



MICHIGAN STATE UNIVERSITY: Prevention of work-related deaths through research & investigation

WORK-RELATED DEATHS FROM FALLS USING PORTABLE LADDERS

Portable ladders are an important piece of equipment in almost every industry. They are primarily used for ascending (climbing up) to elevated areas, descending (climbing down) to lower areas, and working at elevated heights on the ladder itself. Due to how commonplace ladders are, their use may appear to be easy and intuitive, leading individuals to underestimate the danger. Using a ladder incorrectly may result in injury or even death. In Michigan, falls involving portable ladders caused 84 deaths from 2001 to 2021. The average fall from a portable ladder that resulted in a death was 14-15 feet with the falls ranging from as high as 49 feet all the way down to 2 feet. Extension ladders were being used in 36 of the falls (43%), stepladders in 16 of the falls (19%), other types of ladders (e.g., straight, rolling or 5-way ladder) in 4 falls (5%), and the type of ladder was not documented at the time of the incident in 28 of the falls (33%). The majority of deaths occurred in construction (55%) followed by agriculture (11%) other services except public administration (7%) and retail trade (6%). The average age of the victim was 55 years old with a range of 23 to 84 years of age. 98% of the victims were men.

CASE NARRATIVES

- A self-employed painter died after falling 6 feet from a stepladder. The decedent was painting a home when he fell and hit the back of his head on the ground. He complained of head pain and lost consciousness after a few minutes.
- A carpenter died after jumping 15 feet from an unsecured extension ladder that was moved sideways by a gust of wind. As the ladder was falling, the decedent jumped to the deck below and landed at the unguarded deck edge. He then fell 10 more feet into a concrete basement well.
- A country club co-owner died when he fell 17 feet from an extension ladder. The decedent was working from a 24-foot extension ladder using a chain saw to trim tree limbs. He was working alone and when he did not come home for dinner, family members went looking for him. It appeared that when the decedent cut one of the limbs, the limb struck him and/or the ladder.
- A laborer died from a fall from a 12-foot extension ladder. The decedent was climbing the extension ladder carrying a bucket to get onto a roof. When the decedent was almost at the top of the ladder, he slipped and fell. As the decedent was falling sideways, his coworker tried to catch him at the waist, which caused him to fall head-first to the ground below.
- A farmer died as a result of a 6-foot fall. The decedent was performing repairs on a vacuum truck. An employee nearby witnessed him working on a folded 6-foot aluminum stepladder leaned against the back of the truck. He heard a sound and found the decedent unresponsive on his back on the cement.
- A masonry company co-owner died when he fell 10 feet from a scaffold. The decedent was stepping off the scaffolding onto an aluminum stepladder when the ladder slid away causing him to lose his balance and fall 10 feet to the concrete below.
- A self-employed builder died when he fell 4 feet from an extension ladder. The decedent was climbing the extension ladder to access the roof to clean off ice and snow when he fell and struck his head on the ground below.

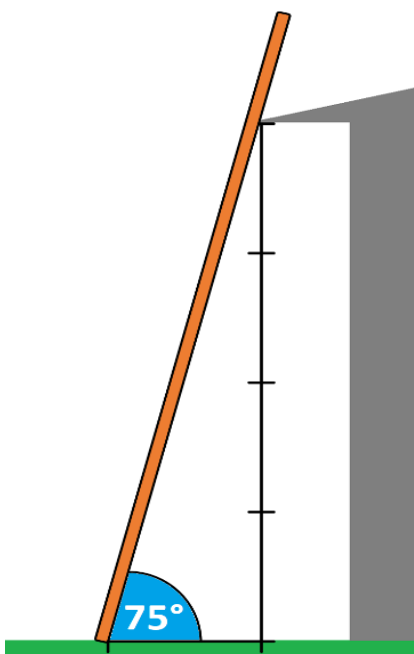


Photo from MIFACE report [18MI105](#). The duty rating of the ladder (Type 1 or 250 pounds) was exceeded by the weight of the decedent and his work equipment.

RECOMMENDATIONS TO PREVENT FALLS WITH PORTABLE LADDERS

There is a wide variety of portable ladders available. Some examples are extension ladders, straight ladders, stepladders, folding stepladders, platform stepladders, double stepladders, and convertible stepladders. There are also several types of portable ladders designed for specific tasks such as orchard ladders, manhole ladders, and shelf ladders. Using the correct type of ladder for the task is important when it comes to preventing falls. It is also important to consider the environment a ladder will be used in and type of material a ladder is constructed from such as wood, fiberglass, or metal (aluminum). These materials have various pros and cons, such as fiberglass ladders being stronger, but heavier, than aluminum ladders. Manufacturers have recommendations on which material is best for your workplace. For instance, do not use metal ladders for electrical work, as it would act as a conductor and pose an additional hazard.

- Always read and follow all of the manufacturer's instruction provided for the ladder. This includes instructions for safe use, pre-use inspection, setup, and care.
- Always keep all manufacturer's labels and markings on the ladder legible, such as the ANSI ladder ratings.
 - Obey ANSI ladder ratings for maximum weight, maximum reach, and highest standing level.
- Do not use portable ladders as platforms, runways, or scaffolds. Ladders are meant for going up and down, not side to side.
 - In some cases, ladders may be used as the upright part of a scaffolding system with a manufacturer approved horizontal plank walking surface.



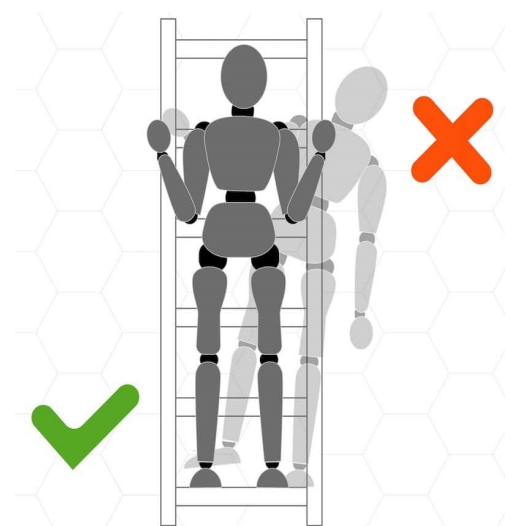
A diagram of the 4:1 Rule. The distance from the base of the ladder is to the point of contact with the structure, not the wall.

PREVENTING FALLS WHEN SETTING-UP PORTABLE LADDERS

- If using an extension or straight ladder to access an elevated level, the ladder must extend 3 feet past the point of contact and should be secured to prevent shifting. Some ladders have hooks or bumpers on the upper end for this purpose.
- For determining the proper angle of a ladder, use the 4 to 1 ratio. For every 4 feet of ladder height, the base of the ladder should be 1 foot from the base of the wall or vertical surface.
- Ladders should be deployed on stable and level surfaces. If not available, the base of the ladder must be secured to prevent movement. In some cases, this can be accomplished by using a ladder leveler or by tying the ladder to a secure and stable point.
- Ensure that all locking mechanisms are present and are fully engaged and locked before ascending the ladder. For example, these would include spreader bars on step ladders, rung locks on extension ladders, and locking hinges on multi-position or modular ladders.
- Never attempt to increase the height of a ladder by standing the ladder on other objects or by securing two ladders together.
- Ensure ladders are kept clear of all energized electrical lines.

PREVENTING FALLS WHEN USING PORTABLE LADDERS

- Ladders must only be used by the purposes for which they were designed. Example: Do not use a folded ladder as a straight ladder by leaning it against support in a folded state.
- Always maintain 3 points of contact and face the ladder when climbing or descending. Use a tool belt or hoist if tools or other materials are needed while on the ladder.
- Always face the ladder when ascending it.
- Follow the "belt-buckle" rule: Keep the center of your body (essentially, your belt-buckle) between the side rails of the ladder. Avoid overreaching to the sides.
- If you can't easily reach your work where the ladder is currently positioned, then descend from the ladder and move it closer to your desired work position.
- Never stand on cap or top step of stepladder or top two rungs of extension or straight ladder.
- Limit or re-schedule work that requires the use of a ladder during windy or other unsafe weather conditions.



An example of the "belt-buckle" rule. The solid figure has the center of their body between the side rails; the transparent figure

CREATING A SAFE WORKSPACE FOR PORTABLE LADDERS

- Do not set up ladders around doorways and blind corners, if possible.
 - If setting up a ladder near a doorway is necessary, prop the door open before setting up the ladder.
 - If the door cannot be propped open, create a Controlled Access Zone around that entrance. Reroute traffic using that doorway, if possible. Post appropriate signage and barriers to redirect workers. Post an employee, or employees, to ensure that only authorized workers are entering the area.
- Do not set up ladders in areas with regular vehicle traffic.
 - Redirect traffic if possible; utilize cones and appropriate signage to prevent vehicle access from the ladder work area.



Photo from MIFACE report [05MI163](#). The ladder is does not have safety feet, was not secured, is leaning against a moveable gate and is not following the 4:1 Rule.

PORTABLE LADDER UPKEEP TO PREVENT FALLS

- Inspections should be performed when ladders are purchased, and before each time they are used.
- Ladders should not have any major defects or damage. Damaged ladders should be inspected for repairs.
 - If repairs are deemed impossible, the ladder should be marked for destruction and disposal.
- Ensure that rungs are tight and secure to the side rails of the ladder. Do not use ladders with missing rungs.
- All fasteners and accessories should be tight and securely attached.
- Ensure that if the ladder has feet, the feet are in good condition.
- Ladder surfaces should be free of oil, grease, or any slick materials.
- Wooden ladders should not be painted, so as to not mask damage. Transparent paints/wood treatments are acceptable.
- Metal ladders must be free of rust/corrosion and dents.
- Fiberglass ladders should be free of cracks and deformation.

RESOURCES

- Get the NIOSH Ladder Safety App! Download for free.
<http://www.cdc.gov/niosh/topics/falls/mobileapp.html>
- MIOSHA General Industry Safety and Health Standard:
[Part 2, Walking-Working Surfaces](#)
- MIOSHA Construction Safety and Health Standard:
[Part 11, Fixed and Portable Ladders](#)
- MIOSHA Fact Sheet
[Portable Ladder Safety](#)
- OSHA Publications: Ladder Safety Fact Sheets and QuickCards
<https://www.osha.gov/publications/bytopic/ladder-safety>
- American Ladder Institute's
<http://www.laddersafetytraining.org>
- Oregon OSHA – Portable Ladders: How to use them so they won't let you down
<https://osha.oregon.gov/OSHApubs/3083.pdf>

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DID YOU KNOW?

The **American National Standards Institute (ANSI)** recognizes five general classes of ladders based on working load capacity:

- Type III Household—Light-duty for users requiring no more than a 200-pound load capacity for general household use.
- Type II Commercial—Medium-duty for users requiring no more than a 225-pound load capacity for painting or other medium-duty work.
- Type I Industrial—Heavy-duty for users requiring no more than a 250-pound working load capacity for maintenance, construction, or heavy-duty work.
- Type IA Industrial—Extra heavy-duty for users requiring no more than a 300-pound working load capacity for maintenance, construction, or heavy-duty work.
- Type IAA—Special duty for users requiring no more than a 375-pound working load capacity for maintenance, construction, or heavy-duty work.

ANSI requires a Duty Rating sticker to be placed on every ladder.

Load capacity includes your weight plus your clothing and PPE, any equipment you are using, and any accessories/materials you may have attached to the ladder.