MIFACE Investigation #06M068

Subject: Surveyor Dies When Struck by Oncoming Vehicle

Summary

On June 22, 2006, a 47-year-old male surveyor for a county Road Commission was struck by an oncoming vehicle while conducting surveying operations in the middle of an intersection of a two-lane highway. He was wearing an orange high visibility vest. The two-person survey crew had not set up any road signage indicating that survey work was being conducted. The crew had not established a proper lane closure nor had they set up traffic cones around the area where he was standing, holding the prism pole. The decedent was holding the prism pole in the southbound lane when an oncoming vehicle traveling in the southbound lane struck him (Figure 1). The collision caused him to become airborne and he was struck again by a northbound vehicle. 911 was called and the decedent was declared dead at the scene. The driver of the southbound vehicle was driving on a revoked license due to "vision problems."

Figure 1. Location of decedent and southbound vehicle direction. Crossroad is dotted line

RECOMMENDATIONS

- Road Commission employers should ensure employees have a copy of the Michigan Manual on Uniform Traffic Control Devices (MMUTCD) and required signage in the work vehicle, use the required signage for work performed, and that the manual requirements are implemented (such as adequate MMUTCD-required personnel are available for a work crew) when working on or near a roadway.
- Road Commission employers should ensure effective health and safety training for their employees.
- Each county Road Commission should form a joint Health and Safety Committee.
- Employers investigating additional technologies to provide supplementary employee protection such as intrusion alarms or lighted vests should consult the National Work Zone Safety Information Clearinghouse for the advantages/disadvantages of these technologies.
- The Michigan legislature should consider increased funding for public education campaigns to educate motorists about Work Zone Safety.

Key Words: Highway Work Zone, Struck By, Road Commission

INTRODUCTION

On June 22, 2006, a 47-year-old male surveyor for a county Road Commission was struck and killed by an oncoming car while conducting a surveying operation. On June 22, 2006, MIFACE investigators were informed by the Michigan Occupational Safety and Health Administration (MIOSHA) personnel who had received a report on their 24-hour-a-day hotline, that a work-related fatal injury had occurred and the decedent had died on that day. On January 31, 2007, MIFACE interviewed the Road Commission's safety manager at his office. Following the interview, the researcher visited the incident site and took several photographs (Figures 1 and 3) of the incident scene. During the course of writing this report, the police report, medical examiner's report, and MIOSHA file and citations were reviewed.

The county Road Commission performed road maintenance and the chipping and brushing of trees. The Road Commission had 180 employees. The decedent was one of three surveyors employed by the Road Commission. He was an hourly, full time employee. His normal work shift was 8-hour days with little overtime. He began work that day at 7:00 a.m. He had had many years of experience in road maintenance. He worked for another city department as a surveyor and had worked for this Road Commission for approximately eight years. The decedent was a member of a union. The Road Commission had a safety and health plan, but there were no specific procedures in place for surveying work on a two-lane state highway. The Road Commission did not have a health and safety committee. Employee health and safety training was performed by the Road Commission, but according the commission's safety manager, funds available for safety training were limited due to the funding mechanism for county Road Commissions. Training was performed on an as-needed basis and included both on-the-job and classroom style training. Training records were kept. There was a written disciplinary procedure for safety and health policy violations. The decedent had received training in Highway Construction and Work Zone Safety in Winter 2003.

MIOSHA issued the following alleged Serious Citations to the county Road Commission at the conclusion of their investigation:

- MIOSHA General Rules, Part 1
    - Rule 114(2)(c) - Employer did not provide an inspection of the construction site, tools, materials, and equipment to assure that unsafe conditions which could create a hazard are eliminated.
    - Rule 114(2)(d) - Employer did not provide instruction to each employee in the recognition and avoidance of hazards and the regulations applicable to his or her work environment to control or eliminate any hazards or other exposure to illness or injury.
- MIOSHA Construction Safety Standard - Signals, Signs, Tags and Barricades, Part 22
    - Rule 2223(2) - Employer did not ensure that all operations have routine inspections of traffic control elements for acceptable levels of operation. When traffic exposures are such that signs, signals, or barricades do not provide the necessary protection on, or adjacent to a highway or street, traffic

regulators or other appropriate traffic controls shall be provided. A qualified person who is responsible for the project traffic control shall determine modification of traffic controls, such as additional signs or devices or a change in work operations.

INVESTIGATION

The decedent and his coworker started work at 7:00 a.m. After receiving his assignment at the Road Commission's engineering department, they gathered the equipment needed for the day, such as the two-way radios, and survey instruments, and loaded them into their work van. Their first assignment was to perform a topographical survey at the intersection of two-lane state highway and a crossroad. A future apron was planned for the crossroad.

Figure 2. Satellite view of incident scene. Courtesy of Yahoo Maps.

They arrived at the incident site at approximately 9:00 a.m. (Figure 2). Both workers were wearing orange reflective vests. The coworker stated that they had placed traffic cones on the intersecting street but not on the highway.

The incident site was a two-lane asphalt road with a 55-mph speed limit. The roadway was fully marked with solid white retro reflective fog lines on the east and west side. In the area of the incident, the roadway had a broken yellow reflective line that would allow passing in the area separating northbound and southbound traffic. The weather was clear; it was daylight and the roadway was dry. There were no obvious vision distractions. The state highway did not have a stop sign. The roadway was straight at the intersection. The crossroad intersecting the highway was gravel with an asphalt apron at the intersection. The crossroad was required to stop. The police report described the traffic volume on the highway as medium.

After arriving at the worksite, the decedent and his coworker began to perform the survey activity. They did not set up road signage nor lane closures. At approximately 9:20 a.m., his coworker was positioned on the crossroad at the top of a hill approximately 1300 feet away from the highway. He was positioned in the "section line" 50 feet off the right of way approximately five feet north of the crossroad's south edge. After his coworker was positioned, the decedent drove the work van to the highway/crossroad intersection. He parked the work van on the crossroad east of the highway. (Figure 3)

Figure 3. Intersection facing east on crossroad. Vehicle location in picture is the approximate location of decedent work vehicle.

The survey crew was going to perform two line and distance measurements. Before the decedent walked onto the state highway, he radioed his coworker to see if he was ready. His coworker replied he was ready, and the decedent stated that when traffic is clear, "I'm going."

The decedent was standing in the southbound lane looking east while handling the prism pole. His coworker took one measurement, but as he was looking at the instrument to take the second measurement, he heard the crash. He didn't hear any brakes or squealing tires. He called the decedent on the radio, but received no response. The coworker started running down to the state highway and was picked up by another driver's van, which took him to the highway.

A southbound vehicle had struck the decedent. After being struck by the southbound vehicle, the decedent was thrown into the northbound lane and was struck again by a northbound vehicle. The decedent was found lying in the northbound lane of the highway. 911 was called and the decedent was declared dead at the scene.

The police report indicated that the individual driving the southbound vehicle stated that his driver's license was revoked because he could not pass the vision test and he had not been able to pass the vision test for the past seven years. He stated that just prior to the crash he was looking down at his passenger's sketchpad. He stated that he could see up close but had problems with distances.

In addition to proper signage, lane closures, and flaggers, the employer is currently investigating several technologies to provide supplementary employee protection while the employee is working on the road, such as an intrusion alarm system and a reflective vest with flashing LED lights.

CAUSE OF DEATH

The cause of death as stated on the death certificate was multiple injuries. Toxicological tests were negative for alcohol and other drugs.

RECOMMENDATIONS/DISCUSSION

- Road Commission employers should ensure employees have a copy of the Michigan Manual on Uniform Traffic Control Devices (MMUTCD) and required signage in the work vehicle, use the required signage for work performed, and that the manual requirements are implemented (such as adequate MMUTCD-required personnel are available for a work crew) when working on or near a roadway.

Michigan adopted the 2003 Federal Manual on Traffic Control Devices (MUTCD) with a 2005 Michigan Supplement and Change list. The supplement addresses those items in the Michigan Vehicle Code that conflict with the 2003 Federal MUTCD and Special Items unique to Michigan. The MMUTCD sets only the minimal standards for work zone safety.

Part 6 MMUTCD requirements identified in Section 6G10: Work Within the Traveled Way of Two-Lane Highways. Figure 6H-16, Surveying Along Centerline of Road with Low Traffic Volumes (Figure 4) illustrates the types of signage and personnel needed to conduct a surveying operation. MMUTCD Figure 6H-16 indicates that the following as a minimum be implemented:

- Survey Crew (or Road Work Ahead) signs,
- Flaggers (traffic regulators),
- Be Prepared to Stop sign, and
- Cones to delineate buffer space on each side of the centerline (unless cross-section survey).

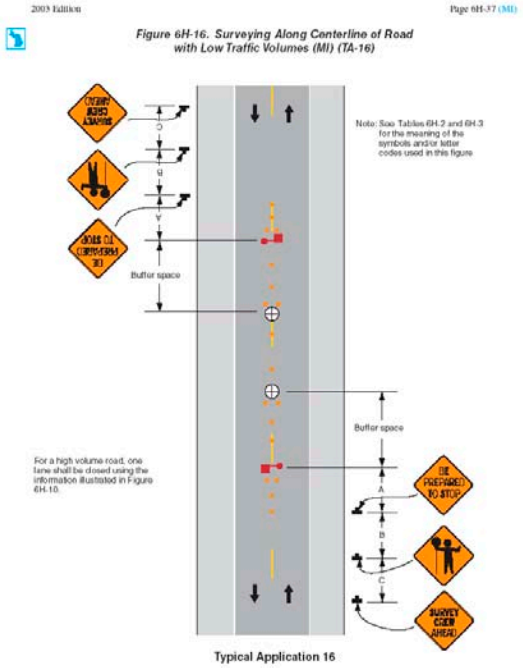

Figure 4. MMUTCD Figure 6H-16.

As noted previously, the work zone was not in compliance with the requirements of the MMUTCD. Local law enforcement officials described the road/work area as a medium traffic volume road. Because the MMUTCD does not have guidance for medium traffic volume, to provide a higher level of work zone protection, the MMUTCD requirements for a high volume road could be implemented. The MMUTCD requires that for surveying on the centerline of a high volume road, one lane shall be closed using the required signage noted in MMUTCD Figure 6H-10, Lane Closure on Two-Lane Road Using Traffic Regulator (Figure 5).

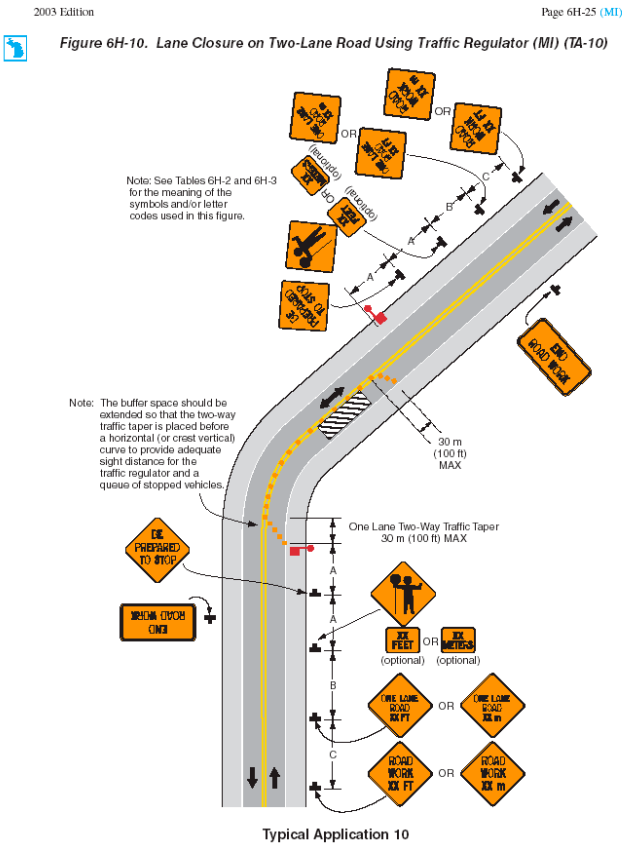

Figure 5. MMUTCD Figure 6H-10.

The decedent had reported to the Road Commission headquarters prior to beginning work that day. If the requirements for work zone protection were discussed, additional personnel may have been assigned and the work zone set up in a different manner. Although the decedent had received work zone training, the MMUTD has many temporary work zone options (low volume vs. high volume roadways, road closures, lane closures, intersection work, ramp closures, shoulder closures, etc). Due to the variability of MMUTCD requirements, it would enhance worker safety if the manual was available at the worksite in the work vehicle.

One of the factors in this incident was a visually impaired driver. In this incident, the work zone was not set up as required by the MMUTCD. Although the best laid-out protected work zone may not prevent an impaired driver from entering the protected zone, there are many options to augment the work zone protection requirements of MMUTCD.

- Portable rumble strips that can be placed on the roadway in advance of the work zone. Signage should also be used to inform the traveling public of the rumble strips ahead.

- Positive protective barriers can be used to shield workers from intruding vehicles.
  - Approved barricades, such as the concrete "jersey-type" barricades provide positive protection by helping prevent vehicles from leaving designated traffic lanes and striking workers within the work zones. Using "jersey-type" barriers requires a little more planning and set up time, and employers also need to have the right equipment available to place and remove the barriers, but they can be well worth the time, effort and cost, because of their life saving potential.
  - Water fillable plastic/composite barriers and barrels (an alternative to the concrete barriers).
  - Transportable guardrail systems.
  - Work zone nets.

Cones and other delineating devices can be useful in defining the proper traffic lanes from the work zone, but they provide little to no physical protection to the workers from an intruding vehicle that enters the work zone. This is especially true with an impaired driver, as discussed in this incident report. An impaired driver may not perceive visual delineation devices, but a well-designed positive protective barrier can be effective to prevent vehicle intrusion.

- Road Commission employers should ensure effective health and safety training for their employees.

During the MIFACE interview, the safety manager indicated that due to a "tight" budget, adequate funding was not available for employee health and safety training. Employers should consider contacting outside resources assist/provide for health and safety training to employees. MDOT offers training, by request, in work zone design, inspection, implementation, and current best practices. The MIOSHA Consultation Education and Training (CET) upon employer request will conduct a non-enforcement hazard survey of an employer's site (full or partial). The hazard survey is a training tool, which affords the employer and selected employees the opportunity to learn how to identify unsafe or unhealthy acts or conditions, MIOSHA violations, and in formulating ways to correct any noted deficiencies.

Michigan County Road Commission Self-Insurance Pool (MCRCSIP) also sponsors safety training programs for the 70 participating Road Commissions. The Loss Control section offers participating road commission members many health and safety training topics including, but not limited to, work zone training, establishing a safety committee and meetings, loss control, hearing and respiratory protection, personal protective equipment, and right-to-know training.

Wayne State University's Department of Civil and Environmental Engineering developed a downloadable training program "Highway Construction Work Zones and Traffic Control Hazards." This material was produced under grant number 46E3-HT18 from the Occupational Safety and Health Administration (OSHA), U.S. Department of Labor. These materials are geared toward workers, supervisors, and managers and consist of six

modules that address various highway construction hazards. The programs address work zone/traffic control aspects for motorists, internal traffic control within work zones, heavy equipment, overhead and underground power lines, and hand and power tools. Included is a self-tutorial, instructor material, a frequently asked questions section on how to use the program, and links to other useful websites such as OSHA, National Institute for Occupational Safety and Health (NIOSH), and Federal Highway Administration (FHWA) has also been included in this program. The materials can be either viewed on-line or downloaded by instructors to use in the classroom. The Wayne State program can be found at: http://webpages.eng.wayne.edu/osha/

- Each county Road Commission should form a joint Health and Safety Committee.

The decedent's employer did not have a joint Health and Safety (H&S) committee. An H&S Committee, comprised of both management and hourly employees provides a forum for management and employees to regularly discuss health and safety issues in the workplace. An H&S Committee is an important way for employees to help manage their own health and safety and assist the Road Commission in providing a safer, healthier workplace. The formation of the Committee provides a process for open communication on health and safety issues and enhances the ability of employees and management to resolve safety and health concerns reasonably and cooperatively.

Much of the potential value of an H&S Committee can be lost without careful development of the purpose, functions and activities of the committee. The committee will function effectively only after the need for the committee is recognized and employees, supervisors and managers welcome its services. At their worst, Health and Safety committees can be a "negative-minded" group confining their approach primarily to (after-the-fact) placing of blame. However, at their best, they can become an effective tool to help prevent unsafe practices and conditions, reduce the risk of injury and illnesses and to help motivate employees and supervisors to become actively involved the Road Commission's health and safety program.

MIOSHA has several resources that can be accessed for development of a Health and Safety committee.

- Good Safety and Health Programs are Built with Good Safety Committees brochure details the advantages of having an effective safety and health committee. Internet Address: www.michigan.gov/documents/cis_wsh_cet0140_103132_7.pdf.
- MIOSHA Safety and Health toolbox: contains materials that focus on the major components of a safety and health system. Module 2 of the toolbox focuses on employee involvement and contains several resources for health and safety committee development. Internet Address: www.michigan.gov/cis/0,1607,7-154-11407_15317-124535--,00.html.

The State of Wisconsin "Guidelines for Developing an Effective Health and Safety Committee" (www.doa.state.wi.us/docs_view2.asp?docid=665) and the Canadian Centre

for Occupational Health and Safety, Occupational Safety and Health Answers: Health and Safety Committees (www.ccohs.ca/oshanswers/hsprograms/hscommittees/) both provide valuable resources and a framework for selection of H&S Committee membership, purpose, function and activities. Michigan County Road Commission Self-Insurance Pool (MCRCSIP) also has a training session on the establishment of a Safety Committee (http://www2.mcrcsip.org/). Road Commissions may wish to contact and/or download these resources as a guide for forming their own H&S committees.

- Employers investigating additional technologies to provide supplementary employee protection such as intrusion alarms or lighted vests consult the National Work Zone Safety Information Clearinghouse for the advantages/disadvantages of these technologies.

The MMUTCD does provide for audible warning devices. Many workers are killed and injured by intruding vehicles because workers had little warning to alert them of a vehicle entering their workspace. Audible warning alarm systems may alert workers of a work zone intrusion or other emergency. There are also many types of automated intrusion warning devices available that are designed to warn workers when a vehicle has entered a restricted area of the work zone. Examples of these types of warning devices can be found in the National Work Zone Safety Information Clearinghouse (Internet Address: http://wzsafety.tamu.edu/outreach/).

Intrusion devices do not take the place of a physical barrier, but they will give the worker or inspector a number of seconds to clear the area should a vehicle enter the work zone. The essential element of an intrusion alarm is that a vehicle crosses a line of demarcation or strikes an impact activated safety alarm that warns both roadway workers and errant vehicle drivers at the same time that the work zone is compromised.

The US Department of Transportation, Federal Highway Administration, Work Zone Mobility and Safety Program, recommends that prior to intrusion alarm system installation, the employer should consider the following aspects:

- Safety - What and how are humans exposed to traffic during deployment and retrieval?
  - Will workers be exposed on foot during installation and retrieval?
  - Will workers be required to kneel, stoop or face away from traffic?
- Safety - Will the system cause motorists to react in an unpredictable manner?
  - Will the system startle passing motorists?
  - Will the system startle violating motorists?
- Ingress and Egress - Can authorized traffic enter and exit without creating a false alarm?
  - Will workers have to slow down excessively in traffic when entering the work area?
  - Will slow moving vehicles be forced to enter high-speed traffic lanes?
  - Can approach gates be developed that offer reasonable paths to enter and leave?

- False Alarms - How well does the system guard against false alarms?
  - Will traffic control devises blown over case false alarms? How many?
  - Can airborne debris cause false alarms?

Note: Any supplementation of the MMUTCD should be approved by the Michigan Department of Transportation.

- The Michigan legislature should consider increased funding for public education campaigns to educate motorists about Work Zone Safety.

Michigan Department of Transportation promotes "Give 'em a Brake," a public education program concerning work zone safety. Increased funding for public educational outreach programs to increase public awareness of the hazards faced by workers in work zones will help save lives and fulfill both MDOT and MIOSHA missions to increase the safety of workers within and motorists traveling alongside the work zone.

Michigan's Give 'em a Brake Safety Coalition is a work zone safety awareness coalition representing union road workers, law enforcement, road builders and transportation interests dedicated to urging motorists to slow down in work zones and watch out for workers. Public awareness efforts have included media public service announcements, news releases, radio advertising, and promotional items used statewide and for specific construction projects.

REFERENCES:

MIOSHA standards cited in this report may be found at and downloaded from the MIOSHA, Michigan Department of Labor and Economic Growth (DLEG) website at: www.michigan.gov/mioshastandards. MIOSHA standards are available for a fee by writing to: Michigan Department of Labor and Economic Growth, MIOSHA Standards Section, P.O. Box 30643, Lansing, Michigan 48909-8143 or calling (517) 322-1845.

- MIOSHA Construction Safety Standard, General Rules, Part 1, Rule 114(2)(c).
- MIOSHA Construction Safety Standard, Signals, Signs, Tags, And Barricades, Part 22, Rule 2223(2).
- MIOSHA Consultation Education and Training. Good Safety and Health Programs are Built with Good Safety Committees. Brochure #0140. Internet Address: http://www.michigan.gov/documents/cis_wsh_cet0140_103132_7.pdf
- MIOSHA safety and health toolbox. Internet Address: http://www.michigan.gov/cis/0,1607,7-154-11407_15317-124535--,00.html
- Michigan Department of Transportation. Work Zone Safety. Internet Address: http://www.michigan.gov/mdot/0,1607,7-151-9615_11261_45351---,00.html
- County Road Association of Michigan (CRAM). Internet Address: http://www.micountyroads.org/page.cfm/1/

- Michigan County Road Commission Self-Insurance Pool (MCRCSIP). Loss Control Section. Internet Address: http://www2.mcrcsip.org/
- Wayne State University's Department of Civil and Environmental Engineering. "Highway Construction Work Zones and Traffic Control Hazards". Internet Address: http://webpages.eng.wayne.edu/osha/
- State of Wisconsin "Guidelines for Developing an Effective Health and Safety Committee".
  Internet Address: http://www.doa.state.wi.us/docs_view2.asp?docid=665
- Canadian Centre for Occupational Health and Safety, Occupational Safety and Health Answers: Health and Safety Committees
  Internet Address: http://www.ccohs.ca/oshanswers/hsprograms/hscommittees/
- National Work Zone Safety Information Clearinghouse, Work Zone Public Education/Outreach. Internet Address: http://wzsafety.tamu.edu/outreach/
- US Department of Transportation, Federal Highway Administration. Work Zone Safety Tips to Live By. Internet Address:
  http://safety.fhwa.dot.gov/wz/wzs.htm
- Washington Department of Labor and Industries. Safety and Health Assessment and Research for Prevention. Fatality Assessment and Control Evaluation Report: Lineman Killed After Being Struck by a Car in Washington State. Investigation: #00WA04001. 2003.
  Internet Address: http://0-www.cdc.gov.mill1.sjlibrary.org/niosh/FACE/stateface/wa/00wa040.html
- US Department of Transportation. Federal Highway Administration. Work Zone Mobility and Safety Program. Text from 'Intrusion Devices—New and Emerging Technology in Worker Safety' PowerPoint Presentation. Internet Address: http://ops.fhwa.dot.gov/wz/workshops/accessible/Kochevar_ID.htm

MIFACE
Investigation Report # 06 MI 068
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To improve the quality of the MIFACE program and our investigation reports, we would like to ask you a few questions regarding this report.

Please rate the report using a scale of:

Excellent	**Good**	**Fair**	**Poor**
1	2	3	4

What was your general impression of this MIFACE investigation report?

Excellent	**Good**	**Fair**	**Poor**
1	2	3	4

Was the report…	**Excellent**	**Good**	**Fair**	**Poor**
Objective?	1	2	3	4
Clearly written?	1	2	3	4
Useful?	1	2	3	4

Were the recommendations …	**Excellent**	**Good**	**Fair**	**Poor**
Clearly written?	1	2	3	4
Practical?	1	2	3	4
Useful?	1	2	3	4

How will you use this report? (Check all that apply)

- ❑ Distribute to employees/family members
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- ❑ File for future reference
- ❑ Will not use it
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Thank You!

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