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## Fall Protection Systems for Bridge Work

Occupational Safety and Health Administration (OSHA) fall protection regulations provide detailed definitions of conventional fall protection systems. The OSHA regulations apply to any work 6 feet or more above levels to which workers could fall. The OSHA fall protection standards appear in 29 CFR 1926 Subpart M. A State OSHA may have more protective standards. The ARTBA position is that use of conventional fall protection equipment is feasible in bridge work.\*

### What Is Fall Protection?

Fall protection is a broad concept. It is more than equipment systems alone. It includes training, procedures, and rules, as well as equipment systems, all working in combination to protect bridge workers from fall hazards. Two basic categories of conventional fall protection equipment systems are available for bridge contractors:

- Fall **prevention systems** that keep a fall from happening. The two main types of fall prevention systems in bridge work are guardrails and personal fall restraint systems. In addition to these conventional fall protection equipment systems, other fall prevention benefits may result from the use of accelerated construction techniques such as precast modular concrete road panels and bridge elements. Such techniques reduce fall exposures for bridge workers.
- Fall **arrest systems** that stop a fall after it has happened. The three main types of fall arrest systems in bridge work are safety nets, personal fall arrest systems (PFAS), and work positioning devices.

### Fall Prevention Systems

**Guardrails** are vertical barriers erected to prevent workers falling to a lower level. Guardrails are an engineering control. Guardrails may be cable, metal, plastic, or wood. Guardrail systems for fall protection are usually different from highway guardrails designed to keep vehicles on the road. Guardrails in place on bridges may not meet OSHA requirements.



(a) Existing bridge guardrails may not meet OSHA requirements. This guardrail is too short and lacks toeboards. Photo source: NBC. (b) This existing guardrail appears to meet OSHA requirements. Photo source: BravoFence. (c) When existing guardrails are not adequate or are not in place, then temporary guardrail can be installed. Photo source: J-Safe.

A standard guardrail consists of a top rail, midrail, toeboard, and uprights. The toeboards prevent tools and materials falling off the work area. The top rail must be 39 to 45 inches above the working surface and must withstand at least 200 pounds of force without deflecting to a point less than 39 inches above the working surface. The midrail must be midway between the top rail and the working surface and must withstand 150 pounds of force. The toeboards must be a minimum of 3.5 inches high and withstand 50 pounds of force. Guardrails may include mesh or wire as greater protection from falling objects.

Guardrail systems provide many advantages. Chief among these is that guardrails are a *passive* fall prevention system, so workers are not required to operate the equipment after it is installed, though regular inspections by a competent person are necessary. In general, guardrails are the preferred fall protection system when feasible.



**Personal Fall Restraint Systems (PFRS)** prevent users falling any distance. A PFRS acts as a leash and keeps a worker's center of gravity from reaching a fall hazard. Like a personal fall arrest system (PFAS), a PFRS includes anchorage, a body harness, connectors, and a lanyard or lifeline. PFRS anchor strength requirements are less than PFAS but, due to the likelihood of misuse or mishap, comparable strength is recommended by experts. A PFRS is more difficult to set up and use than is a PFAS. Like PFAS, PFRS is *active* fall protection because workers must operate it.

*Photo source: OSHA.*

## Fall Arrest Systems

**Safety nets** are hung beneath or around work areas to catch workers or debris. Nets must be rigged high enough so that fallen workers do not hit the ground. Nets must be installed as close as practicable under the working surface, but in no case more than 30 feet below it. When nets are used on bridges, the potential fall area must be unobstructed. Safety nets have three main parts and three optional parts:

- net mesh
- support cables
- mounting brackets
- outriggers
- cantilever arms
- various adapters

Safety nets are classified as fall *arrest* because nets catch workers *after* a fall. Nets do not prevent falling. Unlike PFAS, safety nets do not require workers to actively do anything to make nets work. Therefore, safety nets are called *passive* fall protection systems.



*Photo source: InCord.*

**Personal fall arrest systems (PFAS)** are designed to catch a worker who has fallen. It must hold the fallen worker safely until rescue. A properly selected and installed PFAS does not prevent falls but greatly reduces their impact. A PFAS must limit maximum arresting force to 1,800 pounds. The free fall distance cannot exceed 6 feet. PFAS is an *active* fall protection system because workers must operate it. Thinking of the PFAS parts as **A-B-C-D** helps users remember how the system works and the importance of each part in the system. Here are the A-B-C-Ds of PFAS:



*Photo source: HAKS.*

- (A) Anchor** is a secure point at which to attach a lifeline, lanyard, deceleration device, and/or rescue equipment. The best body harness, lanyard, and connectors are nothing without proper anchorage. Anchorage must be capable of supporting at least 5,000 pounds per worker.
- (B) Body harness** consists of shoulder straps, shoulder strap retainer, D-ring, waist strap, thigh straps, sub-pelvic support, and adjustment buckles. The straps distribute fall arrest forces over the upper thighs, pelvis, chest, and shoulders. The D-ring (attachment point) is typically located between the shoulder blades.



*Photo sources: FallTech.*

**(C) Connectors** are usually D-rings, carabiners, and/or locking snaphooks. (See the ARTBA fact sheet **Selecting PFAS Lanyards and Connectors for Bridge Work**.)

**(D) Descent and rescue** devices are used to retrieve or lower a fallen worker. These devices and the techniques/skills to use them are an essential part of the fall protection program. (See the ARTBA fact sheets **Preventing Suspension Trauma** and **Sample Fall Rescue Plan**.)



**Positioning devices** are body belt or body harness systems rigged to allow a worker to be supported on an elevated *vertical* surface, such as a wall. In construction work, a positioning device may be used only to protect a worker on a vertical work surface. These devices may permit a fall of up to 2 feet, but positioning devices are not designed as fall arrest. Examples of use include concrete form work or installation of reinforcing steel.

\*Note: This fact sheet covers conventional fall protection as defined by OSHA. 29 CFR 1926.501(b)(2)(i) requires use of guardrail systems, safety nets, or personal fall arrest systems for employees doing leading edge work. Controlled Access Zones (CAZ) are not presented here because CAZ is not conventional fall protection. A CAZ can be used only if a bridge contractor can demonstrate that use of conventional fall protection is infeasible or creates a greater hazard.

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