-warn upstream traffic. The use of the lighted arrow device with other emergency lighting can only serve to confuse oncoming traffic.

As part of the illumination package, the research provided limited technical information on the benefits of enhanced graphics like the inverted chevron. Although the illumination technique is beginning to be more prevalent in the U.S., no research or industry technical information has been published as it relates to the fire service applications. Even though limited, this author believes that it does have a place in providing a safe TTC zone. The information contained in the research and through personal experience did however; provide this author with enough interest to recommend its use and further review.

It is now obvious that while understanding that the ability to see firefighters provides for a safer work environment, the use of an ANSI Class III reflective vest is a key component to firefighter safety when working in or near moving traffic. It is also obvious to this author that
the vest provides more visibility than the structural turn out clothing based on NFPA standards. The research indicates that in order to enhance the reflect-ability, an ANSI Class III vest should be worn in conjunction with structural clothing when working in or near moving traffic. The results also indicate that wearing a structural helmet can also provide an added level of head protection when working in these situations.

There was information on the importance of establishing a TTC zone as early in the incident as possible. This step is critical to first controlling traffic and providing a safe work environment. Information found also stressed the importance of training in setting up a TTC zone. Also found were recommendations for early warning and channelizing devices that can be used in establishing a TTC zone. Specifications for traffic cones are critical to the success of a TTC zone and included height requirements, based on the anticipated speed of the roadway in which they are being deployed, and guidelines on the accompanying reflective bands that provide illumination at night. Information was also discovered on a NFPA recommended warning sign that included the words “Emergency Scene”. This sign is another critical tool aimed at pre-warning oncoming traffic to the incident ahead.

DISCUSSION/IMPLICATIONS

As an industry, it seems to this author that we are on the same page with some general recommendations when it comes to firefighter safety when working in or near moving traffic. It
also appears that these recommendations have been adopted by the industry as critical components of an operational safety guideline.

Although the sample framing of the feedback could have been better, this author is pleased with the 51% return. This author is also pleased with the results that indicated only 38% of the departments did not have a policy in place while 62% did. This compares to the EFO paper by Price (1998) that resulted in 56% of the departments not having a policy in place while 44% did (pp. 20-21). Although the sample demographics were slightly different between Price and this author, this could indicate an increase in awareness in the industry.

It was however, discouraging to see that 38% of the departments that participated in the feedback instrument did not have a policy in place that dealt with safety when working in or near moving traffic. It was even more discouraging to see that out of the 21 departments that had no policy, only 23% requested a copy of this research when it was offered as part of the feedback instrument.

The feedback instrument provided information that indicated a majority of the department’s policies had been in effect only 1-5 years. This would be consistent with what the research determined on industry incidents and the significant effect they had on the industry and policies to address them.
Another interesting fact that came out of the feedback instrument was out of the twenty-one departments without a policy, 72% were departments with averages strengths of 428 personnel and populations of 254,000. Although Price’s research did not provide any information on this fact, this author is perplexed by what appears to be a failure to include this type of safety guideline by the larger departments. Although the research indicated that most of those departments were located on the east coast of the U.S., this author believes that further research would have to be done before asserting these two findings to be significant.

It does appear, by the findings from the rest of the feedback instrument, that the departments that have a policy in place have consulted and included portions of what could be considered industry standards in current policy. It also appears that those departments have also included safety equipment for both human and hard assets that are consistent with what this author has found to be industry standards. This author hopes that this research will provide more information to help shore up some of the gray areas the industry might have on this subject.

Out of those discovered recommendations, NIOSH established “Fire departments should ensure that fire fighters responding to a scene involving a highway incident or fire must first control the oncoming vehicles before safely turning their attention to the emergency in the event police have not arrived” (1999, p. 4). In that same report NIOSH would also stressed that “fire departments should ensure that fire apparatus is positioned to take advantage of topography and
weather conditions (uphill and upwind) and to protect fire fighters from traffic” (p. 4). These two recommendations are the basis for an operational safety guideline and would also resonate through other writings by Austin (2001), Solomon (2002), Moore (2003), Wilbur (2001) and the Cumberland Valley Volunteer Firemen’s Association (1999). This fact constitutes and industry standard to this author. The implications of these two recommendations are huge and should be considered as a major component in an operational safety guideline.

Other recommendations by the NFPA 1521(2002) document also addresses scene safety by establishing “the incident safety officer shall evaluate motor vehicle scene traffic hazards and apparatus placement and take appropriate actions to mitigate hazards” (n.p.). *The Traffic Incident Management Handbook* (TIMH) (2000) identifies that an “effective incident site management can be facilitated by an incident command system (ICS)” (p. 1-9). There is no doubt that an Incident Safety Officer is critical to any incident when working in or near moving traffic. But it appears that the line is blurry between the term Flagger and Incident Safety Officer. Flagger is a term adopted from the MUTCD while Incident Safety Officer is a more traditional fire service position. That line must be focused when developing an operation safety guideline. It is critical that there is no confusion and a definite distinction between the two positions.
Moore (2004) provided the only recommendation on the use of a second apparatus. According to Moore (2004) “when a call is received for an incident on a limited-access highway, an additional apparatus should be dispatched along with the first due companies” (p. 27). He explains that a “tandem axle ladder truck is preferred due to its long length and heavy weight” (2004, p. 27). In contrast, the Phoenix guideline, although considered industry standard, did not provide for this recommendation. The recommendation by Moore, although the only research this author has found, is significant and provides added protection when working in or near moving traffic. There is however, an added risk that any department takes when throwing more firefighters and apparatus at any high risk incident. This is a risk that every department must weight when developing their operation guidelines.

Controlling traffic is critical to the success of mitigating firefighter risk during these types of incidents. As part of controlling traffic, the EVSI (2004) provided guidelines for highway operations and recommends “positioning an apparatus at a 45-degree angle to the lanes as an important step in controlling traffic” (p. 39). Moore (personal communication, June 26, 2005) would clarify “it is not the angle that gets the job done”. “The angle is more about what you want to get done, how many lanes you want to block”. This clarification makes sense to this author since it may take more than a 45-degree angle with certain apparatus to block multiple
lanes. The main objective of the positioning should be to institute a blocking of the incident scene from oncoming traffic.

The criticality of “critical wheel angle” was also presented to describe the turning of the wheel to the extreme right or left and explains that “in the event the vehicle is struck from behind, the critical wheel angle should move the colliding vehicles away from the rescuers” (Moore, 2003, p. 38). This author has seen the benefits during the August 2004 accident cited in the background and significance. While the engine was only moved 3-4 feet, it did track toward the direction of the critical wheel angel.

Common terminology provides responders with an understanding at the onset of an incident. Information by Moore (2003) stressed the importance of language during one of these incidents and identified that common terminology will “reduce confusion; improve the safety of responders and make operations at the scene more efficient” (p. 27). This author believes that it is imperative that the TTC zone be established early so firefighters can turn their attention from oncoming traffic to mitigating the hazard. The use of common terminology can facilitate the rapid establishment of the TTC zone.

The MUTCD has developed into an industry standard for the fire service by providing guidelines on establishing a TTC zone to protect firefighters from oncoming traffic. The MUTCD explains “the primary function of TTC is to provide for the reasonably safe and
efficient movement of road users through or around TTC zones while reasonably protecting workers, responders to traffic incidents, and equipment” (2003, p. 6A-1). This author believes that the TTC zone is a critical component in an operational safety guideline for operating in or near moving traffic. The MUTCD (2003) also divides the amount of traffic control measures into time durations. The longer the duration of the incident, the more traffic control devices that are needed to increase the amount of safety to those who are working in or near the moving traffic. But parts of the manual are cumbersome and provide information that is no practical for the fire service. It is also easy to take some of the MUTCD recommendations and stretch them to fit the fire service. It is this author’s opinion that the fire service should take pertinent segments and incorporate them into a specific fire service document.

Reducing the exposure time on scene was identified as a key factor in keeping firefighters safe. The Phoenix (2003) and Plano (1999) SOP’s identified the importance of ‘terminating the incident with the same aggressiveness as initial actions” (p. 3). The CVVFA white paper (1999) also established “understanding when to decommit personal and apparatus and how to expeditiously reopen roadways, are vital parts of traffic management’ (p. 7). This author now believes the validity of this finding and points to the 2002 AFR incident as an example of how exposure time played a key role.
Training was identified as another key factor to an operational guideline. Laird (2003) would conclude that “more comprehensive training” should be included in an operational guideline. MUTCD (2003) identified the importance of training and that “all workers should be trained on how to work next to motor vehicle traffic in a way that minimizes their vulnerability” (p. 6D-4). NIOSH (2001) established that in order to prevent such incidents fire departments should “ensure that firefighters are trained in safe procedures for operating in or near moving traffic” (n.p.). According to Price (1998) “It is essential that every member of the team know how to safely operate at the scene and this may be accomplished through awareness, training and discipline in any on-road call” (p. 7). There is no doubt that the training in any aspect of the fire service is critical to our mission. While fighting fire presents an often unknown enemy, oncoming traffic can present a just a dangerous predator.

The implications of these findings will provide our organization with a set of guidelines that are aimed toward enhancing firefighter safety when working in or near moving traffic. While the department may find some of the recommendations a challenge to implement, the challenge will be keeping firefighters safe while not implementing them.

RECOMMENDATIONS

While the department has made major improvements to its policies and training when dealing with freeway incidents, the research indicates that certain critical elements were omitted
from the original and modified versions. In order to truly reduce “struck by” incidents, the department must consider what this research has uncovered.

The feedback instrument provided information that led this author to realize the importance of partnering with not only our neighboring departments but the industry to enhance safety when working in or near moving traffic. This includes sharing policy, procedures, and training curriculum.

It is apparent to this author that the current policy/procedure should be revised to include any incident in which firefighters are working in or near moving traffic and should be renamed Safety in or Near Moving Traffic. This guideline should be mutually exclusive to all incidents in which firefighters are working in or near moving traffic and in which their attention might be distracted away from oncoming traffic. The underlying theme of the revised guideline should be to first control the roadway before turning the attention to the victims.

Also in the policy revision should be the safety benchmarks that were identified in the Phoenix and Respondersafety.com documents. These benchmarks will provide everyone with a list of items that should be addressed when working in or near moving traffic that will enhance safety.

The policy revision should also include utilizing a second apparatus on all incidents that involve multiple lanes of traffic in one direction. The department currently utilizes this
recommendation but only in incidents that involve freeways. This new language would expand the policy to include all roadways. The current policy includes language on apparatus positioning but the revision should more clearly define the responsibilities of the blocking apparatus and the importance of the proper angle.

The revision should also include the traffic control zone duration recommendations identified by the MUTCD as a guideline to be used by Company Officers when making decisions about long duration incidents and the TTC. This one recommendation would have been a key element in the 2002 AFR incident in which one firefighter was forced to medically retire due to his injuries. Along with this revision should be language that advocates aggressive termination as found in the Phoenix and Plano guidelines. A set of example diagrams for each potential situation should also be included in the policy to give users a visual cue to how the different potential TTC zone scenarios can be established. The policy should also stress the importance of taking advantage of topography when setting up a TTC zone as identified in the Mid-West City Oklahoma incident.

Also included in the policy change should be specific instructions on the reduction of emergency lighting when operating on scene especially those directed toward oncoming traffic. The re-current training should provide everyone with the reasons behind this recommendation
and the research results. The ability of current and future apparatus to selectively shed specific emergency lighting should be evaluated and changed.

The department currently incorporates the use of the inverted chevron in current apparatus orders and has since 2003. The department should consider enhancing it apparatus graphics to include 3M Scotchlite Diamond Grade Reflective Sheeting to all sides of the apparatus. This will ensure the maximum visibility at all angles and in all traffic situations. Currently this reflective sheeting is only used in the inverted chevron design on the back of the apparatus. The department should also consider retrofitting older apparatus with the enhanced graphics.

The policy revision should also provide more detail on the use of an Incident Safety Officer and clearly define his/her roll when operating in or near moving traffic. The current guideline establishes the function of the Incident Safety Officer as a consideration and not a mandatory position on these incidents. This should be revised to provide for that position when the second apparatus arrives on scene.

The new policy should also change the current language of placing cones from one of avoidance to one of necessity and should more clearly define their role in the establishment of a TTC zone. Detailed instructions on how to place cones upstream of the incident should be included in the re-current training curriculum and in the guideline. The cones currently carried
on the apparatus should also be inspected to make sure they comply with the MUTCD recommendations on height and reflect-ability. The department should consider the purchase and use of the NFPA recommended “Emergency Scene” warning sign to pre-warn oncoming traffic of the incident ahead.

As identified in the research training is a key component to enhancing safety. The department should utilize re-current training to enhance the department’s awareness of this high risk, high frequency event. Included in the training should be the cities ambulance provider and Police Department in order to ensure that everyone assigned to the incident is on the same page. The training should involve practical applications of the procedures as they apply to apparatus/vehicle placement, Incident Safety Officer responsibilities and TTC zone establishment in an attempt to build competence in their practical execution. Re-current training should provide information on the Mid-West City Oklahoma incident as an example on its importance.

The department should also consider teaming with other departments in the metroplex to address public education through print, billboard and television ads aimed at providing information on their role in enhancing safety when approaching these incidents and also stress the importance in complying with the Passing Authorized Emergency Vehicle Act.
REFERENCES


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PURPOSE
This policy identifies procedures and parking practices for Fire Department apparatus and other emergency vehicles that will provide maximum protection and safety for personnel operating in or near freeway traffic. It also identifies several approaches for individual practices to keep firefighters safe while exposed to the hazardous environment created by moving traffic.

It shall be the policy of the Fire Department to position fire apparatus at vehicle-related freeway incidents in a manner that best protects the incident scene. Such positioning shall afford protection to Fire Department and emergency medical personnel from the hazards of working in or near moving traffic.

TERMINOLOGY
The following terms shall be used during incidents related to operating in or near moving traffic:

1. Block – The positioning of Fire Department apparatus at an angle to the lanes of traffic creating a physical barrier between upstream traffic and the work area. Includes “block to the right or block to the left.”

2. Upstream – The direction that traffic is traveling from as the vehicles approach the incident scene.

3. Downstream – The direction that traffic is moving as it travels away from the incident scene.

4. Shadow – The protected area at a vehicle-related roadway incident that is shielded by the block from apparatus and other emergency vehicles.

5. Work Zone – The physical area of a roadway within the shadowed area where emergency personnel perform their fire, EMS, and rescue tasks at a vehicle-related incident.

6. Taper – The action of merging several lanes of moving traffic into fewer moving lanes.

7. Lanes of the Roadway – The lanes of a street, road or highway can be identified by a number, beginning with the number 1. When facing in the direction that traffic is flowing, the traveled lane of the road furthest to the right is identified as lane 1. If there are two or more lanes traveling in the same direction, the lane to the
immediate left of lane 1 is identified as lane 2, followed by lane 3, the next lane to the left and so on. The way to remember this is the lower lane number is typically the slower vehicle speed lane.

SIZE-UP
The first officer arriving on scene will establish Command and give an accurate size-up that should include the exact location and direction of travel, nature of the incident and traffic conditions.

A follow-up report should indicate:

- Number of patients/severity of injuries.
- Extrication needs.
- Hazardous materials spills.
- Evacuation needs.
- Call for additional resources.
- A Battalion Chief should be placed on the call if any additional resources are requested.

APPARATUS APPROACH
Command is responsible for redirecting other companies, or requesting additional companies if it becomes apparent that responding units will be unable to reach the incident due to traffic congestion.

- Units should attempt to reach the scene in the direction of the reported incident.
- Units should proceed in the opposite direction of normal traffic flow only at the specific request of Police when it is assured that all traffic has been stopped, or at the direction of the Incident Commander who has verified through Police that all traffic has been stopped.

APPARATUS PLACEMENT
First Fire Apparatus
Always position the first-arriving apparatus as an initial block to protect the scene, patients, and emergency personnel.

- Apparatus will be positioned to create a “shadow.” One foot of shadow should be allowed for every mile an hour of posted speed. (Example: posted speed of 55 miles an hour equals placing the apparatus 55 feet from the wrecked vehicles).
- A work zone will be established within the shadow area.
- Angle apparatus on the roadway with a “block to the left” or “block to the right” to create a physical barrier between the crash scene and approaching traffic.
- Turn wheels to the side to prevent the apparatus from being pushed into the work zone if struck.
- When practical, position the pump panel toward the work zone.
• Use fire apparatus to block at least one additional traffic lane more than that already obstructed by the crashed vehicle(s). Always block the whole lane.

Second Fire Apparatus
The second arriving fire apparatus will be used to maximize overall scene safety. Command will determine if the second apparatus dispatched is beneficial to operations and/or safety and will assign or disregard. When assigning the second unit, Command will consider the following:

• A Scene Safety Officer.
• Placing the second fire apparatus upstream to create a taper for approaching traffic.
• At ramps, or where the incident may be near the middle lane of the roadway, two or more sides of the incident will need to be protected.

Medic Units
Medic Units will be positioned within the protected work zone with their rear patient-loading door angled away from the nearest lanes of moving traffic.

PERSONAL SAFETY
All personnel shall understand and appreciate the high risk that personnel are exposed to when operating in or near moving vehicle traffic. To improve personal safety emergency workers shall:

• Always wear reflective vests, bunker coat or department issued jacket with reflective stripes. During daylight hours consideration should be given to wearing the bright colored high visibility vests.
• Wear structural fire fighting helmet.
• Where possible, avoid turning your back to approaching traffic.
• Be aware of and work within the work zone.
• Use extreme caution if placing traffic cones outside the work zone. Generally, firefighters placing cones upstream in traffic should be avoided.
• Work as rapidly as possible and then clear the traffic lanes and move off the freeway.

LIAISON WITH POLICE DEPARTMENT
Command will establish liaison with Police at the scene as quickly as possible. If the incident presents extreme safety concerns, Command will consider having Police completely shut down the freeway and re-direct traffic. Primary responsibility of liaison with Police:

• Traffic control.
• Directing the approach of additional resources to scene.
• Crowd control.
• Providing resources such as wreckers.
Appendix B Phoenix Fire Department SOP’s
Safe Parking While Working in or Near Moving Traffic

OVERVIEW

This procedure identifies parking practices for fire department apparatus that will provide maximum protection and safety for personnel operating in or near moving vehicle traffic. It also identifies several approaches for individual practices to keep firefighters safe while exposed to vehicle traffic.

IT SHALL BE THE POLICY OF THE REGIONAL FIRE DEPARTMENT TO POSITION APPARATUS AT THE SCENE OF EMERGENCIES IN A MANNER THAT BEST PROTECTS THE WORK AREA AND PERSONNEL FROM VEHICLE TRAFFIC AND OTHER HAZARDS.

All personnel should understand and appreciate the high risk that firefighters are exposed to when operating in or near moving vehicle traffic. We should always operate from a defensive posture. Always consider moving vehicles as a threat to your safety. Each day, emergency personnel are exposed to motorists of varying abilities, with or without licenses, with or without legal restrictions, and driving at speeds from creeping to well beyond the speed limit. Some of these motorists are the vision impaired, the alcohol and/or drug impaired. On top of everything else, motorists will often be looking at the scene and not the road.

Nighttime operations are particularly hazardous. Visibility is reduced, and the flashing of emergency lights tend to confuse motorists. Studies have shown that multiple headlights of emergency apparatus (coming from different angles at the scene) tend to blind drivers as they approach.

SAFETY BENCHMARKS

Emergency personnel are at great risk while operating in or around moving traffic. There are approaches that can be taken to protect yourself and all crew members:

1. Never trust the traffic
2. Engage in proper protective parking
3. Wear high visibility reflective vests
4. Reduce motorist vision impairment
5. Use traffic cones and flares

Listed below are benchmarks for safe performance when operating in or near moving vehicle traffic.
1. Always maintain an acute awareness of the high risk of working in or around moving traffic. Never trust moving traffic. Always look before you step! Always keep an eye on the traffic!

2. Always position apparatus to protect the scene, patients, emergency personnel, and provide a protected work area. Where possible, angle apparatus at 45 degrees away from curbside. This will direct motorist around the scene (See Figure 1). Apparatus positioning must also allow for adequate parking space for other fire apparatus (if needed), and a safe work area for emergency personnel. Allow enough distance to prevent a moving vehicle from knocking fire apparatus into the work areas.

3. At intersections, or where the incident may be near the middle of the street, two or more sides of the incident may need to be protected. Block all exposed sides. Where apparatus is in limited numbers, prioritize the blocking from the most critical to the least critical (See Figures 2, 3 and 4).

4. For first arriving engine companies where a charged hoseline may be needed, angle the engine so that the pump panel is "down stream," on the opposite side of on-coming traffic. This will protect the pump operator (See Figure 5).

5. The initial company officer (or Command) must assess the parking needs of later-arriving fire apparatus and specifically direct the parking and placement of these vehicles as they arrive to provide protective blocking of the scene. This officer must operate as an initial safety officer.

6. During daytime operations, leave all emergency lights on to provide warning to drivers.

7. For NIGHTTIME operations, turn OFF fire apparatus headlights. This will help reduce the blinding effect to approaching vehicle traffic. Other emergency lighting should be reduced to yellow lights and emergency flashers where possible.

8. Crews should exit the curb side or non-traffic side of the vehicle whenever possible.

9. Always look before stepping out of apparatus, or into any traffic areas. When walking around fire apparatus parked adjacent to moving traffic, keep an eye on traffic and walk as close to fire apparatus as possible.

10. Wear the safety vest any time you are operating in or near vehicle traffic.

11. When parking apparatus to protect the scene, be sure to protect the work area also. The area must be protected so that patients can be extricated, treated, moved about the scene, and loaded into Rescues safely.

12. Once enough fire apparatus have "blocked" the scene, park or stage unneeded vehicles off the street whenever possible. Bring in Rescue/Ambulance companies one or two at a time and park them in safe locations at the scene. This may be "down stream" from other parked apparatus, or the Rescue maybe backed at an angle into a protected loading area to prevent working in or near passing traffic. At residential medical emergencies, park Rescues in driveways for safe loading where possible. If driveways are inaccessible, park Rescues to best protect patient loading areas. (See Figures 6 and 7).
13. Place traffic cones at the scene to direct traffic. This should be initiated by the first company arriving on the scene and expanded, if needed, as later arriving companies arrive on the scene. Always place and retrieve cones while facing on-coming traffic.

14. Placing flares, where safe to do so, adjacent to and in combination with traffic cones for nighttime operations greatly enhances scene safety. Place flares to direct traffic where safe and appropriate to do so.

Listed below are general recommendations for the start of traffic cones/flares:

<table>
<thead>
<tr>
<th>Speed</th>
<th>Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 mph</td>
<td>65 feet</td>
</tr>
<tr>
<td>40 mph</td>
<td>105 feet</td>
</tr>
<tr>
<td>60 mph</td>
<td>160 feet</td>
</tr>
</tbody>
</table>

15. At major intersections a call for police response may be necessary. Provide specific direction to the police officer as to exactly what your traffic control needs are. Ensure the police are parking to protect themselves and the scene. Position Rescues to protect patient loading areas. (See Figure 8)

**FREEWAY OPERATIONS**

Freeway emergencies pose a particular high risk to emergency personnel. Speeds are higher, traffic volume is significant, and motorists have little opportunity to slow, stop or change lanes.

The Department of Public Safety will also have a desire to keep the freeway flowing. Where need be, the freeway can be completely shut down. This, however, rarely occurs.

For freeway emergencies, we will continue to block the scene with the first apparatus on the scene to provide a safe work area. Other companies may be used to provide additional blocking if needed.

The initial company officer, or command, must thoroughly assess the need for apparatus on the freeway and their specific positions. Companies should be directed to specific parking locations to protect the work area, patients, and emergency personnel.

Other apparatus should be parked downstream when possible. This provides a safe parking area.

Staging of Rescue companies off the freeway may be required. Rescues should be brought into the scene one or two at a time. A safe loading area must be established.
Traffic cones should be placed farther apart, with the last cone approximately 160 feet "upstream," to allow adequate warning to drivers. Place and retrieve cones while facing the traffic.

Command should establish a liaison with the Department of Public Safety as soon as possible to jointly provide a safe parking and work area and to quickly resolve the incident.

The termination of the incident must be managed with the same aggressiveness as initial actions. Crews, apparatus, and equipment must be removed from the freeway promptly, to reduce exposure to moving traffic.

**Figure #1**

Where possible, angle apparatus at a 45 degree angle from the curb.
Figure #2

Prioritize placement of the apparatus by blocking from the most critical to the least critical side.

Figure #3

Often times two or more sides may need to be protected.
To protect pump operator, position apparatus with the pump panel on the opposite side of on-coming traffic.
Where possible, park rescues in driveways or position rescue to protect patient loading area.

Figure #6

Figure #7
Provide specific direction to police as to what traffic control needs you have.

Position rescues to protect patient loading areas.
Appendix C Recommendations by NIOSH for Developing a Roadway Safety Program

Fire departments:

- Develop, implement and enforce standard operating procedures (SOP’s) regarding emergency operations for roadway incidents.
- Implement an incident management system to manage all emergency incidents.
- Establish a unified command for incidents that occur where multiple agencies have jurisdiction.
- Ensure that a separate incident safety officer (independent of the incident commander) is appointed.
- Develop pre-incident agreements with law enforcement and other agencies such as the highway department.
- Ensure fire fighters are trained in safe procedures for operating in or near moving traffic.
- Ensure that fire fighters wear suitable high-visibility apparel such as a strong yellow-green or orange reflecting flagger vest when operating at an emergency scene.

Fire fighter:

- Ensure that the fire apparatus is positioned to take advantage of topography and weather conditions (uphill and upwind) and to protect fire fighters from traffic.
- Park or stage unneeded vehicles off the roadway whenever possible.
- If police have not yet arrived at a scene involving a highway incident or fire, first control the oncoming vehicles before safely turning your attention to the emergency.
- Position yourself and any victim(s) in a secure area that maximizes your visibility to motorists when it is impossible to protect the incident scene from immediate danger.
- Use a traffic control device that maximizes your visibility to motorist when controlling traffic.
Appendix D Respondersafety.com Safe Positioning Guideline

Fire Department

Operations Division

Issued 00-00-00

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Page 0 of 0

SAFE POSITIONING WHILE OPERATING IN OR NEAR MOVING TRAFFIC

I. Overview

This procedure identifies parking practices for Fire Department apparatus and vehicles that will provide maximum protection and safety for personnel operating in or near moving vehicle traffic. It also identifies several approaches for individual practices to keep firefighters safe while exposed to the hazardous environment created by moving traffic.

It shall be the policy of the Fire Department to position apparatus and other emergency vehicles at a vehicle-related incident on any street, road, highway or expressway in a manner that best protects the incident scene and the work area. Such positioning shall afford protection to fire department personnel, law enforcement officers, tow service operators and the motoring public from the hazards of working in or near moving traffic.

All personnel should understand and appreciate the high risk that personnel are exposed to when operating in or near moving vehicle traffic. Responders should always operate within a protected environment at any vehicle-related roadway incident.

Always consider moving vehicles as a threat to your safety. At every vehicle-related emergency scene, personnel are exposed to passing motorists of varying driving abilities. At any time, a motorist may be driving without a legal driver’s license. Approaching vehicles may be driven at speeds from a creeping pace to well beyond the posted speed limit. Some of these vehicle operators may be vision impaired, under the influence of alcohol and/or drugs, or have a medical condition that affects their judgment or abilities. In addition, motorists may be completely oblivious to your presence due to distractions caused by cell phone use, loud music, conversation, inclement weather, and terrain or building obstructions. Approaching motorists will often be looking at the scene and not the roadway in front of them. Assume that all approaching traffic is out to get you until proven otherwise.

Nighttime incidents requiring personnel to work in or near moving near traffic are particularly hazardous. Visibility is reduced and driver reaction time to hazards in the roadway is slowed.
II. Terminology

The following terms shall be used during incident operations, post-incident analysis, and training activities related to working in or near moving traffic.

1. **Advance Warning**- notification procedures that advise approaching motorists to transition from normal driving status to that required by the temporary emergency traffic control measures ahead of them.

2. **Block**- positioning a fire department apparatus on an angle to the lanes of traffic creating a physical barrier between upstream traffic and the work area. Includes ‘block to the right’ or ‘block to the left’.

3. **Buffer Zone**- the distance or space between personnel and vehicles in the protected work zone and nearby moving traffic.

4. **Downstream**- the direction that traffic is moving as it travels away from the incident scene.

5. **Flagger**- a fire department member assigned to monitor approaching traffic and activate an emergency signal if the actions of a motorist do not conform to established traffic control measures in place at the highway scene.

6. **Shadow**- the protected work area at a vehicle-related roadway incident that is shielded by the block from apparatus and other emergency vehicles.

7. **Taper**- the action of merging several lanes of moving traffic into fewer moving lanes.

8. **Temporary Work Zone**- the physical area of a roadway within which emergency personnel perform their fire, EMS and rescue tasks at a vehicle-related incident.

9. **Transition Zone**- the lanes of a roadway within which approaching motorists change their speed and position to comply with the traffic control measures established at an incident scene.

10. **Upstream**- the direction that traffic is traveling from as the vehicles approach the incident scene.

III. Safety Benchmarks

All emergency personnel are at great risk of injury or death while operating in or near moving traffic. There are several specific tactical procedures that should be taken to protect all crewmembers and emergency service personnel at the incident scene including:

1. Never trust approaching traffic

2. Avoid turning your back to approaching traffic

3. Establish an initial “block” with the first arriving emergency vehicle or fire apparatus

4. Always wear Class III high visibility reflective vests during daylight operations

5. Always wear structural firefighting helmet
6. Wear full protective clothing plus the highway safety vest at all vehicle-related emergencies between the hours of dusk and dawn or whenever lighting levels are reduced due to inclement weather conditions

7. Turn off all sources of vision impairment to approaching motorists at nighttime incidents including vehicle headlights and spotlights

8. Use fire apparatus and police vehicles to initially redirect the flow of moving traffic

9. Establish advance warning and adequate transition area traffic control measures upstream of incident to reduce travel speeds of approaching motorists

10. Use traffic cones and/or cones illuminated by flares where appropriate for sustained highway incident traffic control and direction

11. Establish a fire department member assigned to the “Flagger” function to monitor approaching traffic and activate an emergency signal if the actions of a motorist do not conform to established traffic control measures in place at the highway scene

IV. Apparatus and Emergency Vehicle Benchmarks

Listed below are benchmarks for Safe Parking of apparatus and emergency vehicles when operating in or near moving traffic.

1. Always position first-arriving apparatus to protect the scene, patients, and emergency personnel.
   a. Initial apparatus placement should provide a work area protected from traffic approaching in at least one direction.
   b. Angle apparatus on the roadway with a “block to the left” or a “block to the right” to create a physical barrier between the crash scene and approaching traffic.
   c. Allow apparatus placement to slow approaching motorists and redirect them around the scene.
   d. Use fire apparatus to block at least one additional traffic lane more than that already obstructed by the crashed vehicle(s).
   e. When practical, position apparatus in such a manner to protect the pump operator position from being exposed to approaching traffic.

2. Positioning of large apparatus must create a safe parking area for EMS units and other fire vehicles. Operating personnel, equipment and patients should be kept within the “shadow” created by the blocking apparatus at all times.

3. When blocking with apparatus to protect the emergency scene, establish a sufficient size work zone that includes all damaged vehicles, roadway debris, the patient triage and treatment area, the extrication work area, personnel and tool staging area and the ambulance loading zone.
4. Ambulance should be positioned within the protected work area with their rear patient loading door area angled away from the nearest lanes of moving traffic.

5. Command shall stage unneeded emergency vehicles off the roadway or return these units to service whenever possible.

6. At all intersections, or where the incident may be near the middle lane of the roadway, two or more sides of the incident will need to be protected.
   a. Police vehicles must be strategically positioned to expand the initial safe work zone for traffic approaching from opposing directions. The goal is to effectively block all exposed sides of the work zone. The blocking of the work zone must be prioritized, from the most critical or highest traffic volume flow to the least critical traffic direction.
   b. For first arriving engine or truck companies where a charged hoseline may be needed, block so that the pump panel is “down stream”, on the opposite side of on-coming traffic. This will protect the pump operator.
   c. At intersection incidents, consider requesting police response. Provide specific directions to the police officers as to exactly what your traffic control needs are. Ensure that police vehicles are parked in a position and location that provides additional protection of the scene.

7. Traffic cones shall be deployed from the rear of the blocking apparatus toward approaching traffic to increase the advance warning provided for approaching motorists. Cones identify and only suggest the transition and tapering actions that are required of the approaching motorist.

8. Personnel shall place cones and flares and retrieve cones while facing oncoming traffic.

9. Traffic cones shall be deployed at 15 foot intervals upstream of the blocking apparatus with the furthest traffic cone approximately 75 feet upstream to allow adequate advance warning to drivers.

10. Additional traffic cones shall be retrieved from PD units to extend the advance warning area for approaching motorists.

V. Incident Command Benchmarks

The initial-arriving company officer and/or the Incident Commander must complete critical benchmarks to assure that a safe and protected work environment for emergency scene personnel is established and maintained including:

1. Assure that the first-arriving apparatus establishes an initial block to create an initial safe work area

2. Assign a parking location for all ambulances as well as later-arriving apparatus.
Lanes of traffic shall be identified numerically as “Lane 1”, “Lane 2”, etc., beginning from the right to the left when right and left are considered from the approaching motorist’s point of view. Typically, vehicles travel a lower speed in the lower number lanes.

Directions “Right” and “Left” shall be as identified as from the approaching motorist’s point of view left or right.

Instruct the driver of the ambulance to “block to the right” or “block to the left” as it is parked at the scene to position the rear patient loading area away from the closest lane of moving traffic.

3. Assure that all ambulances on-scene are placed within the protected work area (shadow) of the larger apparatus.

4. Assure that all patients loading into Med Units is done from within a protected work zone.

5. The initial company officer and/or Incident Commander must operate as the Scene Safety Officer until this assignment is delegated.

6. Command shall assure that Opticom strobe systems are turned OFF and that other emergency lighting remains ON.

7. At residential medical emergencies, Command shall direct ambulances to park at the nearest curb to the residence for safe patient loading whenever possible.

V. Emergency Crew Personnel Benchmarks

Listed below are benchmarks for safe actions of individual personnel when operating in or near moving vehicle traffic.

1. Always maintain an acute awareness of the high risk of working in or near moving traffic. They are out to get you!

2. Never trust moving traffic.

3. Always look before you move!

4. Always keep an eye on the moving traffic!

5. Avoid turning your back to moving traffic.

6. Personnel arriving in crew cabs of fire apparatus should exit and enter the apparatus from the protected ‘shadow’ side, away from moving traffic.

7. Officers, apparatus operators, crew members in apparatus with individual jump seat configurations and all ambulance personnel must exit and enter their units with extreme caution remaining alert to moving traffic at all times.
8. Protective clothing, Class III safety vest, and helmet must be donned prior to exiting the emergency vehicle.
   
a. During normal daylight lighting conditions, don helmet and Class III safety vest or structural PPE and Class III vest when operating in or near moving traffic.
   
b. During dusk to dawn operations or when ambient lighting is reduced due to inclement weather conditions, don helmet, full protective clothing and Class III vest.
   
c. All staff personnel and assigned student trainee personnel arriving on an apparatus or emergency vehicle must don assigned helmet and Class III vest prior to exiting their vehicle.

9. Always look before opening doors and stepping out of apparatus or emergency vehicle into any moving traffic areas. When walking around fire apparatus or emergency vehicle, be alert to your proximity to moving traffic.
   
a. Stop at the corner of the unit, check for traffic, and then proceed along the unit remaining as close to the emergency vehicle as possible.
   
b. Maintain a ‘reduced profile’ when moving through any area where a minimum ‘buffer zone’ condition exists.

10. Police Department personnel may place traffic cones or flares at the scene to direct traffic. This action builds upon initial FD cone deployment and can be expanded, if needed, as later arriving Police Officers arrive. Always place and retrieve cones while facing on-coming traffic.

11. Placing flares, where safe to do so, adjacent to and in combination with traffic cones for nighttime operations greatly enhances scene safety. Where safe and appropriate to do so, place warning flares to slow and direct approaching traffic.

VI. High-Volume, Limited Access Highway Operations

High-volume limited access highways include the expressways, Tollway, and multi-lane roadways within the FD response area. The Police Department and Department of Transportation (DOT) have a desire to keep the traffic moving on these high-volume thoroughfares. When in the judgment of FD Command it becomes essential for the safety of operating personnel and the patients involved, any or all lanes, shoulders, and entry/exit ramps of these limited access highways can be completely shut down. This, however, should rarely occur and should be for as short a period of time as practical.

Unique Safe Parking procedures at expressway, Tollway, and limited-access, high-volume multi-lane roadway incidents;
1. First-arriving engine company apparatus shall establish an initial block of the lane(s) occupied by the damaged vehicle plus one additional traffic lane.

2. A ladder truck apparatus shall be automatically dispatched to all vehicle-related incidents on all limited-access, high-volume expressways, Tollway, and highways with the City.

3. The primary assignment of this Truck company apparatus and crew shall be to;
   a. Establish an upstream block occupying a minimum of two lanes plus the paved shoulder of the highway or blockage of three driving lanes of traffic upstream of the initial block provided by the first-due apparatus.
   b. The position of this apparatus shall take into consideration all factors that limit sight distance of the approaching traffic including ambient lighting conditions, weather-related conditions, road conditions, design curves, bridges, hills and over- or underpasses.
   c. Traffic cones and/or cones illuminated by flares should be placed upstream of the ladder truck apparatus by the ladder truck crew at the direction of the company officer.
   d. Traffic cones on limited-access, high-volume roadways shall be placed farther apart, with the last cone approximately 150 feet “upstream”, to allow adequate warning to drivers. Personnel shall place cones and flares and retrieve cones while facing the traffic.
   e. Assign a Flagger person to monitor the response of approaching motorists as they are directed to transition to a slower speed and taper into merged lanes of traffic.
   f. Notify Command on the incident operating channel of any approaching traffic that is not responding to the speed changes, transition, tapering and merging directions.
   g. Flagger shall activate a pre-determined audible warning to operating personnel of a non-compliant motorist approaching.
   h. Driver operator of ladder truck apparatus shall sound a series of long blasts on the apparatus air horn to audibly warn all operating personnel of the concern for the actions of an approaching motorist.

4. Police Department vehicles will be used to provide additional blocking of additional traffic lanes as needed. Med Units shall always be positioned within the safe work zone.

5. Staging of additional companies off the highway may be required. Ambulances may be brought onto the highway scene one or two at a time. An adequate size multi-patient loading area must be established.
6. Command should establish a liaison with the Police Department as soon as possible to jointly coordinate a safe work zone and to determine how to most efficiently resolve the incident and establish normal traffic flows.

7. The termination of the incident must be managed with the same aggressiveness as initial actions. Crews, apparatus, and equipment must be removed from the highway promptly, to reduce exposure to moving traffic and minimize traffic congestion.

**Officer’s Safe Parking “Cue Card”**

“Block” with first-arriving apparatus to protect the scene, patients, and emergency personnel.

- Block at least one additional lane
- Block so pump panel is “down stream”
- Block most critical or highest traffic volume direction first
- Consider requesting additional PD assistance

**Crews wear proper PPE w/Helmet**

- Class III vests at all times
- Helmet at all times
- Full PPE plus Class III vest between dusk and dawn or inclement weather

**Establish more than adequate advance warning**

- Traffic cones at 15’ intervals
- Deploy minimum 5 cones upstream
- Cones only “Suggest” they don’t Block!
- Expand initial safe work zone

**Direct placement of ambulances**

- Assure ambulances park within shadow of larger apparatus as directed
- Lane 1 is furthest right lane, next is Lane 2, then Lane 3, etc. from approaching motorist’s point of view
- Direct ambulance to “block to the right” or “block to the left” to protect loading doors
  - Place ambulance patient loading area facing away from closest lane of moving traffic
- All patient loading into Med Units is done from within a protected work zone
You are the Scene Safety Officer

- Consider assigning FF as upstream “Spotter” as necessary for approaching traffic

Night or Reduced Light Conditions

- Turn OFF vehicle headlights
- Turn OFF Opticom
- Provide overall scene lighting
- All personnel in PPE w/helmets
- Illuminate cones with flares
- Consider additional Truck company for additional upstream “Block”

Limited access, high-volume highway incidents

- Establish initial block: minimum two lanes
- Ladder truck establishes upstream block
  - two lanes plus paved shoulder or
  - three driving lanes
- Place cones and/or cones illuminated by flares upstream of ladder truck apparatus
  - last cone approximately 150 feet “upstream” of apparatus
- Establish Flagger position
  - monitor approaching traffic
  - sound emergency signal as necessary
- Driver operator of ladder truck apparatus
  - sound a series of long blasts on apparatus air horn as necessary
- Use police department vehicles for additional blocking
- Stage additional companies off highway
- Establish liaison with Police Department
- Terminate incident aggressively
Appendix F MUTCD Temporary Traffic Control (TTC) Zone Durations

CHAPTER 6I. CONTROL OF TRAFFIC THROUGH TRAFFIC INCIDENT MANAGEMENT AREAS

Section 6I.01 General Support: Whenever the acronym “TTC” is used in this Chapter, it refers to “temporary traffic control”.

Standard: The needs and control of all road users (motorists, bicyclists, and pedestrians within the highway, including persons with disabilities in accordance with the Americans with Disabilities Act of 1990 (ADA), Title II, Paragraph 35.130) through a TTC zone shall be an essential part of highway construction, utility work, maintenance operations, and the management of traffic incidents.

Support: A traffic incident is an emergency road user occurrence, a natural disaster, or other unplanned event that affects or impedes the normal flow of traffic.

A traffic incident management area is an area of a highway where temporary traffic controls are imposed by authorized officials in response to a road user incident, natural disaster, hazardous material spill, or other unplanned incident. It is a type of TTC zone and extends from the first warning device (such as a sign, light, or cone) to the last TTC device or to a point where vehicles return to the original lane alignment and are clear of the incident.

Traffic incidents can be divided into three general classes of duration, each of which has unique traffic control characteristics and needs. These classes are:

A. Major—expected duration of more than 2 hours;
B. Intermediate—expected duration of 30 minutes to 2 hours; and
C. Minor—expected duration under 30 minutes.

The primary functions of TTC at a traffic incident management area are to move road users reasonably safely and expeditiously past or around the traffic incident, to reduce the likelihood of secondary traffic crashes, and to preclude unnecessary use of the surrounding local road system. Examples include a stalled vehicle blocking a lane, a traffic crash blocking the traveled way, a hazardous material spill along a highway, and natural disasters such as floods and severe storm damage.
Guidance: In order to reduce response time for traffic incidents, highway agencies, appropriate public safety agencies (law enforcement, fire and rescue, emergency communications, emergency medical, and other emergency management), and private sector responders (towing and recovery and hazardous materials contractors) should mutually plan for occurrences of traffic incidents along the major and heavily traveled highway and street system.

On-scene responders should be trained in safe practices for accomplishing their tasks in and near traffic. Responders should always be aware of their visibility to oncoming traffic and take measures to move the traffic incident as far off the traveled roadway as possible or to provide for appropriate warning.

Responders arriving at a traffic incident should, within 15 minutes of arrival on-scene, estimate the magnitude of the traffic incident, the expected time duration of the traffic incident, and the expected vehicle queue length, and then should set up the appropriate temporary traffic controls for these estimates.

Option: Warning and guide signs used for TTC traffic incident management situations may have a black legend and border on a fluorescent pink background (see Figure 6I-1).

Support: While some traffic incidents might be anticipated and planned for, emergencies and disasters might pose more severe and unpredictable problems. The ability to quickly install proper temporary traffic controls might greatly reduce the effects of an incident, such as secondary crashes or excessive traffic delays. An essential part of fire, rescue, spill clean-up, highway agency, and enforcement activities is the proper control of road users through the traffic incident management area in order to protect responders, victims, and other personnel at the site while providing reasonably safe traffic flow. These operations might need corroborating legislative authority for the implementation and enforcement of appropriate road user regulations, parking controls, and speed zoning. It is desirable for these statutes to provide sufficient flexibility in the authority for, and implementation of, TTC to respond to the needs of changing conditions found in traffic incident management areas. 2003 Edition Page 6I-1
Appendix G Moore Recommended Exit Protocols

Exit Protocols: Officer and Driver/Operator

- Look at approaching traffic in a side mirror.
- Turn your head to look rearward over your shoulder at approaching traffic.
- Open the door partially.
- Check for approaching traffic.
- Exit the vehicle to street if safe to do so.
- Close the door.
- Maintain a low profile alongside the apparatus, with you eyes on approaching traffic.
- With your back to the apparatus, move to the front and around to the protected side of the apparatus.

Exit Protocols: Crew

- Look out the window at approaching traffic.
- Open the door partially.
- Check for approaching traffic.
- Exit the vehicle to street if safe to do so.
- Close the door.
- Assure that you are in a protected-activity area.

Exit Protocols: Ambulance Crew

- Look at approaching traffic in a side mirror.
- Turn your head to look rearward over your shoulder at approaching traffic.
- Open the door partially.
- Check for approaching traffic.
- Exit the vehicle to street if safe to do so.
- Close the door.
- Maintain a low profile alongside the ambulance, with you eyes on approaching traffic.
- With your back to the ambulance, move to the front and around to the protected side of the ambulance.
Exit Protocols: Patient Compartment

- Look at approaching traffic through the rear doors.
- Open the door partially.
- Check for approaching traffic.
- Exit the vehicle to street if safe to do so.
- Close the door.
- Maintain a low profile along the rear of the ambulance, with you eyes on approaching traffic.
- Move to the protected side of the ambulance, away from moving traffic.
Appendix H Texas State Law

§ 545.157. PASSING AUTHORIZED EMERGENCY VEHICLE.

(a) On approaching a stationary authorized emergency vehicle using visual signals that meet the requirements of Sections 547.305 and 547.702, an operator, unless otherwise directed by a police officer, shall:

(1) vacate the lane closest to the emergency vehicle when driving on a highway with two or more lanes traveling in the direction of the emergency vehicle; or
(2) slow to a speed not to exceed:
   (A) 20 miles per hour less than the posted speed limit when the posted speed limit is 25 miles per hour or more; or
   (B) five miles per hour when the posted speed limit is less than 25 miles per hour.

(b) A violation of this section is:

(1) a misdemeanor punishable under Section 542.401;
(2) a misdemeanor punishable by a fine of $500 if the violation results in property damage; or
(3) a Class B misdemeanor if the violation results in bodily injury.

(c) If conduct constituting an offense under this section also constitutes an offense under another section of this code or the Penal Code, the actor may be prosecuted under either section or under both sections.

Appendix I Arlington Inverted Chevron Reflective Graphics

3M Scotchlite Diamond Grade Reflective Sheeting
Color Lime-Yellow 3983
Color Red 3992
Red Transparent Film 1172 (Goes over Lime-Yellow)
Appendix J ANSI/ISEA Reflected Garment Standards


ANSI/ISEA 107-1999 is a voluntary standard that offers performance specifications for reflective materials, including minimum amounts, placement, background material, test methods and care labeling. In simplest terms, the ANSI/ISEA 107-1999 standard provides for a high degree of reflective material incorporated into garments...thus improving visibility...and safety.

ANSI/ISEA 107-1999 specifies three classes of garments based on work environment:

Class III
Class III garments provide the highest level of visibility to workers in high-risk environments that involve high task loads, a wide range of weather conditions and traffic exceeding 50 mph. Class III garments, provide coverage to the arms and/or legs as well as the torso, and can include pants, jackets, coveralls or rain wear. The standard recommends these garments for all roadway construction personnel and vehicle operators, utility workers, survey crews, emergency responders, railway workers and accident site investigators.

Class II
Class II garments are for users who need greater visibility in poor weather conditions and whose activities occur near roadways where traffic speeds exceed 25 mph. This class of garment is suitable for railway workers, school-crossing guards, parking and toll gate personnel, airport ground crews and law enforcement personnel directing traffic. Carolina Safety Sport manufactures a full range of vests that conform to Class II requirements.

Class I
These garments are intended for workers who have ample separation from vehicular traffic that does not exceed 25 mph. Class I garments are often safety vests that are recommended for parking service attendants, workers in warehouses with equipment traffic, shopping cart retrievers, sidewalk maintenance workers and delivery vehicle drivers.

<table>
<thead>
<tr>
<th>ANSI/ISEA 107-1999 Garment Requirements</th>
<th>Class III Garments</th>
<th>Class II</th>
<th>Class I</th>
</tr>
</thead>
<tbody>
<tr>
<td>Background Material</td>
<td>1240 in²</td>
<td>775 in²</td>
<td>217 in²</td>
</tr>
<tr>
<td>Reflective material</td>
<td>310 in²</td>
<td>201 in²</td>
<td>155 in²</td>
</tr>
</tbody>
</table>
Appendix K MUTCD Cone Specifications

* The first two cones are labeled "Night and/or Freeway, High-Speed Roadway, (equal to or above 70 km/h (45 mph)." The first cone is shown as a flared tubular shape with a base wider than the tip. The dimension from the bottom of the base to the top of the cone is shown as "More than 900 mm (36 in)." The cone and its base are shown as orange in color. Three parallel horizontal white areas labeled as "Retro-reflective Bands" are shown covering sections of the cone at three specific locations on the cone. The space between the two topmost white bands is shown as "100 to 150 mm (4 to 6 in.)

* The second cone is shown as a flared tubular shape with a base much wider than the tip. The dimension from the bottom of the base to the top of the cone is shown as "700 mm (28 in) MIN." The cone and its base are shown as orange in color. Two parallel horizontal white areas labeled as "Retro-reflective Bands" are shown covering sections of the cone at two specific locations on the cone. The top of the topmost of the two white bands is shown as "150 mm (6 in)," and the space between the two white bands is shown as "50 mm (2 in.)." The height of the lower white band is shown as "100 mm (4 in)."

* The third cone is labeled "Day and Low-Speed Roadway (less than or equal to 60 km/h (40 mph)." It is shown as a short flared tubular shape, with a base much wider than the tip and is shown as orange in color. The dimension from the bottom of the base to the top of the cone is shown as "450 mm (18 in) MIN."
Appendix L Moore Recommends on Deploying Cones, Fares, and Warning Signs etc.

- Obtain partner, if available, to act upstream as your flagger, looking out for you and monitoring the approaching traffic.
- Gather advanced-warning signs, cones and flares.
- Deploy a fluorescent pink, retro-reflective sign upstream a distance equal to 12 times the posted speed limit in feet along the edge of the nearest travel lane to serve as the advanced warning.
- Deploy the first cone or flare device at the corner of the blocking vehicle where the least amount of buffer space exists between it and moving traffic.
- Deploy additional cones or flares at appropriate intervals while moving upstream, tapering at an angle from the corner of the emergency vehicle.

Deploy cones downstream from the blocking vehicle, parallel to the lanes of moving traffic, to identify a buffer area alongside the work area.
Appendix M Feedback Instrument/Cover Letter

August 26, 2005

Po Dunk Fire Department
Chief Joe Blow
911 Emergency Lane
Wherever, USA

Chief Blow:

My name is Brian Cudaback and I am Battalion Chief with the Arlington, Texas Fire Department. I am also a student in the National Fire Academy’s Executive Fire Officer Program.

As part of this program I have to complete an applied research project that looks at an emerging issue within my department. My research topic is *Essential components for an operational safety guideline to address working in or near moving traffic*. As such, I am looking at how other departments with similar demographics approach firefighter safety when working in or near moving traffic.

Attached is a feedback instrument that I would ask you complete in order to help me with my research. I am interested in finding out whether or not you have an established guideline that addresses this problem. I am also interested in finding out what other safety enhancements your department might be incorporating to address this threat to firefighter safety. You can return the feedback instrument with the self address envelope that I have provided.

This research will provide an in-depth look at this emerging problem and will identify industry standards and recommendations as they relate to firefighter safety when working in or near moving traffic. I will also provide my department with a recommendation regarding change in our procedures geared toward enhancing safety.

Thank you for your time and the completion of your survey.
1. Department Name: ______________________________________ Career □ Volunteer □

2. Department strength: _____ Population served: _______ 2004 Total Incidents: _______

3. Does your department have a policy that deals with crews working in or near moving traffic?
   Yes □ If yes, please move to #4   No □ If no, your survey is complete.

4. What, if anything, caused your department to develop this policy?
   ____________________________________________________________________________

5. How long has your policy been in effect? ____________________

6. Has there been any updates to the policy?  Yes □ No □
   If yes, what caused the changes? _______________________________________________

7. Does your policy include recommendations from any recognized industry standard(s)?
   Please list:
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________

8. What personal safety equipment does your department provide for working in or near moving traffic? Please list:
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________
9. What safety enhancements do you provide on your apparatus to increase visibility when working in or near moving traffic? Please list:

__________________________________________________________________

__________________________________________________________________

__________________________________________________________________

__________________________________________________________________

10. What are some key components identified in your procedures? Please list

__________________________________________________________________

__________________________________________________________________

__________________________________________________________________

__________________________________________________________________

11. Has there been any positive results from the implementation of the policy? (crews avoiding injury etc.)

Yes ☐ No ☐ If yes, please explain;

__________________________________________________________________

__________________________________________________________________

__________________________________________________________________

Thanks for your time, effort and quick response!

If you would like a copy of my completed research project, I would be happy to provide you with one by e-mail ONLY. Please provide me with your e-mail address in the space provided below.

__________________________________________________________________