mitigate the severity of the injury and increase the survivability of the worker. OSHA's performance-based definition has consistently recognized, and taken into account, life-threatening injuries and dangers (Ex. 22; *see also* 76 FR 24576 (5/2/2011); Letter to Charles Brogan, January 16, 2007; Letter to Brian F. Bisland (March 23, 2007)). For example, OSHA's Safety and Health Information Bulletin (SHIB) on orthostatic intolerance explains:

> Orthostatic intolerance may be experienced by workers using fall arrest systems. Following a fall, a worker may remain suspended in a harness. The sustained immobility may lead to a state of unconsciousness. Depending on the length of time the suspended worker is unconscious/immobile and the level of venous pooling, the resulting orthostatic intolerance may lead to death. . . . Unless the worker is rescued promptly using established safe procedures, venous pooling and orthostatic intolerance could result in serious or fatal injury, as the brain, kidneys, and other organs are deprived of oxygen.
>
> Prolonged suspension from fall arrest systems can cause orthostatic intolerance, which, in turn, can result in serious physical injury, or potentially, death. Research indicates that suspension in a fall arrest device can result in unconsciousness, followed by death, in less than 30 minutes (SHIB 03–24–2004).

In sum, prompt rescue means employers must be able to rescue suspended workers quickly enough to ensure the rescue is successful, *i.e.,* quickly enough to ensure that the employee does not suffer physical injury (such as injury or unconsciousness from orthostatic intolerance) or death. Many employers provide self-rescue equipment so workers can rescue themselves quickly after a fall, ensuring that the rescue is prompt and risks associated with prolonged suspension are minimal. OSHA believes the performance-based approach in the final rule will ensure prompt rescue of workers after a fall, while also giving employers flexibility to determine how best to provide prompt and effective rescue in the particular circumstance.

Commenters uniformly supported the proposed provision (Exs. 138; 153; 184; 221; 222; 242; 243). Clean & Polish said, ''It is a documented fact that there is a great risk of suspension trauma when hanging from a harness.'' Accordingly, they recommended that a team of at least two workers should perform every job assignment and that workers receive training in self-rescue (Ex. 242). Sunlight also supported self-rescue, saying it is the quickest form of rescue, followed by assistance from a coworker trained in rescue. Sunlight added that, in a medical emergency, they recommend calling the local fire department (Ex. 227). A number of commenters said they train their own workers in rescue and require them to practice/demonstrate their rescue capabilities at least twice a year (Exs. 184; 221; 227; 243).

The final rule is performance-based and gives employers flexibility to select the rescue methods that work best for their workers and worksite. However, OSHA emphasizes that, whatever rescue methods employers use, they are responsible for ensuring that it provides prompt rescue. Some commenters said they rely on calling local emergency responders, which may or may not be adequate. If employers rely on this method of rescue, they need to ensure that the responders have the appropriate equipment to perform a high angle rescue and are trained and qualified to do so. (Also see the discussion of prompt rescue in final § 1910.140 below.)

Final paragraph (b)(2)(ix), consistent with proposed paragraph (b)(2)(viii), the 1991 RDS memorandum, and I–14.1 (Section 5.7.5), requires that employers ensure the ropes of each RDS are effectively padded or otherwise protected where they contact edges of the building, anchorage, obstructions, or other surfaces to prevent them from being cut or weakened. Padding protects RDS ropes from abrasion that can weaken the strength of the rope. If employers do not protect RDS ropes, the ropes can wear against the sharp edges of buildings (*e.g.,* parapets, window frames, cornices, overhangs), damaging their structural integrity and possibly causing them to break.

The final rule requires that employers ensure the rope padding is ''effective.'' To be effective, padding needs to be, for example, firmly secured in place and strong and thick enough to prevent abrasion. To ensure the padding remains effective, employers also need to inspect it ''regularly and as necessary'' (final § 1910.22(d)(1)).

OSHA added language to the final rule specifying that employers may ensure that ropes are padded or ''otherwise protected.'' OSHA believes the added language gives employers greater flexibility in complying with final (b)(2)(ix). OSHA recognizes that padding may not be the only effective measure available to employers. For example, several commenters said that parapet carpets and rope-wrapper protection are effective rope protection devices (Exs. 138; 153; 184; 221; 242). Other available measures include rubber hoses and polyvinyl chloride (PVC) piping. OSHA believes that various materials are readily available and used in common industry practice; thus, employers should not have significant problems complying with the final rule.

Overwhelmingly, commenters supported the provision (Exs. 138; 153; 184; 221; 222; 242; 243), and OSHA did not receive any comments opposing the requirement. Therefore, OSHA adopts the provision as discussed.

Final paragraph (b)(2)(x), like proposed paragraph (b)(2)(ix), requires that employers provide stabilization at the worker's specific work location whenever descents are greater than 130 feet. The purpose of the stabilization requirement is to reduce the risks of worker injury when longer descents are made using a RDS.

For purposes of final paragraph (b)(2)(x), the worker's ''specific work location'' refers to the location in the descent where the worker is performing the work tasks that necessitate the use of an RDS. For example, a window cleaner's specific work location is the window the worker is cleaning. While using an RDS, workers may have many specific work locations during a descent, and they must be stabilized at each of those locations when the descent is greater than 130 feet.

OSHA uses a performance-based approach in final paragraph (b)(2)(x). It gives employers the flexibility to use intermittent or continuous stabilization. In addition, the final rule allows employers to use any method of stabilization (*e.g.,* suction cups, rail and track system) that is effective to protect workers from adverse environmental effects, such as gusty or excessive wind.

OSHA notes that the 1991 RDS memorandum included a requirement for ''intermittent'' stabilization on descents in excess of 130 feet.[41] Similarly, the I–14.1 standard, which also requires stabilization on descents greater than 130 feet, specifies that stabilization may include continuous, intermittent, or work station stabilization (Section 5.7.12). The I–14.1–2001 standard identifies suction cups as an example of work station stabilization.

In the proposed rule, OSHA requested information on commonly used methods of stabilization and on other methods that may increase worker safety. The vast majority of commenters

[41] Shortly after OSHA issued the 1991 RDS memorandum, the Agency confirmed that employers could use suction cups to meet the stabilization requirement in the memorandum (Letter to Mr. Michael Bell, July 31, 1991, available on OSHA's website at: *http://www.osha.gov/portable_ladders/oshaweb/owadisp.show_document?p_table=INTERPRETATIONS&p_id=22722*).

said suction cups are the method they most use for stabilization (Exs. 138; 163; 184; 221; 222; 241; 242). Some commenters said they use different methods for stabilization, but only mentioned suction cups, and said suction cups is their ''primary'' method (Exs. 163; 184; 221; 242; 329 (1/19/2011, p. 436)).

Sunlight said that some buildings have permanent rail or track systems to provide stabilization (Ex. 227). TRACTEL North America (TRACTEL) also said they use ''mulling and track,'' designed for use by powered platforms for stabilization, to stabilize RDS (Ex. 329 (1/19/2011, p. 436)). TRACTEL added that mulling and track stabilization systems provide greater protection because the stabilization is continuous, while suction cups only provide intermittent protection (Ex. 329 (1/19/2011, p. 436)).

Many commenters supported the RDS stabilization requirement for work operations involving descents greater than 130 feet (Exs. 138; 147; 151; 215; 222; 241; 227; 356), and a number of commenters supported the use of suction cups as an effective stabilization method (Exs. 138; 151; 152; 222; 241).

However, a number of commenters said stabilization is not necessary. They indicated there was no need for a stabilization requirement because the prohibition against using RDS in adverse or hazardous weather is adequate and a more protective approach (Exs. 163; 184; 221; 227; 241; 242; 243). Mr. Terry, of Sparkling Clean, explained:

> Every incident that can be partially abated by stabilization can be totally abated by substituting a restriction from working in adverse weather restrictions. Suspended workers using [RDS] only need stabilization during adverse weather conditions. . . .
>
> [Suction cups] can certainly be used for stabilization, if a worker chooses to work in adverse conditions that should have been avoided in the first place . . . (Ex. 163).

Ms. McCurley, of SPRAT, also said the proposed requirement was not necessary:

> Sometimes stabilization is required, and when stabilization is required, the stabilization needs to be adequate to the situation. But, stabilization is not necessarily required just as a matter of course. . . . [T]hat requirement tends to come from the scaffold industry, which does require stabilization all the time, because that's what scaffolds do. They have to have stabilization. But, because of the individual not having nearly the wind load—a wind load on this table, because it looks a lot like an airplane wing, is going to have a much different effect than the same wind load on your body standing there (Ex. 329 (1/19/2011, pgs. 167–168)).

Nevertheless, Mr. Terry and other commenters said they provide stabilization devices (primarily suction cups) and use them on descents as short as 10 feet (Exs. 163; 184; 221; 242; 329 (1/19/2011, p. 62)). Mr. Terry pointed out that his company uses the suction cups ''for positioning to keep us in front of the glass, not for stabilization against the effects of the wind'' (Ex. 329 (1/19/2011, p. 337)).

Mr. Diebolt, of Vertical Access, did not oppose the concept of stabilization, but opposed OSHA's 130-foot trigger:

> Now, the 130-foot tie-offs, I have essentially the same objections. It seems arbitrary for the kind of work at least that we do, it's unnecessary. . . . Granted we're doing light work, making observations and notes and that sort of thing. Occasionally, we have done some work like take core samples out of a concrete structure using a coring rig drill rig hung from a separate line. And under those conditions, you do actually have to put in a bolt or something to hold you to the building . . . when you're on a long pendulum, when you're on a long tether.
>
> But making it mandatory seems arbitrary and sort of eliminates the possibility of the flexibility of doing the work (Ex. 329 (1/21/2011, pgs. 139–140)).

However, the major objection to the proposed rule was not to the proposed regulatory text, but rather with the use of suction cups as a stabilization method. The Glass Association of North America (GANA), a trade association representing the architectural and glazing industry, recommended that OSHA not to allow the use of suction cups for worker stabilization:

> Glass is a brittle material and, as such, can break without warning and vacate the window framing system. Glass installed in commercial and residential buildings is designed to withstand external loads, primarily wind events, with a certain safety factor. . . . In other words, breakage cannot be eliminated in brittle materials like glass. There is no way to guarantee a specific lite of glass will not break under the loads exerted by workers as they move vertically and horizontally back and forth across the glass lites. . . . The use of suction cups may be sufficient in certain conditions to cause the glass to break and vacate the opening, particularly in the event the RDS fails and the worker is left to rely upon the suction cups used for stabilization . . . to support his/her weight.
>
> GANA urges OSHA, in its final rule, to reject the use of suction cups as an approved employee work location stabilization device for RDS. . . . Their use does not satisfy the safety criteria OSHA has established for this rulemaking proceeding: ''to be effective, fall protection systems must be both strong enough to provide the necessary fall protection and capable of absorbing fall impact so that the forces imposed on employees when stopping falls do not result in injury or death'' (Ex. 252).

Mr. Gartner, of Weatherguard, and Mr. Coleman, of JOBS, opposed the use of suction cups for the same reasons as GANA (Ex. 215; 329 (1/19/2011, pgs. 259–260)). Mr. Gartner said:

> The use of suction devices for stabilization is problematic. The glass industry strongly discourages them and the window wall people are robustly against them. They are devices used at whim. The loads that they apply to a surface are totally unknown as there are numerous barrier bowls that influence them and they're applied to surfaces that have never been rated for these pinpoint concentrated loads.
>
> Applying a device to glass seems reckless when we're all aware of glass's characteristics and lack of strength. Furthermore, as glass ages, it becomes more brittle and it loses strength, just another variable to make their use totally uncontrolled (Ex. 329 (1/19/2011, pgs. 259–260)).

Mr. Coleman also stated:

> In order for Work Station Stabilization to be safe, the worker must attach to a component of the building curtain wall that is designed for and capable of providing the stabilization required. Presently most Work Station Stabilization is done by using suction cups attached to the glass pane. The glass is typically not designed for such point loading; it is designed for a wind load spread out over the entire surface of the glass (Ex. 215).

Therefore, Mr. Coleman concluded that the final rule should not allow suction cups, which provide only intermittent stabilization, as the primary stabilization device (Ex. 356). Rather, he said OSHA should define ''Work Station Stabilization'' as: ''a means to stabilize suspended access equipment by securing the worker or suspended access equipment to an approved anchor point on the exterior of the building surface,'' thus ensuring continuous stabilization (Ex. 215). Mr. Schoch, of TRACTEL, agreed with Mr. Coleman's recommendation (Ex. 329 (1/19/2011, p. 439)).

Several workers, based on personal experience, also opposed the use of suction cups, calling the devices ''unsafe'' (Exs. 311; 316; 329 (1/19/2011, pgs. 5, 8, 15, 18, 19, 61, 62); 329 (1/20/2011, p. 222)). For instance, Mr. Rosario, of SEIU Local 32BJ, stated:

> I believe the use of suction cups fails to provide adequate protection. Suction cups are unreliable because they get dirty and fail to maintain suction. I remember having to clean 20-story buildings, sometimes with multiple stops per floor. At least half the time I applied the [suction] cup, it released during the cleaning and I had to apply it again (Ex. 311).

Mr. Rosario also said the support offered by suction cups ''usually only lasts for a few seconds'' (Ex. 329 (1/19/2011, p. 19)). Mr. Rosario added that

usually he had to clean suction cups four or five times per descent (Ex. 329 (1/19/2011, p. 86)). Mr. McEneaney, with SEIU Local 32BJ, said suction cups were not reliable stabilization devices because they leave the worker ''de-stabilized during the movement from one floor to another'' (Ex. 329 (1/19/2011, p. 15)). However, most commenters said they primarily use suction cups for stabilization, and did not indicate they were not effective (Exs. 138; 163; 184; 222; 227; 241; 242).

After reviewing the rulemaking record, OSHA decided, for several reasons, to adopt the stabilization requirement as proposed. First, OSHA believes, and many commenters agreed, that stabilization of RDS is necessary to protect workers on descents greater than 130 feet. The effects of wind gusts, microbursts, and tunneling wind currents on longer RDS ropes is particularly severe and likely to increase the risk of injury to workers. For instance, increases or changes in the wind can cause a significant pendulum effect on the long RDS ropes, and will cause workers not stabilized to swing a great distance away from or into the building, possibly causing injury or death. For example, the RDS accident data analysis Mr. Terry submitted indicated that strong wind gusts (more than 35 mph) swung two workers using RDS 30 feet away from a building (Ex. 163).

In addition, even a single wind gust or a sudden drop in the wind speed can initiate this pendulum effect on RDS ropes and destabilize the workers using them. Moreover, when RDS ropes are long, the slightest wind movement also can cause the ropes to sway (*i.e.,* pendulum effect) and swing or propel workers into the building. OSHA believes that requiring stabilization in these situations will prevent RDS ropes from swaying and buffeting workers against the building.

Mr. Terry's accident analysis demonstrates what can happen when workers are not using stabilization, and how using stabilization could prevent such cases. Three RDS accidents in that analysis involved wind:

- Window cleaner cleaning 50-story building became stranded in descent equipment line as a result of a wind gust;
- Window cleaner was stuck between 12th and 13th floor and managed to rest on narrow window ledge. Winds that were gusting 35 mph caught his ropes and wrapped them around an antenna on the west side of the building so worker was unable free to himself; and
- Two window cleaners were left dangling from a building when their lines became tangled during a windy rain shower. Wind was gusting about 36 mph. The workers were stuck between the 11th and 14th floors and blown 30 feet away from the building (Ex. 163).

OSHA believes that stabilization, as required by this final standard, could prevent many such incidents.

Second, while OSHA agrees that employers must not allow workers to perform suspended work in hazardous weather and gusty or excessive winds, the Agency also recognizes that adverse conditions can suddenly occur without warning. When such conditions occur, employers must ensure that workers using RDS have stabilization methods immediately available so they can protect themselves from the effects of the wind, even if all they are doing is descending to stop work due to hazardous weather conditions. OSHA notes that even those commenters who asserted that stabilization is not necessary because weather restrictions can totally abate the hazard, also noted that they regularly use and rely on stabilization devices, even on descents as short as 10 feet (Exs. 163; 184; 221; 242).

Third, the final rule is consistent with the I–14.1–2001 national consensus standard. The I–14.1–2001 standard also requires that employers ensure workers using RDS have stabilization at their work station on all descents greater than 130 feet (Section 5.7.12). The I–14.1–2001 standard reflects best industry practices.

With regard to suction cups, for the following reasons OSHA decided not to prohibit their use under the final rule. First, OSHA believes that suction cups provide effective stabilization for workers using RDS, particularly in long descents. The record shows that suction cups are an effective and easy-to-use device that helps keep workers positioned or stabilized at their specific work location (Exs. 137; 138; 147; 153; 163; 184; 298).

OSHA received a comment from GANA stating that suction cups are not safe or effective to use for stabilization (Ex. 252). GANA's comment appears to indicate that they believe suction cups are a type of personal fall protection system, and concludes suction cups are not effective because the cups are not ''strong enough to provide the necessary fall protection and capable of absorbing fall impact so that the forces imposed on employees when stopping falls do not result in injury or death'' (Ex. 252). GANA also says suction cups are not effective because they cannot support the worker's weight if the RDS and personal fall arrest system both fail (Ex. 252). However, OSHA agrees with IWCA's post-hearing comments that GANA's description of the purpose and use of suction cups is not accurate (Ex. 346). As IWCA points out, and OSHA agrees, ''Suction cups are not intended to be part of the fall protection system and they are not part of the fall protection system'' (Ex. 346).

The second reason for allowing suction cups is that OSHA believes suction cups can provide stabilization and protection when sudden weather conditions occur while the worker is using an RDS, even if workers use the suction cups only to safely descend due to excessive wind. As Mr. Terry said, ''In the event of a sudden unforeseen weather hazard, the [RDS user] . . . can very easily . . . utilize the suction cup. . . . This method of stability can even be performed while descending out of harm's way'' (Ex. 329 (1/19/2011, p. 329)).

Third, OSHA believes that suction cups are widely used and accepted by employers and workers who use RDS, even by those employers who doubt the need for stabilization, because the devices have a track record of being effective, and economical. As far back as July 31, 1991, OSHA allowed employers to use suction cups to meet the stabilization requirement in the 1991 RDS memorandum. IWCA said that, since 1991, the use of suction cups in conjunction with RDS is widespread among window cleaning companies and workers in the United States and other countries (Ex. 346). Over that period, neither OSHA nor IWCA are aware of any data or evidence indicating that a significant problem exists with using suction cups. Although GANA said it is not safe to use suction cups on glass, they did not provide any data indicating that suction cups are causing glass windows to break (Ex. 252). Moreover, according to IWCA, a 2010 GANA press release said their members did not have any record of windows breaking when window cleaners were using suction cups (Ex. 346). OSHA notes that a review of the rulemaking record failed to show that suction cups cause anything more than a few isolated cases of window breakage. For example, Mr. John Capon, of Valcourt, reported that each year his company only had to replace 15 to 20 windows on the approximately 4,000 buildings they clean 2–3 times each year because of suction cup-related damage (Ex. 329 (1/19/2011, p. 372, 399)).

Finally, the performance-based final rule allows, but does not require, the use of suction cups for stabilization. Employers are free to use other devices, and some commenters said they use other stabilization methods, such as rail