Dangers of Roll-Overs of Riding Mowers

Incidents

On August 30, 2004, a groundskeeper at a mission in Santa Barbara, California, was mowing near the top edge of a retaining wall when his riding mower hit a rock and went over the ledge. The mower fell three feet and landed on top of the groundskeeper, killing him instantly.

On May 7, 2012, a groundskeeper for the National Park Service (NPS) was mowing alongside the Blue Ridge Parkway at an overlook near Asheville, North Carolina. He was operating a zero-radius-turn riding mower that was equipped with a roll-over protective structure. As he maneuvered his mower behind a trash can in a narrow section of the terrain, his mower went over an embankment and fell at least 100 feet, killing the worker.[1]

Definition

A riding mower is a self-propelled vehicle operated by a person in a seated or standing position. It is designed for cutting grassy areas such as residential lawns, golf courses, cemeteries and parks.

Riding mowers are distinct from agricultural and industrial tractors, which "are designed as utility machines for multiple uses with a variety of implements and attachments." (Source: www.dir.ca.gov/oshsb/NoticeDec09.pdf). Roll-over protection for agricultural tractors is covered by the OSHA standards in Section 1928 subpart C, Roll-Over Protective Structures.

Safety Considerations for Using Riding Mowers

Workers operating riding mowers face serious safety issues. Their employers need to make sure that the equipment in use is designed and maintained with safety in mind. The employers must make sure that workers are trained to avoid hazardous surroundings. Finally, the employers must ensure that mowing operations are performed safely.

The guidelines discussed below are based on safety principles issued by the California Department of Industrial Relations, which includes Cal/OSHA; the Canadian Centre for Occupational Health and Safety; and the Outdoor Power Equipment Institute (OPEI).

Employers Must Ensure Equipment Safety

Use and maintain all available safety equipment. Pay particular attention to the following points:

- Some riding mowers are designed by their manufacturer to be equipped with a roll-over protective structure (ROPS). The ROPS can either be standard or optional equipment. See the footnotes in the "Applicable Consensus Standards" section of this document for links to consensus standards governing which mowers must be equipped with a ROPS.
- If the mower a worker will be using does not have a ROPS, look for unused bolt holes or brackets near the seat or frame to see if the mower should be equipped with a ROPS. Do not operate any mower that was intended to be equipped with a ROPS without its ROPS in place. In many cases, retrofit kits are available. Contact the manufacturer to see if there is a kit for the mower you will be using.
- Mowers with a ROPS should also be equipped with a seat belt. Provide and use approved seat belt assemblies on all riding lawn mowers on which a ROPS has been installed.
- Where vertical clearance does not allow for a ROPS to be in the raised (active) position, the ROPS may be temporarily placed in the lowered (inactive) position. Also, workers should not wear a seat belt while operating a riding mower with the ROPS in the lowered position. Return the ROPS to the raised position as soon as the riding mower is in an area where the vertical clearance allows its use and reconnect the seat belt.
- Equip riding mowers with an operator presence control system that shuts off the blades when the operator dismounts the machine or rises out of the seat.
- Equip riding mowers with interlocks that ensure that the engine cannot start while the mower is in gear or if the blade is engaged. Inspect mowers to ensure that operator presence systems and all safety features are always in place and operable.
- Keep riding mowers in good working order, and inspect them periodically for an insecurely or incorrectly attached ROPS or seat belt.
- Mower operators should use a standard checklist to do a general inspection of the equipment before use. For example, the checklist should include checking the tire pressure and checking for missing or damaged guards, etc.
- Experienced service personnel should inspect riding mowers for the necessary safety features and overall maintenance at least annually. Only qualified personnel should service and repair riding mowers.

While it is essential to have the proper safety equipment in place on riding mowers, you should think of that step as just the beginning of your safety program.

Mowers with Sulkies Attached

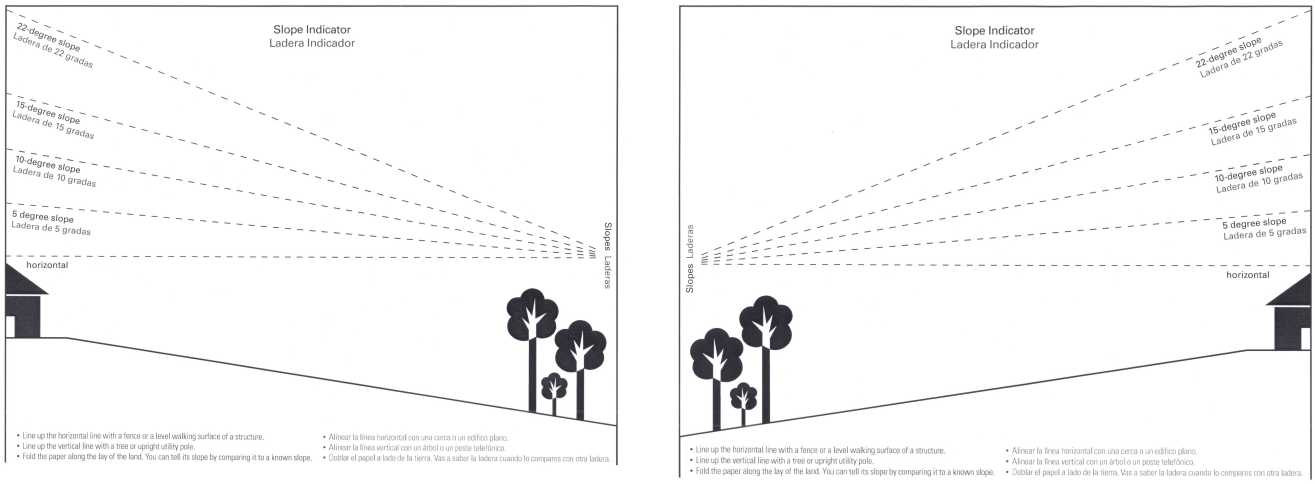
A sulky is a "[r]emovable trailing seat or stand-on platform with wheels or skids designed to carry an operator while controlling a self-propelled, pedestrian-controlled lawnmower." (Source: ANSI/OPEI B71.4-2012, page 5). This document is not meant to apply to mowers with sulkies attached. Workers and employers should see other guidance, such as ANSI/OPEI B71.4-2012, Sections 10.5 and 20.7.

Determining the Safety of the Surroundings

Employers should be familiar with the conditions of the terrain on which their mowers are being used. They should ensure that their workers take the following precautions:

- Do not operate mowers on slopes that exceed the angle limits specified by the manufacturer. Look for a label on the mower with this information.
- When the manufacturer's instructions are not available or do not specify the angle limits for operating on sloped surfaces, evaluate the terrain and slope conditions to ensure that the mower is operated in a safe manner. Avoid mowing on slopes with an angle of over 15 degrees if there is no other information available.
- Use a slope indicator, also known as a clinometer or inclinometer, if you need one. Used to determine slope angles, inclinometers are devices that attach to equipment; applications for mobile devices; or printable versions that can be downloaded online. Refer to the "Additional Resources for Employers and Workers" section of this document, and Figure 1, Slope Indicator, below.
- Always remove the key when you are leaving a mower unattended, but never leave mowers unattended on a slope. After turning off a mower, the rider/operator should set the brake, remove the key and wait to make sure that all the moving parts have stopped before leaving. The rider cannot assume that the moving parts will stop.
- Do not operate mowers in areas where the drive wheels are within five feet, as measured from the outside wheel edge, of the unprotected edges of retaining walls, embankments, levees, ditches, culverts, excavations, or similar locations that present an overturn or roll-over hazard. Use a string trimmer or a push mower instead.
- When it is necessary to operate riding mowers near ponds, creeks, reservoirs, canals, sloughs, lakes, golf course water hazards and similar bodies of water, evaluate the terrain and any slope conditions. Establish a safety zone to ensure that the mower is operated at a safe distance from such hazards. Sometimes, a distance of two mower widths is sufficient.

Figure 1, Slope Indicator



Training for Workers

Employers are responsible for providing workers with training before they can operate any lawn-mowing equipment. Training ensures that each operator is competent to operate a riding mower safely. Training must be provided in a language and vocabulary that workers can understand. Training should cover topics on the safe operation of specific riding mowers and other equipment that workers will use. These topics include:

- A review of all safety devices to ensure that ROPS, guards, seat belts, and shields are securely in place and properly used.
- The importance of surveying the terrain for hazards prior to mowing.
- How to identify obstacles in the mowing path, such as large rocks, man-made hazards such as signs and trash receptacles, tree stumps, soft or wet spots, and the areas where the use of riding mowers is prohibited.
- Reading and understanding the operations, maintenance, limitations and warning sections of the equipment manual.
- Speed control, steering and maneuvering such as:
    - Decrease speed when the mower is traveling down slopes or around sharp corners to prevent tipping.
    - Be particularly alert when backing up or while operating in low-light conditions.
    - Do not mow from side-to-side when operating mowers on unlevel or sloped ground. Always mow slopes in the up-and-down direction.

- A review of stability and roll-over hazards associated with operating riding mowers on surfaces, terrain, or areas that could pose a risk. Locations that present a roll-over risk include loading ramps, wet surfaces, slopes, and areas near drop-offs, retaining walls, embankments, streams, bodies of water (e.g., lakes and ponds), unprotected ditches, culverts and excavations.

- Employees should also be trained to:

    - Use all required personal protective equipment (PPE) at all times: hearing and head protection, safety glasses, work boots, etc. Avoid wearing jewelry and loose-fitting clothing that can easily become entangled with moving parts.
    - Never carry passengers. Riding mowers are one-person machines.
    - Always start the mower from the driver's seat. Never start the machine while standing beside it. Keep both feet on the machine at all times while it is running.
    - Never place the mower in motion until a worker is ready. Putting the mower in gear unintentionally could make it jerk forward without warning.
    - Never mount or dismount a mower while it is running, as there may be enough space for an operator's toes to pass under the mower housing and be struck by the blade. Perform proper shutdown procedures before dismounting.
    - Never stop or start a riding mower suddenly when it is going uphill or downhill. Avoid all sudden starts, stops, or turns.

In addition, agility and quickness do not ensure invincibility. The mower involved in the North Carolina incident, for example, was a zero-radius-turn mower.

Finally, the safe operation of a riding mower is similar to the safe operation of a motor vehicle – **drive defensively and expect the unexpected**. Employers should train workers to operate the mower as if there were no roll-over protective structure (ROPS) in place. A protective structure is not unlimited in its ability to protect the operator, as indicated by the incident in North Carolina described above.

Retraining and evaluation are necessary to ensure that workers maintain their competency to operate a riding mower safely. Provide refresher training to workers when:

- An operator has been observed operating a mower in an unsafe manner.
- An operator has suffered an injury or been involved in a near-miss incident.
- An operator receives a new job assignment that includes operating a mower or machinery with which the operator is unfamiliar.
- An operator receives a new job assignment that includes mowing on terrain or surfaces that present hazards unfamiliar to the operator.

How One Employer Responded to an Incident

This document began with the descriptions of two incidents, one of which occurred at a National Park Service site in North Carolina. This NPS site covered a landscaped area of 30,000 acres along a 500-mile long parkway. Following the incident, the NPS suspended all its mowing operations and did a site assessment to identify which equipment was appropriate for use in the different types of terrain that workers have to mow. Site assessment is a good practice for employers to follow before buying equipment and starting operations, because there are different types of equipment, with some designed for use only in specific terrain or on certain slopes.

The NPS evaluated the landscaped acreage and broke it down geographically. For every area that required mowing, whether covered by string trimmers, push mowers, tractors with PTO-driven flail mowers, tractors with a side-mounted, hydraulically driven, sickle bar mower attachments or riding mowers, the officials performed a site assessment to see which equipment was appropriate. (There are tractors on which flail mowers are mounted at the end of a hydraulically positioned boom, but this employer had none of those.) String trimmers and push mowers can be used on any terrain. Beyond them, the choice of allowable equipment is based on the slope of the terrain. The slope limits of 15 and 22 degrees are based on instructions provided by manufacturers.

- 0- to 15-degree slope -- riding mowers or tractor mowers are approved for these areas.
- 15- to 22-degree slope -- tractor mowers are approved for these areas.
- 22-degree and up slope -- these areas are mowed with string trimmers, push mowers or specialized equipment. Specialized equipment can be riding mowers intended for use on slopes; i.e., slope mowers. The employer had about a half-dozen to a dozen mowers with such abilities.
- Within 5 feet of a drop-off -- a buffer zone is maintained. Only string trimmers and push mowers can be used inside this zone.

For more information on performing a risk assessment, see http://www.hse.gov.uk/risk/fivesteps.htm. Accessed March 13, 2013.

Accident Prevention Programs and Injury and Illness Prevention Programs

Be prepared. Information and templates on setting up an injury and illness prevention plan can be found at these websites:

- California Department of Industrial Relations, "Guide to Developing Your Workplace Injury and Illness Prevention Program with checklists for self-inspection," http://www.dir.ca.gov/dosh/dosh_publications/iipp.html. Accessed March 18, 2013.
- Washington State Department of Labor & Industries, "Accident Prevention Program (APP)," http://www.lni.wa.gov/Safety/Basics/Programs/Accident/default.htm. Accessed March 18, 2013.

Applicable Consensus Standards

Three consensus standards cover riding mowers:

- ANSI Standard B71.1-2012 contains safety specifications that "are intended to apply to products specifically intended as consumer products for the personal use of a consumer around a house. These specifications are not intended to apply to commercial products customarily used by hired operators or to products designed primarily for agricultural purposes…."[2]
- ANSI/OPEI Standard B71.4-2012 contains the specifications for "powered (a) pedestrian-controlled machines, (b) ride-on machines and (c) implements for use with pedestrian and ride-on machines intended for marketing as commercial turf care equipment and that are customarily used by hired operators."[3]
- ISO 21299:2009 "Powered ride-on turf care equipment—Roll-over protective structures (ROPS)—Test procedures and acceptance criteria," sets forth test procedures for roll-over protective structures.[4]

On-Site Safety and Health Consultation Services for Employers

OSHA's On-site Consultation Program offers free and confidential advice to small- and medium-sized businesses in all states across the country, with priority given to high-hazard worksites. On-site consultation services are separate from enforcement and do not result in penalties or citations. Consultants from state agencies or universities work with employers to identify workplace hazards, provide advice on compliance with OSHA standards, and assist in establishing safety and health management programs. To find the On-site Consultation programs nearest you, call 1-800-321-OSHA (6742) or visit www.osha.gov/consultation.

What Rights Do Workers Have?

Workers have the right to:

- Work in conditions that do not pose a risk of serious harm.
- Receive information and training (in a language and vocabulary they can understand) about workplace hazards, methods to prevent harm and the OSHA standards that apply to their workplace.
- Obtain records of work-related injuries and illnesses.
- Get copies of test results done to find and measure hazards in their workplace.
- File a complaint with OSHA to inspect their workplace if they believe there is a serious hazard or that their employer is not following OSHA standards. When requested, OSHA will keep all identities confidential.
- Use their rights under the law without retaliation or discrimination.

Many states operate their own OSHA-approved safety and health program, with standards that may be different from but are at least as effective as Federal OSHA standards. For further information, please visit www.osha.gov/dcsp/osp/index.html.

Additional Resources for Employers and Workers

Information on Regional Emphasis Programs (REPs) and Local Emphasis Programs (LEPs) can be found at OSHA's Local Emphasis Programs website, www.osha.gov/dep/leps/leps.html.

There are additional resources available outside of OSHA:

Slope Indicators – Inclinometers - Clinometers

An inclinometer/clinometer (slope indicator) is included with this document. It can be printed as separate, machine-readable pages. Printable slope indicators can be found at the websites of some riding mower manufacturers.

Inclinometers are available as applications for mobile devices that run the Apple iOS, Google Android, PalmOS, WebOS and Windows 8 operating systems. Some are free.

Other Online Resources

American Society of Safety Engineers, "Ride-On Lawnmowers – The hazards of overturning." http://www.asse.org/professionalsafety/pastissues/054/05/F4Myers_0509.pdf. Accessed March 12, 2013.

ANSI B71.1-2012, "American National Standard for Consumer Turf Care Equipment – Pedestrian-Controlled Mowers and Ride-On Mowers – Safety Specifications." American National Standards Institute (ANSI), http://www.ansi.org. Accessed March 12, 2013.

ANSI/OPEI B71.4-2012, "American National Standard for Commercial Turf Care Equipment – Safety Specifications." American National Standards Institute (ANSI), http://www.ansi.org. Accessed March 12, 2013.

California Department of Industrial Relations, Notice of Public Meeting, December 2009. http://www.dir.ca.gov/oshsb/NoticeDec09.pdf. Accessed March 12, 2013.

California Department of Industrial Relations, Title 8, §3563, Power Lawn Mowers. Subsection (e) discusses a program of training for operators of all powered mowers. http://www.dir.ca.gov/title8/3563.html. Accessed March 12, 2013.

Canadian Centre for Occupational Health and Safety, Landscaping - Riding Lawnmowers. http://www.ccohs.ca/oshanswers/safety_haz/landscaping/lawnmower.html. Accessed March 12, 2013.

Exmark training video, http://www.youtube.com/watch?v=tiJ-PIdCedA, or, in Spanish, http://www.youtube.com/watch?v=98OtWv0YXr4. Both accessed March 19, 2013.

ISO 21299:2009 “Powered ride-on turf care equipment—Roll-over protective structures (ROPS)—Test procedures and acceptance criteria.” International Organization for Standardization (ISO), http://www.iso.org/iso/home/store/catalogue_tc/catalogue_detail.htm?csnumber=40135. Accessed March 12, 2013.

Outdoor Power Equipment Institute, Riding Lawn Mowers and Tractors, http://opei.org/content/uploads/2012/03/Riding-Lawn-Mowers-and-Tractors.pdf. Accessed March 12, 2013.

Wright Manufacturing product brochure for installing ROPS on a riding mower, http://www.wrightmfg.com/wp-content/uploads/oms/mid-mount-z/MMZ/ROPS%2005-10699.pdf. Accessed March 12, 2013.

This is one in a series of informational documents highlighting OSHA programs, policies or standards. It does not impose any new compliance requirements. For a comprehensive list of compliance requirements of OSHA standards or regulations, refer to Title 29 of the Code of Federal Regulations. This information will be made available to sensory-impaired individuals upon request. The voice phone is (202) 693-1999; teletypewriter (TTY) number: (877) 889-5627.

For assistance, contact us. We can help. It’s confidential.

OSHA® Occupational Safety and Health Administration

www.osha.gov (800) 321-OSHA (6742)

U.S. Department of Labor

[1] “Mowing halted at national parks after fatal fall,” http://bigstory.ap.org/content/mowing-halted-national-parks-after-fatal-fall, accessed February 27, 2013. “OSHA investigating mowing fatality on Blue Ridge Parkway,” http://www.carolinapublicpress.org/9921/osha-investigating-employee-death-on-blue-ridge-parkway, accessed February 27, 2013.
"11 violations found in federal investigation at Blue Ridge Parkway after worker’s death," http://www.carolinapublicpress.org/12670/11-violations-found-in-federal-investigation-at-blue-ridge-parkway-after-workers-death, accessed February 27, 2013.

[2] ANSI B71.1-2012, “American National Standard for Consumer Turf Care Equipment – Pedestrian-Controlled Mowers and Ride-On Mowers – Safety Specifications.” Accessed March 12, 2013.

[3] ANSI/OPEI B71.4-2012, “American National Standard for Commercial Turf Care Equipment – Safety Specifications.” Accessed March 12, 2013.

[4] ISO 21299:2009 “Powered ride-on turf care equipment—Roll-over protective structures (ROPS)—Test procedures and acceptance criteria.” Accessed March 12, 2013.