

The content of this resource has been generously provided by the American Road & Transportation Builders Association.

Preventing Suspension Trauma



Arresting a fall is only the first step in preventing injury or death. Even if the arrest does not cause injury, a fallen worker can die from *suspension trauma* (orthostatic shock) if not rescued in time. Too often, a worker is saved by a personal fall arrest system (PFAS), only to succumb to suspension trauma while waiting for rescue.

Many safety managers, superintendents, and foremen assume their job is done if they limit total PFAS arresting force to 1,800 pounds and prevent impact injury during a fall. Unfortunately, post-fall suspension trauma and the time needed for rescue are often left out of fall protection plans. For a fallen worker awaiting rescue, suspension trauma can become a life-threatening emergency if not handled properly. Therefore, a fall protection plan should always include a plan for rescue.

What Is Suspension Trauma?

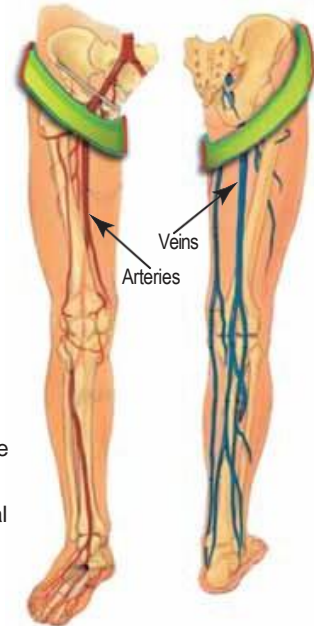
Suspension trauma happens when a fallen worker is suspended in a harness with legs hanging. While arteries near the *fronts* of the legs continue pumping blood, the harness straps act like tourniquets on the veins in the *backs* of the legs and prevent used (deoxygenated) blood returning to the heart. If circulation is impeded enough, the heart rate will abruptly slow and reduce oxygen to the brain.

Even under ideal circumstances, with a rescue plan in place, suspension trauma must be treated as an *emergency*. It can be fatal in as little as 10 minutes. Typically, suspension trauma causes death in 15 to 40 minutes.

Immediate Steps to Reduce the Risk of Suspension Trauma

The best way to slow progression of suspension trauma is to stand. When a worker stands, the leg muscles must contract, which puts pressure on the veins. This pressure, along with a series of one-way valves within the veins, helps blood return to the heart and reduces the amount of blood pooling in the legs. A fallen worker can stand in one of several ways:

- **Suspension trauma relief straps:** A fallen worker can deploy trauma relief straps, creating a loop that the worker steps into and presses against to stand up. Relief straps are typically packaged in two pouches that attach to each side of a harness.
- **Onsite work equipment:** The onsite rescue team may be able to bring a ladder, an aerial lift, or other equipment for the suspended worker to stand on.
- **Structural member:** The onsite rescue team may be able to pull the suspended worker over to a structural member, a lower level, or the ground.



Planning and Preparation



Everyone who works at heights must be fully trained in fall protection. Training should include PFAS rescue and first aid/CPR.

A specific rescue plan must be developed for each jobsite. The supervisor should assign duties, such as who calls 911 and who performs the rescue. The supervisor should evaluate in advance how *onsite work equipment* could be used. Employers should also provide specialized equipment:

- suspension trauma relief straps,
- self-rescue devices, and/or
- technical rescue equipment for assisted rescue by trained onsite workers. This may include pulley systems, brake-tube systems, winch systems, controlled descent devices, rope ladders, or other devices.

Relief Straps



Hands-On Training

The Rescue

Whether or not the suspended worker has lost consciousness, the rescue team must be careful in handling the victim. Post-rescue death is caused by the heart's inability to tolerate the abruptly increased flow of carbon dioxide-saturated blood from the legs. Do not put a rescued worker in a horizontal position - whether conscious or not.



Source: Stryker EMS.

If the rescued worker does not have any apparent injuries from the fall, the worker should be placed in a sitting position with knees close to the chest. The position is often called a 'W' position. The fall victim should remain in the 'W' position for at least 30 minutes to prevent the oxygen-deprived blood returning to the heart suddenly.

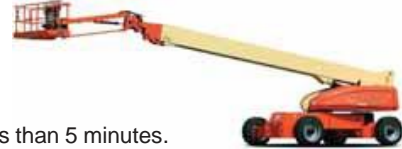
When Emergency Medical Services (EMS) arrive onsite, ensure that they know to treat the rescued worker for possible suspension trauma. Inform them how long the worker was suspended.

Employers must plan for and practice fall rescue. Even if self-rescue is the primary plan, a fallen worker may not be able to perform self-rescue, so all workers using PFAS must be trained and prepared to perform assisted rescue.

A Sample Fall Rescue Plan is available from ARTBA.

Before a Fall

- All personnel should be trained that suspension in an upright condition for longer than 5 minutes can be fatal.
- Workers should be trained to try to move their legs in the harness and try to push against any footholds.
- Workers should receive hands-on training on hanging in a harness and should try to get their legs as high as possible and their heads as close to horizontal as possible.
- Workers should not be permitted to work alone in a harness.
- Workers should have a way to signal for help, such as a whistle.
- The rescue plan and training should ensure that rescue of a fall victim happens in less than 5 minutes.
- Onsite work equipment should be evaluated for potential use in a fall rescue.
- Harnesses should be selected for the specific job application and must consider design, compliance, convenience of use, fit, potential arrest injury, and suspension trauma.



After a Fall

- Suspended workers should try to move their legs in the harness and try to push against any footholds, such as relief steps.
- Suspended workers should try to get their legs as high as possible and their heads as close to horizontal as possible.
- If the worker is suspended upright, emergency measures must be taken to remove the worker from suspension or move the fallen worker into a horizontal posture or at least to a sitting position *prior* to the rescue.
- Rescuers must be aware that post-rescue death may happen if a victim is moved too rapidly to a horizontal position. Moving a worker too quickly to a horizontal position is likely to allow a large volume of used (deoxygenated) blood to move to the heart, causing cardiac arrest.
- Rescuers must be aware of the first aid measures to prevent suspension trauma.

References

1. Illinois Region VII EMS, Emergency Medical Services, an alliance of six EMS Systems with nearly 5,000 EMS providers. A PowerPoint presentation for EMS responders can be downloaded at <http://www.regionviiems.com/forms/SCC%20CE%20April%202013.pdf>
2. U.S. Department of Labor, Occupational Safety and Health Administration, Safety and Health Information Bulletin on Suspension Trauma. <https://www.osha.gov/dts/shib/shib032404.html>
3. Robertson, David. Orthostatic Intolerance. Vanderbilt University, Nashville, Tennessee. <http://mc.vanderbilt.edu/gcrc/aas/CAR/NOH%20Supplement/06%20Dr.%20Robertson.pdf>
4. Seddon, Paul. Harness Suspension: Review and evaluation of existing information. Health and Safety Executive. http://www.hse.gov.uk/research/crr_pdf/2002/crr02451.pdf
5. Weems, Bill and Bishop, Phil. Will Your Safety Harness Kill You? Electronic Library of Construction Occupational Safety & Health (elcosh). http://elcosh.org/document/1662/d000568/Will%2BYour%2BSafety%2BHarness%2BKill%2BYou%253F.html?show_text=1

Although the information and recommendations contained in this document have been compiled from sources believed to be reliable, the National Safety Council makes no guarantee as to, and assumes no responsibility for, the correctness, sufficiency or completeness of such information or recommendations. Other or additional safety measures may be required under particular circumstances. NSC Construction & Utilities Division is comprised of leading professionals and subject matter experts in their field. Thanks to these authorities, NSC can further its mission of saving lives.

Learn more about American Road & Transportation Builders Association at artba.org

nsc.org/divisions