Know the Rules:

One Size Does Not Fit All in Fall Restraint and Positioning

By Matt McElvogue, RWC, RRO, PE

Two of the most commonly misunderstood and misapplied hazard mitigation measures present in construction are fall restraint and positioning. For the most part, safety officers, occupational safety personnel, and contractors engaged in roofing and waterproofing generally understand the equipment and systems associated with fall arrest but tend to apply their understanding to all working-at-heights situations.

The built world around us does not permit 100% tie-off onto certified 5,000-pound anchorages in all instances. Authors of applicable OSHA regulations and ANSI fall protection standards were well aware of this and placed provisions in codes and standards to allow us to work sensibly and in a manner that properly addresses the hazards present. Given the prevalence and acceptance of ANSI Z359, the "Fall Protection Code," this family of standards will be discussed in lieu of ANSI A10.32, *Personal Fall Protection for Use in Construction and Demolition Operations*. Also, it should be noted that OSHA is currently in the process of reviewing the proposed rule, "Walking-Working Surfaces & Personal Fall Protection Equipment." The main purpose here is to review the applicability of regulations and standards as well as considerations directly related to fall hazard mitigation.

APPLYING REGULATIONS AND STANDARDS

Before we address these items, it is critically important that we understand the relationships intended by OSHA regulations as well as mandatory and voluntary standards. The best way to consider these regulations and standards is to consider how we manage project delivery in the construction industry.

An architect, engineer, or other professional evaluates a wide range of information and develops a set of design docu-

Photo 1 – Care must be exercised when employing fall restraint near roof edges.

Photo 2 – Technician near roof edge employing positioning (rope descender is positioned below right arm).

ments for a project. Contractors or subcontractors review the design documents and prepare submittals. The submittals are the contractor's way of saying, "I understand what is required, and here is how I plan to accomplish it." Once the submittals are approved, the shop drawings, assembly drawings, or other documents are generally what are found in the field. The subcontractors are experts in their systems and fully understand these documents prepared by them.

The analogy is that OSHA regulations and ANSI or other standards are the "design documents." They are written by committees of individuals who consider a wide range of issues, including but not limited to risk mitigation, cost, enforcement, compliance, and legal precedent. OSHA compliance goes way past understanding 29 CFR 1910 (Occupational Health Safety Standards/General Industry) and 29 CFR 1926 (Safety and Health Regulations for Construction). Researching and understanding letters of interpretation, citations, accident reporting, and legal precedence are critical to ensuring that compliance is maintained.

This is the role of employers and their appointed safety personnel. If employers do not have the internal resources to properly manage this, it is their obligation to engage third-party resources. Therefore, in our example, the "shop drawings" are our employer-developed policies and safety plans/programs. These documents must be developed to provide clear communication to our employees about how we intend to maintain safety and compliance in our area(s) of practice. Also, for purposes of our example, the fact that we've produced shop drawings does not relieve us of being in compliance with the design documents. In the same way, if during the application of our policies or plans/programs, we fall outside of the parameters of the regulations and/or mandatory standard or—believe it or not—even our own policies, plans, or programs, we open ourselves to citations, fines, and possibly litigation.

It is important to understand that one size does not fit all. Sometimes proper hazard mitigation cannot coexist with prescrip-

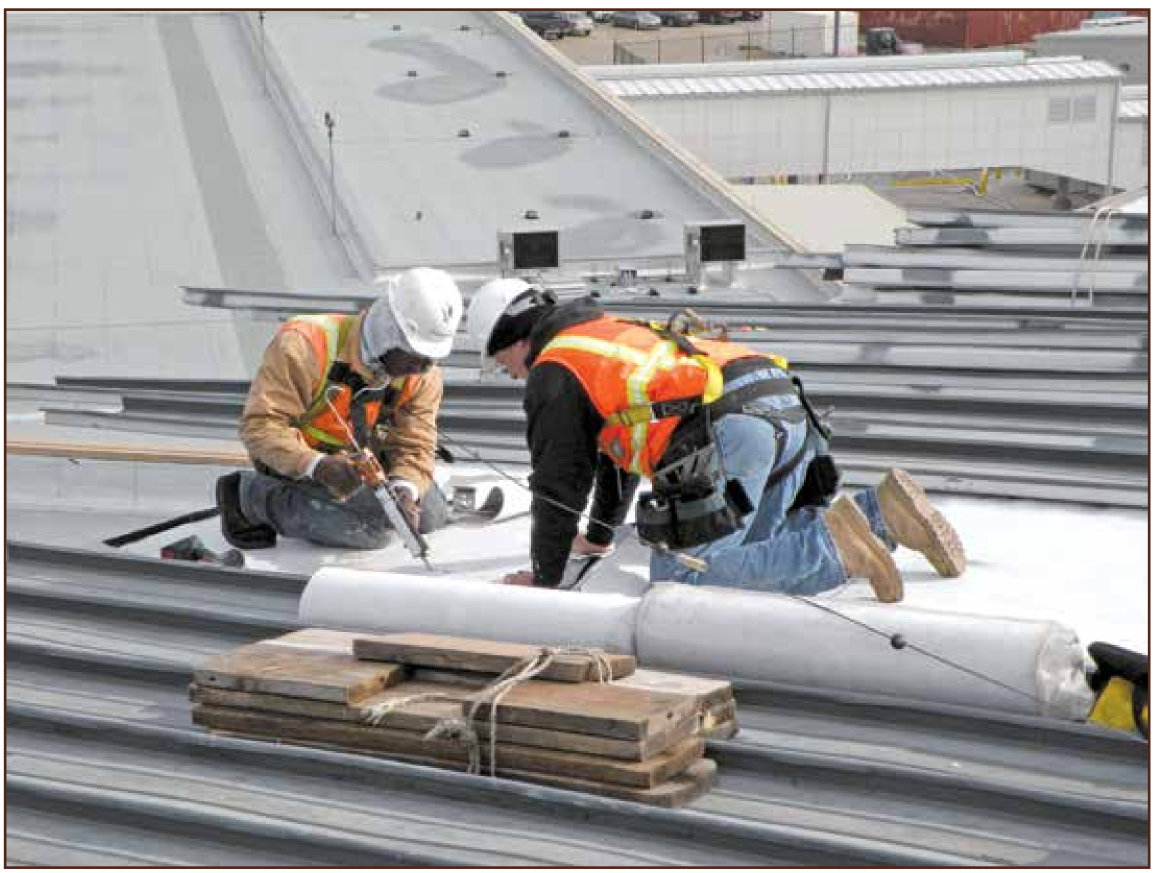

Photo 3 – According to ANSI Z359.6, self-retracting lanyards are not to be used for restraint unless the worker cannot reach a roof edge when fully deployed.

tive regulations and standards. Since it is the duty of employers to ensure the safety of their employees, compliance with regulations without properly mitigating the hazard is still noncompliance and is often cited under the infamous "general duty" clause. Therefore, best practices are to comply with company and site policy and plans/programs, as well as applicable regulations and standards whenever possible, but deviate from prescriptive requirements when necessary.

This deviation must be accompanied by a proper hazard assessment and documentation. The documentation must show that proper mitigation requires measures that may be in conflict with company or site policy, plans, programs, or regulations/standards, and that there is no other feasible way to accomplish this safely.

According to the August 1994 Preamble to the final rule on Fall Protection for Construction, Section 3 – III, "Summary and Explanation of the Final Rule," "OSHA considers compliance with a measure to be 'infeasible' when it is technologically impossible to do what a standard requires or when following the standard would prevent performance of the work in question." The section goes on to state, "The Agency does not consider 'economic infeasibility' to be a basis for failing to provide conventional fall protection for employees constructing leading edges, erecting precast concrete members, or performing residential construction work."

HAZARD IDENTIFICATION AND FALL PROTECTION

The reason for discussing the above-noted issues in detail is that it serves a critical foundation to properly manage fall hazards. Full-cycle hazard assessment, including what to do if a fall does occur, is essential in proper hazard management. So, as good employers, we've provided our employees with and properly trained our employees in sound and easy-to-follow policies and plans/programs; and they are out in the world practicing good safety. They have performed a proper hazard assessment that covers all relevant hazards that may include, but are not necessarily limited to, impact from falling objects, moving equipment, cutting/abrading surfaces, impact with objects/lower levels, and other hazards, in addition to dynamic fall.

Once these hazards are identified, mitigation measures can be determined. Here, the goal is to minimize the exposure of the employee to the hazards. Our goal should be to avoid the hazard, remove the hazard, or prevent the employee from coming into contact with the hazard, if in doing so we are not exposing other employees or bystanders to more potential hazard than we would otherwise be resolving. If we determine that avoidance, removal, or barriers are not feasible, then other means must be taken. A helpful "hierarchy" of preferred mitigation methods can be found in ANSI Z359.2-07, (*Minimum Requirements for a Comprehensive Managed Fall Protection Program*), section 5.

First, we need to review some definitions. According to ANSI Z359.0-12 (*Definitions and Nomenclature Used for Fall Protection and Fall Arrest*), paragraph 2.115, a personal fall arrest system (PFAS) is defined as "An assembly of components and subsystems used to arrest a person in a free fall." Paragraph 2.117 defines positioning as "the act of supporting the body with a positioning system for the purpose of working with hands free," and 2.120 defines a positioning system as "a full-body harness system or a body belt incorporated into a full-body harness or work-positioning harness configured to allow an authorized person to be supported on an elevated vertical or inclined surfaces, such as a wall, and work with both hands free from body support." Finally, paragraph 2.143 defines restraint as "the technique of securing an authorized person to an anchorage using a lanyard short enough to prevent the person's center of gravity from reaching the fall hazard."

TRAVEL RESTRAINT

Where do these measures come into play? Let's consider a worker on a roof. If the roof has no openings or skylights and has a "compliant" parapet, we have absence of fall hazards and a barrier to a fall hazard. If not and there is no other way to mitigate the hazard, we must apply fall protection. If our goal is to prevent the worker from falling, the safest way to do this is to prevent him or her from reaching the fall hazard. This is the principle of travel restraint.

So, let's again consider our worker on a roof; only this time, a parapet is not present; and assumedly, the distance to the next level is well over 6 feet. The safest way to

Photo 4 – Workers employing fall restraint near a roof edge. Because the workers could possibly pass the edge, the systems were also designed for fall arrest.

prevent the employee from being adversely affected by the hazard is to prevent him or her from getting to it. Although this is the safest solution in active fall protection, a number of requirements are also provided in 29 CFR 1926.502 and related appendices, as well as in ANSI Z359.6, paragraphs 6.2.1 through 6.2.3.

This is an area of practice where the use of self-retracting lanyards (SRLs) is often misapplied. According to ANSI Z359.6, paragraph 4.4.4.1, "SRLs shall not be used in travel restraint systems unless the length of the lifeline on the drum of the SRL will not permit the worker to reach the hazard even when fully deployed."

During a recent project, workers were performing roof replacement of a standing-seam metal roof and using seam clamps to provide restraint anchorage. SRLs connected to the clamps were used as fall protection. In this case, the length of SRLs varied, with some of the SRLs sufficiently long enough to allow the workers to reach the edge of the roof. In this case, the system was not serving as a travel restraint system, but as a fall arrest system.

Another option that would also have served as a fall restraint system includes workers connected to fixed-length lifelines. So can a worker use a lanyard and rope grab attached to a lifeline to serve the same purpose? The answer is "no" if the worker can physically get to the edge. It is up to the employer and site policy or plans/programs to allow this type of configuration; however, in all instances, some other means of ensuring the worker cannot reach the edge—such as a hard knot tied below the rope grab—is necessary.

The reason this matters is that the requirements of fall arrest systems may vary significantly from travel restraint systems. According to ANSI Z359.6, paragraph 6.2.2.1, temporary travel restraint anchorages must be designed to withstand, as a minimum, 400 lbs. per attached worker, but must provide sufficient strength to arrest a slide from a sloping surface (ANSI Z359.6, paragraph 6.2.3). However, ANSI Z359.2, paragraph 5.2.6 requires restraint systems be limited to a slope of 4 in 12. Additionally, permanent (dedicated) travel restraint system anchorages (ANSI Z359.6, paragraph 6.2.2.2) must be designed as fall arrest anchorages, and ANSI Z359.2, paragraph 5.4.4.1 states that anchorages used for restraint must be capable of sustaining static loads of 1,000 lbs. for noncertified systems or a minimum of two times the intended load for certified systems. Also, if using travel restraint, it is critical that the user is not able to reach any fall hazards. Conditions such as unprotected skylights may still require guardrails or some other means of preventing access.

POSITIONING

As noted above, ANSI defines positioning as "the act of supporting the body with a positioning system for the purpose of working with hands free." So, let's take our roof example again; only this time, the worker is on a sloping roof surface. The worker now must use a fall protection system that not only prevents him from getting to the edge, but also keeps him in a stationary working position where he can use both hands to perform work. These systems require knowledge and training to design and use, as they often require rope, equipment, techniques, and training not typically used in commercial fall arrest. This equipment may include kernmantle rope, harnesses with front and/or side positioning rings, and autolocking descent devices.

Depending on the conditions being accessed and the manner in which the worker traveled to the area being accessed, a variety of other means may also be required. Consider a tower or portion of a large structure, such as a stadium roof truss, that requires painting. Workers may have to access this area by way of an unenclosed exterior ladder, which may require climbing with wye lanyards. Once in place, the workers may use a positioning line to allow them to haul equipment and perform work efficiently. In this case, it may also make sense to set additional lines or devices at strategic locations to facilitate use of other fall arrest systems to make work easier or to facilitate prompt rescue if required.

Here, however, is an area where common sense should take over. When a worker is using an aerial lift or suspended scaffold or is attached to a lifeline near a roof edge, the worker is essentially provided with 200% tie-off. If the walking surface is solid and capable of supporting workers in the event they lose their balance, and they are able to adjust their position and remain standing, the walking surface essentially provides 100% support. The personal fall arrest system provides the other 100%.

But consider the worker moving along a narrow ledge or structural member and using positioning to maintain stability. If the worker were to lose his or her balance and try to readjust, a fall might occur. Given this situation, I personally would not consider the walking surface to be 100%. My team would be required to utilize a second means of fall protection. Depending on the situation, this might be wye lanyards, a belay line (safety line manned from above or below), or possibly even an SRL set above the work area. But again, common sense dictates that while moving or rigging, my team would never experience less than 200% tie-off.

According to 29 CFR 1926.502.e.2 and ANSI Z359.2, paragraph 5.4.3.1, anchorages utilized for positioning must be capable of withstanding 3,000 lbs. (for noncertified anchorages, according to ANSI) or two times the foreseeable force (for certified anchorages, according to ANSI). But probably the biggest consideration for positioning is the fall-limiting distance. According to 29 CFR 1926.e.1, positioning devices must be rigged to prevent a fall of greater than 2 feet from occurring. This is partially due to the fact that the worker is engaged with the structure, and a longer fall would likely result in significant harm to the worker from impact with the structure. Limiting fall distance reduces the potential impact with the structure.

FALL ARREST SYSTEMS

Finally, the most employed fall protection mitigation is the fall arrest system. As noted above, this system is intended to arrest a free fall; however, it also serves as overflow requirement for restraint or positioning systems that cannot meet limiting requirements. Both OSHA and ANSI provide mostly prescriptive requirements with regard to the strength required for personal fall protection system components; however, some performance requirements are present. It is also important to understand that all of the components of the system are not required specifically to provide 5,000 lbs. of resistance. Other requirements, such as limited arresting force, are required of various components such as harnesses and lanyards.

Probably the most contentious issue is the requirement for “anchorages.” Anchorage is defined in ANSI Z359.0 as “a secure connecting point or a terminating component of a fall protection system or rescue system capable of safely supporting the impact forces applied by a fall protection system or anchorage subsystem.” 29 CFR 1910.66, 29 CFR 1926.502, and ANSI Z359.2 all require anchors to resist 5,000 lbs. of static force or two times the intended load if the system is designed and used under the supervision of a qualified person. For workers utilizing 6-ft. lanyards attached dorsally, this force can be assumed to be

1,800 lbs. (3,600 lbs. with a safety factor of two). For workers using sternal (front-of-the-chest) attachments with equipment sufficient to limit fall distances to less than 2 ft., this force can be assumed to be 900 lbs. (1,800 lbs. with a safety factor of two).

Numerous other provisions are applicable to fall arrest that are generally overlooked. One of these provisions being cited more and more in construction is 29 CFR 1926.502.d.20, which states, "The employer shall provide for prompt rescue of employees in the event of a fall or shall assure that employees are able to rescue themselves." Therefore, if fall arrest is the chosen hazard mitigation method, it should be properly considered and implemented.

Proper fall hazard identification and hazard mitigation require continual training and exercise by employers and their safety professionals. A variety of means and methods are available to properly mitigate hazards, and we should avoid applying the one-size-fits-all technique to our projects. Our employees and their families place their trust in our diligent management of their safety. Just one incident is enough to result in significant financial loss and regret that may last a lifetime.

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RCI Issues New Technical Advisories

By Walt Rossiter, *Director of Technical Services*

In December, RCI issued two new Technical Advisories (TAs). The first is RCI-TA-003-2013, titled "Issues With ANSI/SPRI ES-1." The second is RCI-TA-004-2013, "Concerns Related to Water-Based Adhesives for Use in Roofing." Both were developed under the direction of the RCI Technical Advisory Committee and may be accessed on the RCI website at: http://www.rci-online.org/member-policy-statements.html#ta.

RCI-TA-003-2013

This TA provides commentary on issues associated with the ANSI/SPRI ES-1 standard, *Wind Design Standard for Edge Systems Used With Low-Slope Roofing Systems*. The 2006, 2009, and 2012 editions of the International Building Code (IBC) require compliance with the ANSI/SPRI ES-1 standard. They have been adopted by a majority of the code-enforcing bodies throughout the United States and have become the basis for building design. This code requirement has not occurred without debate in the roofing community. RCI has put forth its position with the release of this TA. Reasons behind the TA's development are best summed up in the TA itself where it states, "While it is understood that ANSI/SPRI ES-1 standard was developed for the betterment of the design, installation, and performance of perimeter edge metal systems and currently is included in the building code that has been adopted by most, the actual guidelines and specific requirements may not be that critical or necessary for all buildings at all geographic locations. The applicability, overall financial impact, and potential risks of these requirements should be reviewed by both the building owner and the designer."

RCI-TA-004-2013

This TA is intended to provide commentary and to raise awareness of limitations related to water-based adhesives used with roof systems. Solvent-containing products such as roofing bonding adhesives historically have been formulated with volatile organic compounds (VOCs). Presently, the VOC content of products is restricted in some sections of the U.S., particularly California and most of the Northeast, primarily due to environmental effects. As a consequence, in the case of roofing adhesives, water-based products have appeared as alternatives, but their use is not without limitations. This TA discusses those limitations and presents recommendations regarding their use. In this regard, as stated in the TA, users should:

- Check the local jurisdiction to determine if VOC limitations apply.
- Review the roof design to limit moisture ingress (both liquid and vapor) into the roof assembly. Consider the use of a vapor retarder over new concrete decks. Eliminate gaps that can allow interior air from entering the roof assembly.
- Require that the material supplier verify that the water-based products have been properly transported and stored at temperatures in accordance with the manufacturer's printed literature.
- Require compliance with the manufacturer's printed literature at all times, with particular focus on storage temperatures and proper mixing.
- Require the contractor to verify often the proper tack of the adhesive during application.
- Take care to prevent slippage of vertical flashing materials.

To ascertain full details of both RCI-TA-003-2013 and RCI-TA-004-2013, please refer to the RCI website. The Technical Advisory Committee anticipates the release of at least two additional TAs early in 2014. Readers with suggestions for technical topics that should be considered for future TAs should contact Technical Advisory Committee Chair Dave Hawn at drhawn@drhroofsolutions.com or me at wjrossiter@verizon.net.