

REPORT#: 17MA018

REPORT DATE: September 19, 2018

INCIDENT HIGHLIGHTS



DATE:

June 15, 2017



TIME:

9:45 a.m.



VICTIM:

57-year old municipal equipment operator



INDUSTRY/NAICS CODE:

Public Works / 237110



EMPLOYER:

Municipal public works



SAFETY & TRAINING:

No safety and health program and limited on-the-job training



SCENE:

A pump station in a residential area



LOCATION:

Massachusetts

EVENT TYPE:

Crushing



Equipment Operator Dies After Zero-Turn Mower Overturns—Massachusetts

SUMMARY

On June 15, 2017, a 57-year-old equipment operator was killed while operating a ride-on mower. At the time of the incident, the equipment operator was mowing grass at a municipality-owned pump station. As the operator turned the mower to the left, it struck a low-lying rock covered by vegetation. The mower overturned, pinning the operator against the ground. [READ THE FULL REPORT](#) > (p.3)

CONTRIBUTING FACTORS

Key contributing factors identified in this investigation include:

- Mower was operated across a slope greater than 15 degrees;
- Mower was operated while rollover protective structures (ROPS) were in the folded down position;
- Lack of a comprehensive safety and health program; and
- Working alone. [LEARN MORE](#) > (p.9)

RECOMMENDATIONS

Massachusetts FACE Program concluded that, to help prevent similar occurrences, employers should:

- Ensure ride-on mower operators use ROPS and seatbelts when the mower is equipped with them.
- Routinely perform job safety analyses before mowing begins to outline the proper equipment and practices are used to perform the task safely.
- Ensure that ride-on mowers are not operated on slopes where the angle is greater than the maximum slope specified by the manufacturer.
- Routinely provide employees with training on the equipment used to complete tasks.
- Develop and implement a comprehensive safety and health program that addresses hazard recognition and avoidance of unsafe conditions.
- Consider developing policies that prevent employees from working alone when performing certain tasks. [LEARN MORE](#) > (p.9)



MASSACHUSETTS

State **FACE** Program

Fatality Assessment & Control Evaluation

Massachusetts Department of Public Health



Fatality Assessment and Control Evaluation (FACE) Program

The Massachusetts Department of Public Health, in cooperation with the National Institute for Occupational Safety and Health (NIOSH), conducts investigations on the causes of work-related fatalities. The goal of this program, known as Massachusetts Fatality Assessment and Control Evaluation (Massachusetts FACE) is to prevent future fatal workplace injuries. Massachusetts FACE aims to achieve this goal by identifying and studying the risk factors that contribute to workplace fatalities, by recommending intervention strategies, and by disseminating prevention information to employers and employees.

NIOSH funded state-based FACE Programs currently include: California, Kentucky, Massachusetts, Michigan, New York, Oregon, and Washington.



SUMMARY

On June 15, 2017, a 57-year-old equipment operator was killed while operating a ride-on mower. At the time of the incident, the equipment operator was mowing grass at a municipality-owned pump station. As the operator turned the mower to the left, it struck a low-lying rock covered by vegetation. The mower overturned, pinning the operator against the ground. A motorist passing by noticed the overturned mower, stopped, and placed a call for emergency medical services (EMS).

INTRODUCTION

On June 15, 2017, a municipal equipment operator was fatally injured when the zero-turn mower he was operating overturned. The Massachusetts FACE Program was notified by the local police department about the incident on the same day. On June 16, 2017, representatives from the Massachusetts FACE Program and the Massachusetts Department of Labor Standards traveled to the municipality where the incident occurred and met with multiple representatives from the town's police and public works departments to discuss the incident. The police report, death certificate, and other information were reviewed.

EMPLOYER

The employer was a local municipal Department of Public Works for a Massachusetts town with a population of approximately 8,900 residents. The town was incorporated in the early 1900's. The Department of Public Works had a highway division and a water and sewer division. The public works department had about five equipment operators at the time of the incident, including the victim. These employees typically worked 8 hours per day with shifts routinely starting at 7:00 a.m. and ending at 3:30 p.m., Monday through Friday. The main tasks for equipment operators included general maintenance that involved operating mowers, weed string trimmers, loaders, and skid-steer loaders. Most of the town's non-management public works employees had union representation, as did the victim.

WRITTEN SAFETY PROGRAMS and TRAINING

At the time of the incident, the department did not have a comprehensive safety and health program. Workers were provided some basic training and were also provided with personal protective equipment (PPE), including hearing and eye protection and high visibility safety apparel. When the mower involved in the incident was purchased and delivered to the town, the distributor provided training on it. The town-owned trucks were equipped with radios and when employees were not in the trucks, they used personal cell phones for communication.

WORKER INFORMATION

The victim was a 57-year-old male municipal worker who had been employed as an equipment operator by the public works department for approximately 31 years. The victim held two Massachusetts Department of Public Safety and Inspections issued licenses. One was a hoisting engineer license and the other was a license to operate front end loaders and backhoes.

INCIDENT SCENE

The incident occurred at a town-owned pump station that was located one mile from the town center in a residential area. The pump station was a single story, wood framed, vinyl sided building on a 0.31 acre corner lot. The lot was mostly flat with two sloped areas along the east and west property lines. There was an asphalt driveway that led to the station, some vegetation along the south and west property lines, and the remaining land area was grass.

WEATHER

The weather at the time of the incident was approximately 75 degrees Fahrenheit, 34% humidity, 12 mph average southerly wind speed, and mostly clear skies. There was no precipitation on the day of the incident and during the days leading up to the incident.¹ The weather is not believed to have been a factor in this incident.

EQUIPMENT

The equipment being used at the time of the incident was a zero-turn mower that was equipped with a 23 horsepower gasoline engine and four tires (Figure 1). The front tires had a smooth tread and were 13 inch by 6 inch. The rear tires had a more aggressive tread and were 22 inch by 10 inch. The mower was equipped with a foldable ROPS (Figure 2), and the operator's seat had a seatbelt and an interlock that shut off the engine if the operator left the seat while the parking brake was disengaged.

Fig. 1: Mower involved in the incident



Fig. 2: Mower with ROPS folded down



Fig.3: Manufacturer warning decal



The mower's dimensions were 78.5 inches long, 62.25 inches wide (with chute down), 68 inches high with the ROPS extended and 48.5 inches high with the ROPS in the down position. The mower had a cutting width of 48 inches and a cutting height that was adjustable from 1 – 5 inches. The mower weighed approximately 918 pounds and had a forward maximum speed of 9 miles per hour and a reverse maximum speed of 5 miles per hour.

The mower had two (right and left) levers that controlled speed and direction of travel. To move the mower in reverse, both steering control levers would be pulled backward. To travel straight forward, both steering control levers would be pushed forward. To turn left, the left lever would be pushed back or the right lever would be pushed forward or a combination of both of these operations would be performed to make a tight turn or a gradual turn. To turn right, the right lever would be pulled back or the left lever would be pushed forward or a combination of both of these operations would be performed.

The mower had many warning decals that included messaging about operating the mower on slopes greater than 15 degrees (Figure 3). The manufacturer-developed operator's manual instructed to never mow slopes greater than 15 degrees; a push mower or other equipment should be used for slopes steeper than 15 degree. The manual also instructed to mow up and down slopes and to never mow across slopes. The manual included information on the importance of using the equipped ROPS and seatbelt together at the same time. The manual stated that the foldable

ROPS should never be folded down when the mower is being used and that the ROPS should only be folded down, if needed, when transporting the mower.

INVESTIGATION

On the day of the incident, the victim arrived at the public works garage location at about 6:00 a.m. for his 7:00 a.m. shift. One of the victim's tasks this day was mowing. The mowing task routinely occurred during the growing season. There was no set schedule and how often employees mowed depended on how quickly the grass grew.

The victim transported the mower using an open trailer pulled by a town-owned pickup truck. The victim arrived at the pump station (Figure 4) at around 1:00 p.m. and unloaded the mower and started mowing. It appears that the he was mowing in the forward direction across a section of the sloped land along the east property line when the incident occurred. After the incident the slope was measured to be approximately 24 degrees (Figure 5).

Fig. 4: Pump station where the incident occurred



Fig. 5: Sloped land measured to approximately 24 degrees



The mowed path indicated the victim operated the mower across the slope, traveling towards the southern property line, which had vegetation and foliage along it. When the mower reached the area where the edge of the grass meets the edge of the vegetation and foliage (Figure 6) it appears the victim was making a 90 degree left turn, down the slope. During the turn, the mower's right front tire struck a low rock (Figure 7) that was hidden by the low vegetation and foliage, causing the mower to overturn to the left and landed on top of the victim. The victim was pinned against the ground with the mower on top of him.

Fig. 6: Incident location where the grass meets the foliage



Fig. 7: The rock that the mower right front tire struck



A passing motorist noticed the overturned mower, stopped, and then saw the victim face down with the mower's seat against the middle section of his back. The motorist immediately placed a call for emergency medical services (EMS). A second motorist stopped and both motorists tried to lift the mower off the victim, but the mower was too heavy. Within minutes of the placed call, EMS arrived. Three firefighters and a police officer were able to lift the mower off the victim. Cardiopulmonary resuscitation (CPR) was started and the victim was transported to a local hospital where he was pronounced dead.

The police reported that the victim was not wearing a seatbelt and that the rollover protective structure was not in use. The ROPS was folded and locked in the down position. During the site visit the ROPS was observed and its condition suggested that the ROPS was routinely not used due to the lack of wear and tear on the ROPS.

CAUSE OF DEATH

The medical examiner listed the cause of death as traumatic asphyxia.

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 Program identified the following contributing factors in this incident:

- *Mower was operated across a slope greater than 15 degrees;*
- *Mower was operated while the ROPS were in the folded down position;*
- *Lack of a comprehensive safety and health program; and*
- *Working alone.*

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Employers should ensure that ride-on mowers are not operated on slopes where the angle is greater than the maximum slope specified by the manufacturer.

Discussion: The manufacturer of the mower that was being used at the time of the incident included in the operator's manual that the mower should not be operated on slopes greater than 15 degrees. Operating the mower on slopes greater than 15 degrees can result in the mower overturning. The manufacturer recognizes this hazard and stated in the operator's manual that "Slopes are a major factor related to loss of control and tip-over accidents, which can result in severe injury or death." Also on slopes less than 15 degrees, the manufacturer states that the mower should only be operated up and down the slope and never across the slope.

In this case, the slope was measured to be 24 degrees at the location where the incident occurred. The ride-on mower should not have been used to mow this section of the grass. Since this slope was greater than 15 degrees, a push mower or string trimmer should have been used. In addition, because the mowing was being performed across the slope and not up and down the slope, this increased the mowers instability.

Recommendation #2: Employers should ensure ride-on mower operators use rollover protective structures (ROPS) and seatbelts when the mower is equipped with them.

Discussion: Employers should make sure that all manufacturer provided safety features are used at all times. The manufacturer had equipped the mower with both a rollover protective structure (ROPS) and a seatbelt.² The ROPS and seatbelt should be used at the same time as they are designed to work together to protect the operator of the mower. In the event that the mower overturns, the ROPS will create a space underneath the mower and the seatbelt will help keep the operator within the created space.

In this case, a foldable ROPS was provided by the manufacturer with the mower. Employers must ensure that foldable ROPS are locked in the upright position before operating the mower. Typically, foldable ROPS should only be folded down when the mower is being transported. If for some reason the mower has to be briefly operated with the ROPS folded down, for instance to avoid overhead obstruction, then the mower's seatbelt should not be used by the operator while the ROPS is folded down. Once beyond the overhead obstruction, the ROPS should immediately be positioned back into the locked, upright position for regular use.

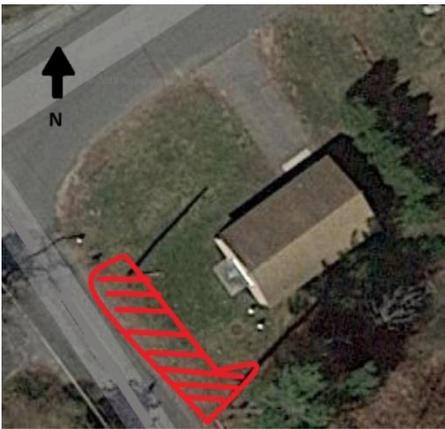
Recommendation #3: Employers should routinely perform job safety analyses before mowing begins to outline the proper equipment and practices to be used to perform the task safely.

Discussion: A job safety analysis (JSA) is a technique to systematically evaluate job tasks to ensure they are performed safely. It involves identifying potential hazards and hazardous situations that could occur when performing tasks by focusing on the relationship between the worker, the task, the tools, and the work environment.³ JSA should be routinely performed to identify uncontrolled hazards. Start by breaking down the tasks to be performed into steps, including the operation of any equipment and the use of tools to complete the task. Each step should be evaluated to identify the hazards or potential hazards. Once hazards are identified, employers should take steps to eliminate or control these hazards. It is important to have employees participate in the JSA.

In this case, a JSA could have identified the potential hazards and unsafe conditions involved with the mowing task, such as the sloped land on the eastern property line being greater than 15 degrees. This could have led to a policy that a push mower or a string trimmer should be used and not a ride-on mower for the sloped area. In addition, the JSA would have identified any protrusions and objects that would present a hazard for a ride-on mower, such as the low-lying rock that was covered by vegetation. The next step would have been to ensure workers did not operate ride-on mowers on

the sloped area or too close to the edge of the vegetation and that a push mower or a string trimmer were used instead. To ensure it is clear to employees what equipment should be used in each area, an aerial map that indicates what type of equipment should be used to cut/trim the grass for each area could be generated (Figure 8). Also, identify other potential site hazards on the map, such as slopes greater than 15 degrees and protrusions. Ensure that these maps are provided to the workers who will be completing the task.

Fig. 8: Example of an aerial map showing the location where the grass should not be cut by a ride on mower



Recommendation #4: Employers should routinely provide employees with training on the equipment used to complete tasks.

Discussion: Employers should provide workers with training before operating any equipment, including grass cutting equipment. Training ensures that the operator knows how to safely operate the equipment. Trainings should be performed by a competent person, which is defined by OSHA as “one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them”. Any training needs to be provided in the employee’s preferred language. This means the training must be provided in the language(s) and at the literacy level(s) of the employees.

In this case, the training should cover topics on the safe operation and the limitations of the specific ride-on mower, and other equipment, that workers will use. These topics include:

- Reviewing all safety devices provided by the manufacturer and ensuring that ROPS, seat belts, and guards are securely in place and properly used
- Reviewing stability and roll-over hazards associated with operating the ride-on mower
 - Never operate a ride-on mower on an angle of greater than 15 degrees
 - Always mow up and down slope; never mow across slopes
 - Decrease speed when the mower is traveling down slopes or around sharp corners
 - Avoid all sudden starts, stops, or turns
- Reviewing the importance of surveying the area for hazards and how to identify these hazards prior to beginning mowing and the areas where the use of ride-on mowers is prohibited
- Always starting the mower from the driver's seat; never start the machine while standing beside it
- Keeping both feet on the machine at all times while it is running and always perform proper shutdown procedures before dismounting.

- Always use personal protective equipment (PPE), including hearing and head protection, safety glasses, and work boots

Retraining and evaluation are necessary to ensure that workers maintain their competency to operate a riding mower safely. Retraining should be provided for each employee as required (typically annually or every couple of years), when there is an incident, including incidents where no one was injured, and when employees are observed not operating the equipment properly. In addition, all training should be documented and the documentation should include who provided the training and their qualifications, the content of the training, workers who were trained, and the assessment of each worker's comprehension of the training.

Recommendation #5: Employers should develop and implement a comprehensive safety and health program that addresses hazard recognition and avoidance of unsafe conditions.

Discussion: Having a municipality-wide safety and health program is an important part of keeping employees safe. A safety and health program should include the systematic identification, evaluation, and prevention or control of both general workplace hazards and the hazards of specific jobs and tasks. The core elements of an effective safety and health program are management leadership, worker participation, hazard identification and assessment, hazard prevention and control, education and training, and program evaluation and improvement.⁴ The program should outline safe work practices workers are expected to adhere to, specific safety protection for all tasks workers perform, how workers can identify and avoid hazards, and who workers should contact when safety and health issues or questions arise.⁴ The program should also include an explanation of the workers' rights to protection in the workplace.

When developing a safety and health program, employers should start by performing a hazard analysis of all routine tasks performed by employees for potential hazards and incorporate information about any identified hazards and their controls into the program.⁴ When determining potential hazards associated with equipment, information in the manufacturer operator's manual and on the equipment's warning labels should be reviewed and incorporated into the safety and health program procedures.

Employers should also use their employees' expertise throughout the program development process by seeking employee input. Once the program is developed, employers should continue to seek employees' input during the routine updating of the program. The program should be updated when safety concerns arise and when new equipment, tasks and chemicals are introduced into the workplace. In addition, for situations where work sites change with each job, the safety and health program should also require that a job safety analysis be performed for each job site before work begins to ensure that the required tools and personal protective equipment (PPE) needed to complete the tasks are available.

Employers should ensure that they have fully and effectively implemented their safety and health program by routinely performing assessments of tasks and immediately addressing any observed unsafe conditions. As part of the program's implementation, training should be provided to all employees on the program's topics and procedures, and should also include hazard recognition and the avoidance of unsafe conditions. All training provided to employees should be documented. In this case, the safety and health program should include a section on proper mower and other equipment selection, use of the equipment, and training.

The Massachusetts Department of Labor Standards (DLS) offers free consultation services to help small employers improve their safety and health programs, identify hazards, and train employees. DLS can be contacted at 978-242-1351. More information about DLS can be found on their website at www.mass.gov/dos/consult.

The Massachusetts Department of Industrial Accidents (DIA) has grants available for providing workplace health and safety training to employers and employees. Any company covered by the Massachusetts Workers' Compensation Insurance Law is eligible to apply for these grants. More information about these DIA grants can be found on their website at www.mass.gov/dia/safety.

Recommendation #6: Employers should consider developing policies that prevent employees from working alone when performing certain tasks.

Discussion: Not all tasks rise to the level of ensuring that workers are not working alone, but some situations do. If the task involves a location away from other workers and a ladder will be used or large piece of equipment will be operated, especially when the operator is riding on the equipment, then it is a good idea to have at least two employees working together. Companies should consider developing policies that prevent workers from performing these types of tasks alone.

Having a second person at the job site can also shorten the amount of time to complete the task. For lawn cutting tasks, while one employee uses a ride-on mower, the other employee could use a string trimmer or push mower. In this case, another reason to have more than one worker at a job site was the fact that the victim was transporting and operating a larger piece of equipment. If a co-worker was on site when the victim was pinned underneath the mower, the co-worker could have potentially minimized the victim's injuries by immediately assisted the victim and placing a call to emergency medical services.

ADDITIONAL RESOURCES

OSHA. Dangers of Roll-Overs of Riding Mowers. www.osha.gov/dsg/riding_mowers/index.html

KY FACE. Seasonal Lawn Mower Operator Crushed and Dies After Lawn Mower Rolls Over a 30 Degree Slope. www.cdc.gov/niosh/face/pdfs/15Ky041.pdf

National Association of Landscape Professionals. www.landscapeprofessionals.org

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REFERENCES

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2. OSHA. Dangers of Roll-Overs of Riding Mowers. www.osha.gov/dsg/riding_mowers/index.html. Date accessed: April 10, 2018.

3. OSHA. Job Hazard Analysis. Publication Number: 3071. www.osha.gov/Publications/osha3071.pdf. Date accessed: April 10, 2018.

4. OSHA. Recommended Practices for Safety and Health Programs. OSHA 3885. 2016. www.osha.gov/shpguidelines/. Date accessed: April 10, 2018.