Calculating Shock-Absorbing Lanyard Fall Clearance for Construction Workers

By Rick Pedley | Tuesday, November 30, 2021

Employees working on elevated surfaces increase their risk of falls that could lead to injury and death. The Occupational Safety and Health Administration says that all construction workers must have fall protection when they are more than six feet from the next work level. Therefore, construction managers and engineers should know how to calculate fall clearance on a worksite and ensure their calculations are accurate so workers can safely focus on the task at hand.

WHAT IS FALL CLEARANCE?

Fall clearance is de ned as the minimum vertical distance between a worker's feet and a lower level, such as the ground or a lower working platform, needed to prevent an injury. This number is used to prevent workers from falling to the next lowest level. If the calculated fall clearance is equal to or greater than the physically available clearance, the worker will risk injury and death.

For example, if a worker needs six feet of fall clearance to avoid coming in contact with the next closest level, but there is only ve feet of available clearance, the worker will still hit the ground even when wearing fall protection.

Once the fall clearance has been established, managers should use this information to assess their fall protection needs. Workers will need to wear the proper fall protection gear if they are more than six feet from the next closest level.

CALCULATING SHOCK ABSORBING LANYARD FALL CLEARANCE FOR CONSTRUCTION WORKERS

There are several factors that can a ect fall clearance, including:

- Free Fall Distance is the distance that a worker falls before the protection system begins slowing them down. The location of the anchor point will be a big factor. It is best if directly overhead, but could be down at the worker ′s feet. OSHA allows up to 12 feet of free fall when anchored at a worker's feet and the manufacturer has permitted lanyard use for this type of free fall. It is based on the length of the lanyard and where the harness attaches to the lanyard.
- Arrest or Deceleration Distance is the distance it takes for a personal energy absorber to activate and slow the fall. According to OSHA standards, the arrest distance shouldn ′t be greater than 3.5 feet.
- Harness Stretch is how much the safety harness stretches and attachment points shift in a fall. The D-ring will likely shift during the fall. This varies based on the manufacturer. Another factor is how loose the harness is worn. Properly fitted harnesses worn tight will have around 12 inches of harness stretch. Some manufacturers make harnesses using stretchy material, in which those harnesses will have higher stretch factors.
- The Safety Factor is the additional distance to ensure there ′s enough clearance between a worker and a lower level and should not be less than one foot.
- Height and weight of suspended workers.

To calculate fall clearance, construction managers and engineers should use the following equation:

Fall clearance = Free fall distance + Arrest distance + Harness stretch + Safety factor.

When calculating the free fall distance, consider the placement of the anchor point as well as the vertical distance between the anchor and the lanyard's attachment point on the full body harness.

If the anchor point is above the harness attachment point, the free fall distance would equal the length of the lanyard minus the distance between the anchor and attachment points.

If the anchor point is below the harness attachment point, the free fall distance would equal the length of the lanyard plus the distance between the anchor and attachment points.

If the anchor point is level with the harness attachment point, the free fall distance would equal the length of the lanyard.

When selecting anchorage and anchorage systems, go with stable anchorages that must be able to support 5,000 pounds per employee attached. Also consider certi ed anchorages that are part of OSHA and CalOSHA. They are identi ed by a quali ed person who possesses a recognized degree certi cate, or professional standing by extensive knowledge, training and experience. Location is also important in reducing potential free fall distance, preventing swing fall hazards, and clearing space in the fall path. In this case, anchorage should be attached above the harness attachment point.

Height and weight of suspended workers should also be considered. A common misconception is that lanyard shock packs deploy exactly the same in each fall, which is not true. A higher free fall distance means more speed before the shock pack deploys and more energy to absorb. With more energy to absorb, longer deployments will be needed to absorb the energy.

Managers can use the following as examples:

- **Overhead Anchor Point.** If a worker falls from a ledge while being attached to an overhead anchor point four feet above the attachment point, using a D-ring harness and a 6.5-foot shock-absorbing lanyard, the values would be as follows:
  - A free fall distance of 2.5 feet (6.5-foot lanyard – 4-foot distance between the D-ring and anchor point), a deceleration distance of 2.5 feet, a harness stretch of 1 foot and a safety factor of 2.5 feet. The necessary fall clearance would then be: 2.5 + 2.5 + 1 + 2.5 = 8.5 feet.
- **Level Anchor Point.** If a worker falls from the same ledge with the attachment point level with the anchor point, the values would change as follows:
  - A free fall distance of 6.5 feet, a deceleration distance of 2.5 feet, harness stretch of 1 foot, and a safety factor of 2.5 feet. The necessary fall clearance would then be: 6.5 + 2.5 + 1 + 2.5 = 12.5 feet.
- **Lower Anchor Point.** If a worker falls from the same ledge and the attachment point is above the anchor point (at the workers feet for instance), the values would change as follows:
  - A free fall distance of 11 feet (6-foot lanyard + 5-foot distance between the D-ring and anchor point), a deceleration distance of 2.5 feet, harness stretch of 1 foot, and a safety factor of 2.5 feet. The necessary fall clearance would then be: 11+ 2.5 + 1 + 2.5 = 17 feet.

Managers and engineers need to follow manufacturers' instructions and guidelines for the products being used. For example, some lanyards are only rated for six-foot free falls and cannot be used for foot level tie- off. They should keep this information in mind when calculating the proper fall clearance for their workers. There's no room for error when crunching these numbers together. These calculations just might save someone's life.

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