MICHIGAN State FACE Program
Fatality Assessment & Control Evaluation

Michigan State University
Department of Medicine • Occupational and Environmental Medicine
909 Fee Road, 117 West Fee Hall • East Lansing, MI 48824 • 1-517-353-1846 • https://oem.msu.edu

REPORT#: 14MI119 **REPORT DATE:** 1/16/19

Construction Owner Died in Trench Wall Collapse

INCIDENT HIGHLIGHTS

DATE:
Fall, 2014

TIME:
9:13 a.m.

VICTIM:
Pipe layer

INDUSTRY/NAICS CODE:
Construction/23

EMPLOYER:
Excavation Company

SAFETY & TRAINING:
Trench safety

SCENE:
Residential Subdivision

LOCATION:
Michigan

EVENT TYPE:
Struck By

SUMMARY

In Fall 2014 an excavating company owner in his late 50s died in a trench collapse. The decedent was performing a sanitary sewer tap to a 60-inch sewer pipe for a new home under construction. The decedent used a CAT 325BL excavator to dig a 15- to 22-foot deep, varied-width trench. The west side of the excavation was nearly vertical. The decedent entered the excavation without installing shoring or a trench box. He was standing next to the south wall near the 60-inch sewer and before he could perform any work, one of his co-workers yelled for him to watch out.... READ THE FULL REPORT> (p.3)

CONTRIBUTING FACTORS

Key contributing factors identified in this investigation include:

- Inadequate excavation protection system (shoring, benching, sloping)
- A qualified person did not inspect the trench
- Inadequate employee training in the recognition and avoidance of unsafe conditions and required safe work practices

LEARN MORE> (p.6)

RECOMMENDATIONS

MIFACE investigators concluded that, to help prevent similar occurrences, employers should:

- Protect employees from trench wall cave-in with an appropriate protective system, such as trench boxes, shields, benching and/or appropriate sloping of trench sides
- Ensure a qualified person inspects the excavation, adjacent areas, and supporting systems on a daily basis and that worker protection measures are followed… LEARN MORE> (p.6)

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Michigan Fatality Assessment and Control Evaluation (FACE) Program

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SUMMARY

In Fall 2014 an excavating company owner in his late 50s died in a trench collapse. The decedent was performing a sanitary sewer tap to a 60-inch sewer pipe for a new home under construction. The decedent used a CAT 325BL excavator to dig a 15- to 22-foot deep, varied width trench. The decedent centered and placed the 4-foot 6-inch wide excavator bucket at the top of west wall, which was nearly vertical, apparently to provide wall support. One coworker (Coworker A) was retrieving a piece of pipe outside of the excavation when the incident occurred. Coworker B was assigned to watch the walls. The decedent entered the excavation via a ladder without installing shoring or a trench box. He was standing next to the south wall near the 60-inch sewer and before he could perform any work, the day laborer yelled for him to watch out. He could not react in time when the south (left) wall of the excavation collapsed. The day laborer called emergency response. The first responders contacted another excavating contractor working nearby and he entered the excavation. The first responders and others who had entered the excavation had uncovered the decedent's head and arms almost to his waist when a second collapse (south wall and southwest corner) occurred and injured a first responder. Rescuers in the excavation were placing plywood and studs to shore the walls when an emergency responder noticed that clay was ready to fall in the northwest corner of the excavation. All rescue workers were ordered out of the excavation. The northwest wall's clay eventually fell and reburied the decedent. Trench rescue teams were called and the decedent's body was recovered from the excavation two days later.

INTRODUCTION

MIFACE personnel contacted the attorney for the decedent who agreed to be interviewed by MIFACE personnel. MIFACE reviewed the MIOSHA compliance officer file, death certificate, medical examiner and police reports during the writing of this report. Pictures used in the report are courtesy of the responding police department and pictures taken by the MIOSHA compliance officer at the time of the MIOSHA compliance inspection.

EMPLOYER

The decedent owned the excavation company for 40 years. He performed excavation and underground work for private parties, usually residential. He had approximately 30 years of experience performing excavation work. He employed one individual (Coworker A) as work required; he usually worked alone. On the day of the incident, Coworker A and a friend of the decedent (Coworker B) were at the worksite. Coworker B's tasks were handing down pipe and watching the excavation walls for signs of failure. The attorney indicated that this was the first time the decedent was involved in such a deep excavation; the decedent's firm usually excavated 5- to 6-feet below ground.

WRITTEN SAFETY PROGRAMS and TRAINING

The decedent did not have a health and safety program and did not provide health and safety training to his employees.

WORKER INFORMATION

Coworker B was a friend of the decedent's. The decedent called his friend the morning of the incident asking him to "please come watch me in a hole because he had no one" and because the "hole was not safe and dangerous to be in". The decedent responded that he had been doing this for 25-30 years. The responding police indicated Coworker B had a language barrier and that he could not write his statement.

The attorney representing the decedent did not have any information regarding Coworker A, such as how long he had worked for the decedent, any training received, level of excavation experience, etc.

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INCIDENT SCENE

The morning of the incident, the decedent used CAT 325BL excavator to dig the 15- to 22-feet deep trench. The width of the trench was variable. According to one of his coworkers, the excavation was approximately 10 feet wide, had banks on each side approximately 4 feet below ground level, and steps were created on the "back" wall about six feet in height. The area in which the decedent was working was approximately 18 feet deep. The angle of repose for the north and south walls were estimated by MIOSHA at 70^0 (best case) and 76^0 (worst case). The west wall was nearly vertical. The excavator was placed on the east wall, with the boom extended over the excavation. The decedent centered and placed the 4-foot 6-inch wide excavator bucket at the top of west wall apparently to provide wall support.

MIOSHA tested the excavation spoils and found two types of clay (a very fine textured soil that derives its resistance to displacement from cohesion) with a penetrometer. Soft clay is defined as a clay-type soil that has an unconfined strength of less than 1.0 ton per square foot (T.S.F.). Medium clay is defined as a clay-type soil that has a minimum unconfined strength of 1.0 T.S.F., firm soil is a is a clay-type soil that is resistant to forces causing rupture or displacement (a firm clay has a minimum unconfined strength of 1.5 T.S.F.). Stiff clay is a clay-type soil that is very resistant to forces causing rupture or displacement and has a minimum unconfined strength of 2.5 T.S.F. One type of clay was determined to be "soft" clay (0.5-1.0 TSF) and one was determined to be "firm" (1.25-1.75 T.S.F.).

WEATHER

Weather Underground was utilized to check the weather conditions on the day of the incident. The weather was in the upper 40s and partly cloudy. [Weather Underground]. It rained the day prior to the incident; the precipitation amount was 0.3 inches.

INVESTIGATION

The decedent had a verbal subcontract with a residential developer to perform a sanitary sewer tap to a 60-inch sewer pipe for a new home under construction. When the decedent obtained the construction permit, he was told by a city official that he needed to post a surety bond and use a trench box during the sewer tap. The workday began at approximately 0900. At the site were the owner and both of his coworkers.

The decedent entered the excavation via a ladder without any protective structures in place, such as shoring, appropriate benching, or a trench box. The Coworker B stood outside and on top of the excavation to watch the walls. Coworker A was retrieving a piece of pipe that would have been used for the final connection to the sewer from the construction truck when the incident occurred at approximately noon. The decedent was standing next to the south wall near the 60-inch sewer and before he could perform any work, the day laborer yelled for him to watch out. He could not react in time when the south (left) wall of the excavation collapsed, completely burying him and partially burying his ladder.

Figure 1. Recovery operations trench wall support

The day laborer called emergency response. Several responders arrived. A ladder from one of the city's fire trucks was lowered into the hole for egress. Rescue ropes were also lowered into the excavation and tied off to the excavator. Responders entered the excavation to start rescue efforts. The decedent was heard yelling for help and to save him. One of the responding police officers (PO#1) requested the city's dispatcher to broadcast through LIEN to area departments requesting a trench rescue team. Responders were able to clear the decedent's body of clay down to his waist. Oxygen was lowered into the excavation and placed on the decedent to help his breathing while crews continued to dig the decedent out. A police officer observed clay starting to fall from the south west corner of the excavation, and then more clay fell from the south wall. A piece of clay approximately two feet in length fell from the south wall and struck one of the emergency responder. The responder grabbed his right leg and then he was helped out of the excavation and transported to a local hospital by ambulance. Other rescuers entered the hole in attempts to place boards and studs into the hole to brace the clay. Attempts failed and PO#1 observed clay ready to fall in the northwest corner of the excavation. PO#1 ordered everyone out of the hole. The clay eventually fell and buried the decedent.

Figure 2. Placement of trench box after road removal

While recovery efforts were ongoing, city personnel contacted another contractor to assist. Recovery operations (Figure 1) were suspended early in the morning on the next day at 0130 hours until daylight hours. Later that morning, the contractor arrived and removed a portion of the street near the south side of the excavation. When this was completed, one of the responders removed a portion of their shoring equipment from the excavation. The contractor placed a trench box and stabilized the excavation. The responders recovered the rest of their equipment (See Figure 2).

Recovery operations continued and the decedent was recovered the next day. After the decedent was removed from the excavation, this same contractor filled the excavation after the sewer tap was completed.

MIOSHA Citations

MIOSHA Construction Safety and Health division issued the following Serious and Willful Serious citations to the employer at the conclusion of its investigation relating to the fatality:

SERIOUS: GENERAL RULES, CS PART 1, RULE 408.40114(1): An employer shall develop, maintain, and coordinate with employees an accident prevention program, a copy of which shall be available at the worksite.

> No accident prevention program developed. Employer engaged in sanitary sewer installation for new home construction.

SERIOUS: EXCAVATION, TRENCHING AND SHORING, CS PART 9, RULE 408.40953(2): Before the excavation begins, the design of the protection used shall be set forth by a qualified person who is knowledgeable in the subject area.

Employer failed to evaluate soil conditions; select and construct appropriate protective systems for an excavation up to 22 feet deep. Employer engaged in sanitary sewer installation for new home construction.

SERIOUS: SIGNALS, SIGNS, TAGS, AND BARRICADES, CS PART 22, RULE 408.42223(1): Traffic control devices shall be installed and maintained as prescribed in Part 6 of the 2011 MMUTCD, which is adopted by reference in R 408.42209.

Inadequate traffic control implemented, only "No Through Traffic" signs installed. Excavation in right of way on *Street Name*, vehicular traffic is being permitted to pass the excavation. Employer engaged in sanitary sewer installation for new home construction. (*MIFACE removed the name of the street)*

WILLFUL SERIOUS: EXCAVATION, TRENCHING AND SHORING, CS PART 9, RULE 408.40941(1): The side of an excavation more than 5 feet deep shall be sloped as prescribed in Table 1, unless supported as prescribed in this part.

Sides of excavation are not cut to the proper angle of repose, no shoring, no trench box. One excavation 14 ft. 11 in. north to south, and 15 ft. 7 in. east to west, and 15 to 22 ft. deep. West side of the excavation is near vertical. Employer engaged in sanitary sewer installation for new home construction.

Soil conditions previously excavated material, blue clay 0.5 to 1.0 TSF and grey clay 1.25 to 1.75 TSF.

MIOSHA Concurrent Investigation

The decedent's attorney shared with the MIFACE researcher the MIOSHA Construction Safety and Health Division concurrent investigation Citation and Notice of Penalty document which included the following Serious and Other-than-Serious citations issued to the decedent's firm:

SERIOUS: CS PART 1, GENERAL RULES, RULE 408.40132(3): A person who has a valid certificate in first aid training shall be present at the worksite to render first aid. A certificate is valid if the requirements necessary to obtain the certificate for first aid training meet or exceed the requirements of the United States Bureau of Mines, the American Red Cross, the guidelines for basic first aid training programs, or equivalent training.

No designated first aid person on site. Employer engaged in sanitary sewer installation for new home construction.

SERIOUS: CS PART 6, PERSONAL PROTECTIVE EQUIPMENT, RULE 408.40622(1): An employer shall ensure that each affected employee is provided with, and wears, head protection equipment and accessories when the employee is required to be present in areas where a hazard or risk of injury exists from any of the following:

(a) Falling or flying objects or particles
(b) Electrical shock and burns
(c) From other harmful contacts or exposures
No helmet worn by employee working within an excavation which caved in, below a suspended excavator bucket. Employee engaged in sanitary sewer installation for new home construction.

SERIOUS: CS PART 9, EXCAVATION, TRENCHING AND SHORING, RULE 408.40934: To prevent exposure to harmful levels of atmospheric contaminants and to assure acceptable atmospheric conditions, all of the following requirements shall apply:

(a) Where an oxygen deficiency (an atmosphere that contains less than 19.5% oxygen) or a hazardous atmosphere exists, such as in excavations in areas where hazardous substances are stored nearby, the atmosphere in the excavation shall be tested before employees enter excavations that are more than 4 feet (1.22m) deep.
(b) Precautions shall be taken to prevent employee exposure to atmospheres that contain less than 19.5% oxygen and any other hazardous atmosphere. These precautions include providing proper respiratory protection or ventilation in accordance with the requirements of this part.
(c) Precautions shall be taken, such as providing ventilation, to prevent employee exposure to an atmosphere that contains a concentration of flammable gas in excess of 20% of the lower flammable limit of the gas.
(d) When controls are used that are intended to reduce the level of atmospheric contaminants to acceptable levels, testing shall be conducted as often as necessary to ensure that the atmosphere remains safe.

No atmospheric testing performed prior to access into an excavation up to 22 feet deep. Employees tapping a 60-inch diameter live combined sanitary sewer with an electric drill. Natural gas line is running perpendicular to sewer line. Employer engaged in sanitary sewer installation for new home construction.

SERIOUS: CS PART 10, LIFTING AND DIGGING EQUIPMENT:

- RULE 408.41041a(2): An operator shall not leave excavation equipment unattended with a load suspended above the ground, floor or platform during working operations. A bucket or blade shall not be left suspended above the ground when a machine is unattended.

  Employee is working below an elevated excavator bucket, excavator is unattended. Bucket is being used to support one side of an excavation. Employer engaged in sanitary sewer installation for new home construction.

- RULE 408.41041a(26): If an employee could be struck by the rotating superstructure of excavation equipment, the hazardous area shall be barricaded to prevent an employee from entering and being struck.

  No barricade in place for stationary excavator guarding the swing radius. Danger signs on excavator are missing on the sides and are worn on the rear of a Cat 325 BL excavator. Employer engaged in sanitary sewer installation for new home construction.

OTHER-THAN-SERIOUS: CS PART 10, LIFTING AND DIGGING EQUIPMENT, RULE 408.41051a(1): A thorough annual inspection of all boom equipment excavating equipment shall be made by a qualified person. An employer shall maintain, on the jobsite or attached to the equipment, a copy of the latest equipment inspection record with the date and results for each piece of equipment.

No annual inspection of a Cat 325BL excavator. Employer engaged in sanitary sewer installation for new home construction.

CAUSE OF DEATH

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The death certificate listed the cause of death as asphyxiation due to a trench collapse. Toxicological results were noncontributory.

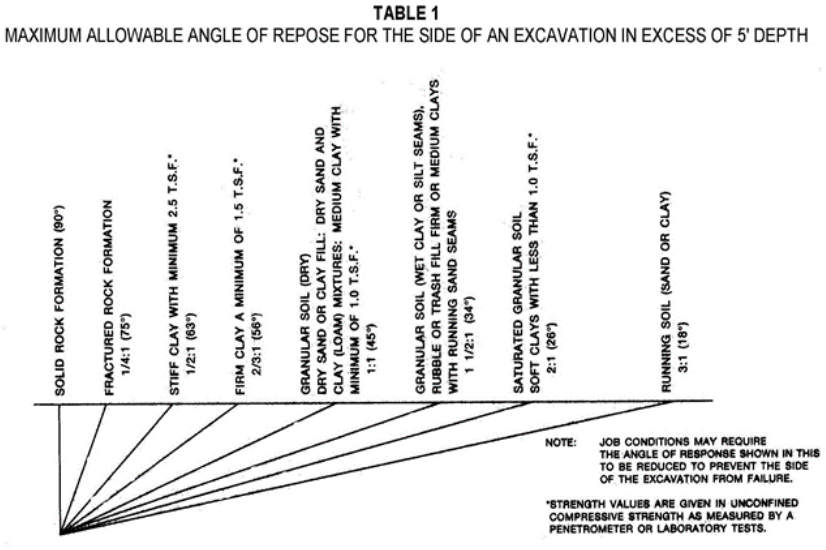
CONTRIBUTING FACTORS

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 following unrecognized hazards were identified as key contributing factors in this incident:

- *Inadequate trench support systems.*
- *Qualified person did not inspect trench prior to entry*
- *Insufficient understanding of hazards*

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Employers should ensure that employees working in excavations are protected from cave-in by an appropriate protective system, such as trench boxes, shields, benching and/or appropriate sloping of trench sides designed in accordance with MIOSHA Construction Safety Standard, Part 9, Excavation, Trenching, and Shoring.



Discussion: The MIOSHA Construction Safety Standard Part 9: Excavation, Trenching and Shoring, R408.40925 defines an excavation as any man-made cavity or depression in the earth's surface, including its sides, wall or faces, formed by earth removal. When earth is removed from the ground, the walls are left unsupported and pressures are generated at the face of the excavation. Where soil can no longer withstand the pressure, the wall will shear and break away. Usually, soil at the base of the excavation falls into the hole first, then as support is lost from below, higher wall failure may occur. One cubic foot of soil can weigh 100 pounds or more, depending on the soil's composition. Each cubic yard of soil may weigh more than 2,500 pounds producing a crushing injury to anyone caught in the wall collapse. A cubic yard of soil can weigh nearly the same amount as a mid-size automobile.

R408.40942 of Part 9 details what must be evaluated during an excavation to protect workers inside the excavation. The selection of preventative measures is based on this evaluation. Methods such as angle of repose, sloping and benching, tight sheeting/sheet piling or trench boxes and shields may be used to protect personnel in the excavation. If either adequate sloping or shoring had been used in this incident, the fatality would likely have been prevented.

Employers should consult Table 1 of Part 9 that details the maximum allowable angle of repose for the side of an excavation in excess of five-foot depth that is required, which depends upon the soil and environmental conditions

present at the site. Employers can also consult the manufacturers of protective systems to obtain detailed guidance for the appropriate use of these products. The Appendix in Part 9 has examples of good engineering practices.

When determining factors that could impose additional loads on the side of and excavation site condition, materials and equipment must be considered. If equipment is going to be used or stored next to an excavation the additional "imposed loads" must be considered and evaluated when sloping or shoring an excavation. These imposed loads could create a hazardous condition that could result in a cave-in or failure of a trench supporting system. When using supporting system some of these loads are accounted for in the tabulated data for the system as part of an industry standard and must be reviewed to ensure that site conditions and equipment are accounted for. Depending on the supporting system this can vary or be limited by the types of materials used.

Most manufactures tabulated data take into account equipment use for excavating next to an excavation and steel trench boxes are rated at 72# per square foot of load. This would only cover equipment use during the excavating activity and if a crane or additional earth moving equipment would be stored or used next to an excavation then additional calculations by an engineer would be required.

To assist employers in complying with Part 9, MIOSHA Construction Safety Division has a Trenching and Excavation – Protective Systems Fact Sheet and MIOSHA Consultation, Education and Training division has an *Excavation Training By the Numbers* Fact sheet.

OSHA and NIOSH have several resources: OSHA Construction e-Tool for Trenching and Excavation, OSHA's Safety and Health Topics Trenching and Excavation, and NIOSH Workplace Safety and Health Topics Trenching and Excavation.

The Michigan Infrastructure and Transportation Association (MITA) has developed a Trench Safety Handbook. Although not intended to be a substitute for the MIOSHA standards, the handbook provides employers with a quick reference to identify and avoid potential hazards associated with excavation activities. The Handbook is available for purchase by accessing the MITA website. Click on the MITA Store link and then Safety.

A free resource available to employers is the Trench Right application (app) developed by Ingenious Robot, Inc., and sponsored by MITA using MIOSHA Consultation, Education and Training Division grant funds. The Trench Right "app" has a step-by-step process that asks users to enter information about the trench's dimensions, soil type, and penetrometer's TSF reading to assist the determination of the required angle of repose. The Trench Right app can be downloaded from the Apple Store.

Recommendation #2: Employers should ensure that a qualified person inspects the excavation, adjacent areas, and supporting systems on an ongoing basis and that the qualified person ensures the appropriate measures necessary to protect workers are followed.

Discussion: The decedent knew that the trench was unsafe but chose not to use a protective system. He also did not have a qualified person inspect the trench as required by MIOSHA regulations. A qualified person means a person who by possession of a recognized degree or certificate of professional standing or who by extensive knowledge, training and experience has successfully demonstrated the ability to solve or resolve problems relating to the subject matter and work. If the qualified person responsibilities had been carried out, the qualified person would not allow a worker into the trench until it was made safe for the worker. Unfortunately, the decedent accepted the risks of not adequately shoring the excavation, using a trench box, or having the proper angle of repose.

Recommendation #3: Employers should ensure that all employees are trained to recognize and avoid hazardous work conditions. Employers should also ensure that the training in recognizing and avoiding hazards is coupled with employer assessment that workers are competent in the recognition of hazards and safe work practices.

Discussion: Because jobsite conditions change on a daily basis, MIFACE recommends that individuals responsible for safety on the site, discuss the day's work with the employees prior to the start of the work. This could be accomplished in short daily "tailgate" talks, covering applicable health and safety issues, weather issues, equipment issues, etc.

Employees who work in or around excavations should receive as part of their safety training the hazards associated with working in and around trenches and other excavations. Training should include the hazards of water accumulation, vibration, heavy equipment operations, underground utilities, hazardous atmospheres, soil types, and stability of surrounding structures. Other elements of excavation training should include requirements regarding means of access and egress, emergency rescue equipment, inspections, competent persons, professional engineer services, and protection of employees by sloping, benching, and support systems. Employers should also ensure that the training in recognizing and avoiding hazards is coupled with employer assessment that workers are competent in the recognition of hazards and safe work practices.

Recommendation #4 The employers of law enforcement and fire department personnel should develop standard trench rescue protocol and train their employees never to enter an unprotected trench during an emergency rescue operation.

Discussion: As happened in this incident, soil walls may collapse multiple times or in phases in the same trench. The first collapse of the trench wall may result in an undercut area of the remaining trench wall, creating a large unsupported overhang of soil. Phase Two of the collapse can occur when the overhanging section falls into the trench and may result in a smaller section of unsupported soil near the top of the trench. This section of unsupported soil is held in place only by the cohesion with the soil columns around it and will finally fail in Phase Three.

The police and fire personnel entered the unsupported excavation to provide first aid. A police officer stood atop the excavation to “watch it” in case of further collapse. While in the trench, the trench wall collapsed further injuring a responder. Rescue personnel should never, under any circumstances, enter a hazardous environment to attempt a rescue operation unless properly equipped and trained in the use of the equipment and methods required for rescue.

Only those persons trained in the requirements of NFPA 1670: Standard on Operations and Training for Technical Search and Rescue Incidents should attempt rescue operations after an excavation cave-in occurs. All persons at the incident site should follow the directions given by the Incident Commander or his/her designee in order to provide the most optimal circumstances for the safety of all persons on the site during rescue operations. Rescue attempts should be discontinued when rescue personnel are placed in imminent and immediately dangerous situations until proper shoring of excavations can be accomplished.

MIFACE recommends only those persons trained in requirements of National Fire Protection Association (NFPA) 1670 should attempt rescue operations after a trench cave-in.

ADDITIONAL RESOURCES

- MIOSHA Excavations, Trenching and Shoring Card.
  https://www.michigan.gov/documents/lara/lara_miosha_cet0204_406724_7.pdf
- OSHA Construction Safety and Health Topics.
  https://www.osha.gov/SLTC/trenchingexcavation/construction.html

- OSHA Trenching and Excavation Safety Publication: OSHA 2226-10R 2015. https://www.osha.gov/Publications/osha2226.pdf
- OSHA Excavations in Construction/Trenching v-Tool (video available in English and Spanish). https://www.osha.gov/dts/vtools/construction/trench_fnl_eng_web.html
- OSHA Construction e-tool: Trenching and Excavation. https://www.osha.gov/SLTC/etools/construction/trenching/mainpage.html
- OSHA Quick Card: Working Safely in Trenches. https://www.osha.gov/Publications/trench/trench_safety_tips_card.pdf
- OSHA Construction e-tool – Trenching and Excavation: Guide for Daily Inspection Trenches and Excavations. https://www.osha.gov/SLTC/etools/construction/trenching/excavchec.html
- NIOSH Workplace Solutions: Preventing Worker Deaths from Trench Cave-Ins. https://www.cdc.gov/niosh/docs/wp-solutions/2011-208/pdfs/2011-208.pdf
- E-LCOSH: Safety Walk-around Checklist: Trenches and Excavations. http://www.elcosh.org/record/document/1345/d000246.pdf
- Michigan Infrastructure and Transportation Association. https://thinkmita.org/
- CPWR subsite www.cpwrconstructionsolutions.org . They have a series of JSA/THA analysis for a variety of hazards for different "lines of work". One line of work is Excavation and Demolition. Various tasks can be selected, including Excavate Sites. http://www.cpwrconstructionsolutions.org/hazard/2168/collapse.html
- State and NIOSH Fatality Assessment and Control Evaluation (FACE) Reports
    - Michigan FACE Investigation #06MI004: Male Hispanic Landscape Laborer Dies When Nine-Foot-Deep Trench Collapses. https://oem.msu.edu/images/MiFACE/Investigation%20Report%2006MI004.pdf
    - Michigan FACE Investigation #06MI174: Hispanic Laborer Dies as a Result of a Trench Collapse https://oem.msu.edu/images/MiFACE/06MI174.pdf
    - Michigan FACE Investigation #12MI121. Pipefitter Dies When Excavation Wall Collapses, Causing Water Tank to Rotate and Pin Him Against Excavation Wall. https://oem.msu.edu/images/MiFACE/12MI121.pdf
    - NIOSH In-house FACE Report 99-02: Youth Dies in Trench Collapse – Arizona. https://www.cdc.gov/niosh/face/in-house/full9902.html
    - Minnesota FACE Investigation 96MN073: Construction Worker Dies After Being Buried In A Trench That Caved In. https://www.cdc.gov/niosh/face/stateface/mn/96mn073.html

DISCLAIMER

Mention of any company or product does not constitute endorsement by the Michigan FACE program or the National Institute for Occupational Safety and Health (NIOSH). In addition, citations to websites external to NIOSH do not constitute NIOSH endorsement of the sponsoring organizations or their programs or products. Furthermore, NIOSH is not responsible for the content of these websites. All web addresses referenced in this document were accessible as of the publication date.

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REFERENCES

Weather Underground [2015]. Weather history for nearby weather station. The Weather Channel Interactive, Inc.

MIOSHA standards may be found at and downloaded from the MIOSHA, Michigan Department of Licensing and Regulatory Affairs (LARA) website at: www.michigan.gov/mioshastandards. MIOSHA standards are available for a fee by writing to: Michigan Department of Licensing and Regulatory Affairs, MIOSHA Standards Section, P.O. Box 30643, Lansing, Michigan 48909-8143 or calling (517) 322-1845.

- MIOSHA Construction Safety Standard, Part 9. Excavation, Trenching and Shoring https://www.michigan.gov/documents/lara/lara_miosha_CS_9_3-18-2013_414603_7.pdf
- MIOSHA Construction Safety Standard, Part 1, General Rules https://www.michigan.gov/documents/lara/lara_miosha_cs_part_1_426600_7.pdf
- MIOSHA Construction Safety Standard, Part 6, Personal Protective Equipment https://www.michigan.gov/documents/lara/lara_miosha_CS_6_3-18-2013_414601_7.pdf
- MIOSHA Construction Safety Standard, Part 10, Lifting and Digging Equipment is now PART 10. CRANES AND DERRICKS https://www.michigan.gov/documents/CIS_WSH_part10c_35505_7.pdf

ACKNOWLEDGEMEMENT

The Michigan FACE Program would like to acknowledge the company representative for providing assistance and information for this investigation.