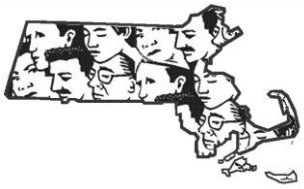
MA FACE
Occupational Fatality Report



Foreman of a Highway Line Painting Crew Killed When a Car Enters the Work Zone – Massachusetts

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Investigation: # 16-MA-023-01

Massachusetts Department of Public Health
Occupational Health Surveillance Program

SUMMARY

On June 28, 2016, a 52-year-old male foreman (victim), employed by a roadway painting and safety company, was fatally injured when he was struck by a car. The victim was part of a work crew painting roadway lines within a highway work zone at night. While standing in front of his work truck, a passing motor vehicle intruded into the work zone. The motor vehicle struck the victim and continued forward, striking a cone truck that was backing. A call was immediately placed for emergency medical services (EMS). EMS and state police arrived within minutes. The victim was transported to a local hospital where he was pronounced dead on arrival.

Contributing factors identified in this investigation included the victim being on foot and in proximity to the edge of the work zone and the operator of the motor vehicle that struck the victim was allegedly under the influence of alcohol.

The Massachusetts FACE Program concluded that to prevent similar occurrences in the future, employers should:

- **Ensure shadow vehicle operators remain inside the shadow vehicle's cab at all times while in an active work zone; and**
- **Provide routine start of shift reminders of potential hazards.**

Transportation departments should:

- **Consider using blue LED light trailers at work zones where a police detail is not required and the roadway speed limit is greater than 45 mph.**

In addition, motorists should:

- **Never drink and drive and always plan ahead to ensure they have a ride with a sober driver, so remember: Ask, Designate, Hail.**

INTRODUCTION

On June 28, 2016, the Massachusetts FACE Program was alerted by the local media that earlier that day a male employee had died from injuries sustained when he was struck by a car. The car had crashed into the highway work zone where the victim was working. On October 13, 2016, a representative from the Massachusetts FACE Program traveled to the company office location and met with multiple company representatives to discuss the incident. The state police report, death certificate, company information, and the OSHA fatality and catastrophe report were reviewed during the course of the investigation.

EMPLOYER

The employer was a roadway safety company that had been in business for about 36 years. The company provided multiple services that included roadway and pavement markings / painting. Other services the company provided were manufacturing of roadway signs, providing traffic control operations, and roadway sweeping services. The company employed approximately 150 workers in the summer months, making up about 30 roadway work crews that are sent out to complete jobs. The number of employees would drop to about 20 employees during the winter months. The job being performed on the night of the incident was part of the roadway painting contract the company had with the Massachusetts Department of Transportation.

WRITTEN SAFETY PROGRAMS AND TRAINING

At the time of the incident, the company routinely had held safety meetings with employees. The company had a safety and health program that included, but was not limited to, information on work zones and the Manual of Uniform Traffic Control Devices (MUTCD), personal protective equipment, high visibility vests and clothing for work along roadways, and hazard communication. Although new employees were typically hired with previous experience, all employees were provided with on-the-job training and partnered with more experienced employees. The on-the-job training usually started in the shop area of the company, where traffic control signs are manufactured, before the new employee was assigned to a roadway crew. Employees were also provided with the OSHA 10-hour training and a training refresher every six years.

All employees who were assigned to be out on a roadway crew were provided with American National Standards Institute's (ANSI) compliant high-visibility safety apparel. These items were yellow-green ANSI Class 3 vests with sleeves and pants. In addition, hardhats and steel toe shoes were also provided to employees.

VICTIM

The victim was a 52-year-old male foreman. He had worked for the company for a couple of years at the time of the incident. Although the victim was a foreman for the company, on this job his role was not as a foreman, but as a shadow vehicle operator. Shadow vehicles are trucks that are equipped with crash attenuators at the rear of the truck and provide a physical barrier to protect workers performing the task from traffic approaching from the rear.

The shift for this job was 8:00 p.m. to 5:00 a.m. and the victim arrived at the company location first and drove the shadow truck he was assigned to the job site. The victim was one of six

company employees that made up the work crew on site the day of the incident. The incident occurred around 2:30 a.m., about six and a half hours into his shift.

The task to be performed was roadway line painting, which is classified as a mobile operation because the work moves intermittently or continuously along down the roadway. During mobile operations, such as the one that was being performed, the shadow vehicle are spaced a short distance behind the operation and will follow the crew and equipment as work progresses.[1] The victim's task was to operate and position the shadow truck at the beginning of the work zone to help warn motorists of the work being performed ahead.

INCIDENT LOCATION

The incident location was an interstate highway that was comprised of asphalt and primarily ran north and south (Figure 1a and 1b). The highway was an eight lane divided roadway, with four travel lanes and two shoulders in each direction. The speed limit for the highway was posted at 55 miles per hour (mph). This location of the highway was in an urban area and was a relatively straight section of roadway.

The incident occurred on the northbound side of the divided highway immediately after an exit off-ramp. The four northbound travel lanes were each approximately 12 feet wide and the travel lanes were separated by white-painted dashed (skip) lines. The west side of left-hand travel lane was bordered by a 7 ½ foot paved shoulder. A solid yellow painted line separated the shoulder from the left travel lane. The western edge of this shoulder was a concrete median barrier.

The east side of the right-hand travel lane was bordered by a paved shoulder that was approximately 13 ½ feet wide. A solid white fog line separated this first travel lane from the shoulder. The location beyond the shoulder was primarily bordered by a grassy area that gently sloped upwards toward the off-ramp. In the area immediately adjacent to the off-ramp, the location between the shoulder and off-ramp was asphalt painted with white channelizing lines and white chevron markings (Figure 1).

EQUIPMENT

The company had three trucks on site for this job. As motorists approached the work zone, the first truck was the shadow truck (truck 1) the victim was operating (Figure 2). This six wheeled flatbed truck was equipped with a conventional cab, mounted attenuator, arrow board, and two yellow flashing beacons. At the time of the incident, this shadow truck was positioned at the beginning of the work zone and not moving. The attenuator was in use and in the down position, the arrow board was illuminated with a flashing arrow pointing to the left, and the two yellow beacons were also illuminated.

The second truck that was struck by the car that intruded into the work zone was the cone truck (truck 2). This six wheeled truck had a conventional cab, mounted attenuator, arrow board, and two yellow flashing beacons (Figure 3). The cargo area of the truck was open with side rails to store cones, signs, and other equipment. The truck also had rear cone wells on either side of the truck where a worker would stand to position and collect cones. The attenuator was in use and in the down position, the arrow board was illuminated with a flashing arrow pointing to the left, and

the two yellow beacon lights were also illuminated. This truck also would follow the paint truck (truck 3) as it moved along performing the painting task.

The third truck was a paint truck (truck 3), which paints the roadway lines (Figure 4). At the time of the incident, this truck was further ahead of where the incident occurred and pulled off the roadway onto the grassy area east of the right travel and breakdown lanes. This truck was equipped with an arrow board.

INVESTIGATION

The incident occurred during the early hours of a Tuesday morning. At the time of the incident, it was dark outside and the roadway was dry. The temperature was 70 degrees Fahrenheit with mostly cloudy skies and a wind speed of 12 miles per hour.

Originally the job for this shift was to paint lines on the southbound side of the highway. This particular job would have required a six mile lane closure of the southbound right travel lane and would have included exit ramp detours. The Thursday before the incident, the company contacted the state police and requested a police detail for the shift. The company was notified by the state police that they would not be able to fill the request. The state police then contacted a local municipal police department to ask them to fill the police detail.

While at the work location the day of the incident, the work crew checked in with the municipal police department because the detail was not on site. At this point the work crew was notified that the municipal police department was not going to be able to provide the police detail for the shift. Not having a police detail available prompted a change in the job for the work shift.

The job was changed to painting the white fog lines located at the east side of the northbound right travel lane between the exit off and on ramps (Figure 5). The decision to change the job was made by a state Department of Transportation inspector and a representative of the company. This job was considered a lower risk task because it was a mobile operation and the work crew would not be located in any one work area for more than 20 minutes. Also, it was considered lower risk because motorists would be traveling past only one side of the work zone.

Once the job change was communicated to the work crew, the work zone for a mobile operation on a multi-lane road work zone (Figure 6) was set up. Part of the work zone involved closing the right travel lane to oncoming traffic between the off and on ramps when the painting was occurring. The lane closure included advance warning signs, multiple 36 inch reflective traffic cones that started after the shadow truck (truck 1), and two trucks (truck 1 and 2) mounted with arrow boards. Both of these trucks were also equipped with crash attenuators. In addition, MassDOT activated overhead message boards on the highway leading up to the work zone to alert oncoming motorists of the roadway work being performed ahead. The cones were used to delineate the closed lane for motorists. There was no posted reduction in speed in the work zone area.

The shadow truck (truck 1), the truck the victim was assigned to, was positioned at the beginning of the work zone and was positioned partly in the right-hand travel lane and partly in the paved shoulder. This truck had the attached attenuator in the down position, the arrow board

illuminated with a flashing arrow pointing to the left, and the two yellow beacon lights were also illuminated. The traffic cones started in front of the shadow truck. The traffic cones were used to keep motorists out of the right-hand travel lane and were positioned in immediately to the right of the white-painted dashed skip lines that separate the right-hand travel lane from the next travel lane over. Then the cone truck (truck 2) was positioned in the right-hand travel lane in front of the shadow truck. This truck also had an attenuator in the down position and an arrow board with a flashing arrow pointing to the left, along with two illuminated yellow beacon lights.

Once a section of the fog line between the off and on ramps was painted, the work zone would be moved to the next exit location and the painting process would start again. The incident occurred at around 2:35 a.m. and at this point in the work shift all of the painting was completed. The work crew was picking up the cones as part of removing the work zone. The paint truck (truck 3) was positioned completely off the highway on the grassy shoulder further north, away from the incident. The cone truck (truck 2) had two workers in it when the crash occurred. One worker was operating the backing truck and another worker was riding in the cone well in the rear of the truck, picking up cones. The shadow truck (truck 1) was positioned at the beginning of the work zone, located just north of an exit on ramp. The victim was the operator of this truck. Immediately prior to the incident, for an unknown reason, the victim had exited truck's cab and was standing inside the work zone in the first travel lane, which was closed to oncoming traffic. Although it is unclear why the victim exited the shadow truck, his position at the time of the incident suggests that he might have gone to pick up some of the traffic cones.

According to the police report, a motorist observed a car traveling north in the second travel lane and then switched to the first travel lane. The car then started to bear to the right as if it was going to take the off-ramp located before the beginning on the work zone. The car then moved back into the second travel lane, passed the victim's truck and then moved right and entered the closed travel lane that was part of the work zone. As the car entered the work zone it struck the victim who was on foot in front of his truck (truck 1). The car continued in a northerly direction for about 75 feet and then struck the crash attenuator attached to the rear of the cone truck (truck 2) (Figure 7). The car then spun clockwise, exited the work zone and came to a stop facing southeast in the second northbound travel lane. When the car struck the victim, it threw him in a northerly direction and the victim landed in the second northbound travel lane beyond where the car ended up. The worker standing in the cone truck's well collecting cones was injured in the crash.

A call was immediately placed for emergency medical services (EMS). EMS arrived within minutes and the victim was transported to a local hospital where he was pronounced dead. Prior to the crash, the car was traveling at around 58 mile per hour (MPH) in the 55 MPH zone, and at the time of the crash the car was traveling at about 43 MPH. The driver of the car was placed under arrest and charged with Operating Under the Influence of Intoxication Liquor, among other charges.

In March of 2017, Massachusetts Department of Transportation (MassDOT) implemented some safety initiatives aimed to help reduce motor vehicle crashes and enhance safety in and around the state's work zones. Some of these initiatives included:

- Positioning portable trailers with flashing blue LED (light-emitting diode) lights, which can simulate the presence of a law enforcement vehicle, at the beginning of select work zones.
- Placing temporary portable rumble strips at the entrances of select work zones to help alert distracted drivers to the work zone ahead.
- Including work zone safety instructions in the Massachusetts Registry of Motor Vehicles Driver's Manual.
- Incorporating a "take-five" huddle or toolbox talk at the beginning of a shift, prior to setting up a work zone, to discuss potential hazards and facilitate improved communication.

CONTRIBUTING FACTORS

Occupational injuries and fatalities are often the result of one or more contributing factors or key events in a larger sequence of events that ultimately result in the injury or fatality. The Massachusetts FACE team identified the following contributing factors in this incident. The victim being on foot in proximity to the work zone edge, and that the operator of the motor vehicle that struck the victim was allegedly under the influence of alcohol.

CAUSE OF DEATH

The medical examiner listed the cause of death as multiple blunt force injuries.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Employers should ensure shadow vehicle operators remain inside the shadow vehicle's cab at all times while in an active work zone.

Discussion: In this case, the victim was assigned to operate the shadow vehicle; the first vehicle at the start of the work zone.[2] Operating the shadow vehicle was his only assigned task. Prior to the incident occurring, the victim exited his truck and then walked in front of the truck, standing between his truck and the cone truck further ahead. The victim could have been going to pick up some of the cones positioned on the white skip lines that separated the first and second travel lanes. This would have brought the victim to the edge of the work zone and in proximity to passing traffic. This location would have increased his risk of being struck by a passing vehicle.

Employers should ensure that workers assigned to operate shadow vehicles in highway work zones remain inside these vehicles at all times, especially when the operators' task does not does require the operator to exit the vehicle. The line painting task that was being performed at the time of the incident can be accomplished without workers being on foot while along the roadway. If an employee has to exit a vehicle while on a highway work zone, when possible, they should keep as far away as possible from passing motor vehicles, and always face, be attentive to, and never turn their backs to approaching motor vehicles.

Recommendation # 2: Employers should provide routine start of shift safety reminders of potential hazards.

Discussion: The employer had a safety and health program and provided employees with safety training that included training on work zones. As in this case, the company's process of deploying and picking up cones for highway work zones was typically performed from a cone truck. The cone truck makes the process faster, minimizes the amount of time the worker is on foot, and provides the employee with some protection from struck-by hazards.

As mentioned above, MassDOT is encouraging contractors to incorporate a pre-work zone setup meeting to discuss safety.[3] Providing employees with a reminder at the beginning of each shift about the hazards associated with the work to be performed and what to do if a situation arises could help employees to not become complacent with the hazards they could be exposed to. In this case, one of the routine reminders could have been about being aware of the surroundings, keeping an eye to approaching vehicles, such as the passing motorists in the adjacent travel lane with only traffic cones separating the work area from traffic. In addition, routine hazard reminders at the beginning of each shift will help ensure these workers are mentally prepared to identify hazards and to help respond appropriately if a situation arises.

Recommendation #3: Transportation departments should consider using blue LED light trailers at work zones where a police detail is not required and the roadway speed limit is greater than 45 mph.

Discussion: If feasible, transportation departments should consider using blue LED light trailers at highway work zones where police details are not required, and at non–highway work zones where police details are not required but the roadway speed limit is greater than 45 mph.

The work zone where the incident occurred was considered a lower risk work zone set up because there was traffic passing only on one side of the work zone, the left side. Having traffic passing only on one side reduces the chance of traffic conflicts occurring. In this case, the right side of the work zone was the paved highway shoulder and then a grassy area. Because this particular work zone set up was considered lower risk a police detail was not required.

MassDOT has started using blue LED light trailers at some work zones.[3] MassDOT and/or researchers should consider evaluating the effectiveness of these trailers in reducing the speed of traffic in work zones and reducing the occurrence of vehicles intruding into work zones. If these trailers are having a positive impact, then consideration should be given to expand the use of these trailers at MassDOT controlled work zones where police details are not required. These trailers could especially be used at work zones set up when it is dark outside and on roadways with a speed limit greater than 45 MPH.

Recommendation #4: Motorists should never drink and drive and always plan ahead to ensure they have a ride with a sober driver, so remember: Ask, Designate, Hail.

Discussion: In 2015, there were 272 motor vehicle traffic fatalities in Massachusetts where the driver of the vehicle had a blood alcohol concentration of 0.01 gram per deciliter (g/dL) or higher.[4] Of these fatalities, 154 involved a driver of a vehicle with a blood alcohol concentration of 0.08 g/dL or higher.[5] To make roads safe for all users, no one should ever drive under the influence of alcohol or other substances. Motorists should plan ahead to ensure they have a sober ride if consuming alcohol or other impairing substances.

There are many events and situations where a motorist has advanced notice that they will be consuming alcohol. In these types of situations, before consuming alcohol, ask a friend or family member to provide a ride to where you need to go after consuming alcohol. If there is a group of people, designate a sober driver. This person will not drink and will be responsible of getting the people who have been drinking to their desired location. If planning ahead didn't work out as expected and there is no sober driver when it is time to leave, hail a ride-sharing car, taxi service, or use public transportation. So remember: Ask, Designate, Hail to ensure you don't drive impaired or get into a car with an impaired driver.

REFERENCES

1. MUTCD 2009 Edition Part 6 Figure 6H-35. Mobile Operation on a Multi-Lane Road (TA-35)
https://mutcd.fhwa.dot.gov/htm/2009/part6/fig6h_35_longdesc.htm

2. Field Guide for the Use and Placement of Shadow Vehicles in Work Zones
https://www.workzonesafety.org/training-resources/fhwa_wz_grant/atssa_field_guide_shadow_vehicles/

3. MassDOT Blog: MassDOT to Add Additional Work Zone Safety Features. March 2017.
https://blog.mass.gov/transportation/uncategorized/massdot-to-add-additional-work-zone-safety-features/

4. NHTSA. Traffic Safety Facts, 2015 Data, December 2016
https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812350

5. Massachusetts General Laws, Part I, Title XIV, Chapter 90, Section 24
Driving while under influence of intoxicating liquor, etc.; second and subsequent offenses; punishment; treatment programs; reckless and unauthorized driving; failure to stop after collision

Figure 1a – Incident location and surrounding area

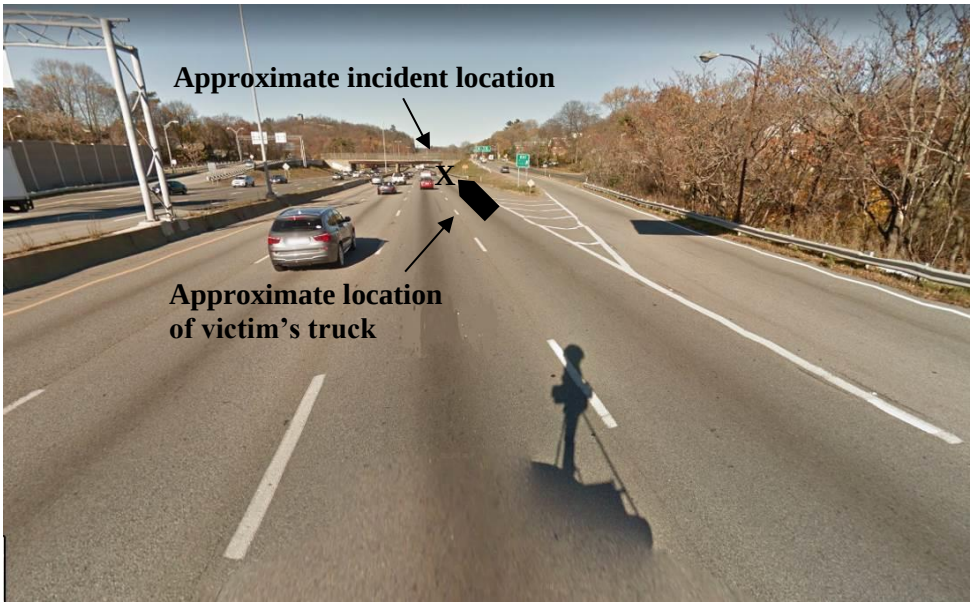

Figure 1b – Incident location aerial view

At the time of the incident the paint truck (truck 3) was further up the highway and completely off the roadway parked on the grassy area.

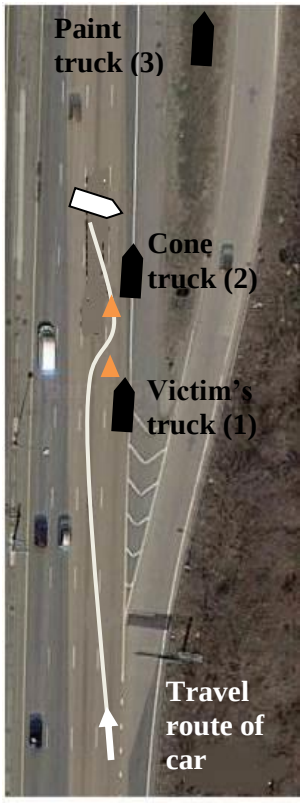

Figure 2 – Victim's truck (truck 1)

Figure 3 – Cone truck (truck 2)

Figure 4 – Paint truck (truck 3)

Figure 5 – Incident location and surrounding area

Figure 6 – MUTCD work zone set up

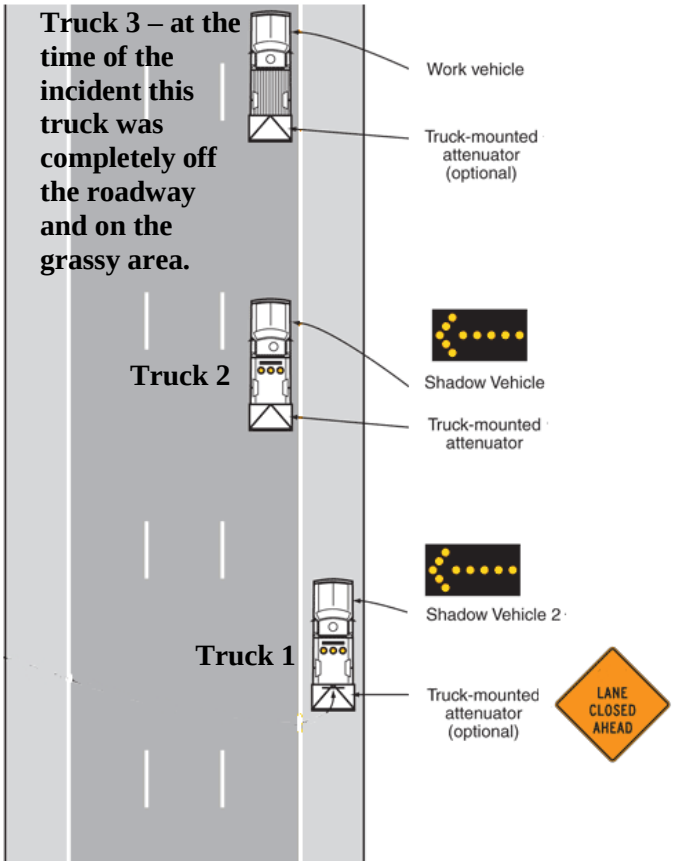

Figure 7 – The attenuator attached to the cone truck that was struck (truck 2)