# Anchorage LAYOUT GUIDELINES



Cover Picture: Founder of Summit Anchor Co. Gus Strats tries out anchorages he retrofitted at the World Trade Center Building at Baltimore Harbor Maryland, in 2001.

a. What OSHA standard regulates the safe use of rope descent systems? b. What other standards guide the use of rope descent systems?

There have been advances to safe practices for Rope Descent Systems (RDS) since that picture was taken. For example, in 2017, OSHA Subpart D went into effect regulating Rope Descant Systems. And the publication Safe Practices for Rope Descent by the International Window Cleaning Association and The ANSI Z459 Safety Requirements for Rope Access Systems make standard use of helmets.



Figure 1 Worker using a rope descent system to access building facade

## Forward

a. What are building owners required to provide an employer before a rope descent system is used by employees, according to the I.14 Standard and OSHA Subpart D 1910 Rope Descent Systems?

Rope descent systems are the most common form of accessing exterior high-rise buildings for window cleaning operations in the United States. In 2001, the I.14.1 ANSI/IWCA Window Cleaning Safety Standard was released in large part to address the lack of regulation for Rope Descent Systems. The I.14.1 section 3.9 advanced safety, saying: "Building owners and window cleaning contractors shall not allow suspended work to be performed unless it has been determined that the building has provided, identified and certified anchorage..." This standard also provided some anchorage layout guidance. Prior to that standard, clear direction for building owners and architects on how to equip their buildings with anchorages for rope descent systems for window cleaning operations in the United States, was all but nonexistent. While this was a voluntary standard, some safety-minded building owners either provided written certification that their anchorages were compliant and/or had a complete anchor system designed and installed. Finally, in November 2017, OSHA released Subpart D 1910.21 Working and Walking Surfaces, drawing many of the provisions of the I.14.1. For example, OSHA requires that building owners provide written certification that each anchorage has been tested to confirm it can support 5,000 lbs.

a. What is proper or sound rigging? B. What is OSHA's 15 and 6 foot rule for fall protection?

OSHA, in the preamble to their final rule on fall protection, essentially adopted the provisions of the I.14.1 inasmuch as that publication addressed proper rigging. Proper rigging requires that anchorages be located to allow workers to attach at appropriate angles from the point of suspension. In addition to regulating rope descent systems, OSHA regulated 15 and 6 foot fall protection zones (see pages 6, 7 and 11 for information on zones.) Per OSHA's new fall protection rule, designers not only need to lay out anchorages for multiple workers using rope descent systems simultaneously but also need to consider fall protection to allow those workers safe approach to those anchorages. Therefore, the writer of this chapter believes an updated guide is needed to help designers lay out permanently installed anchorages for rope descent systems.

a. Who must review and approve an anchorage layout for rope descent systems?

This Anchor Layout Guide provides technical guidance to qualified designers. It should be noted that designing anchorage layouts for rope descent systems and fall protection is a highly specialized skill. This guide shall not be used as a sole source of design; all designs must be reviewed and approved by a qualified person as defined by OSHA.

ANCHORGE LAYOUT GUIDELINES for Rope Descent Systems

MANUAL

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#### ANCHORGE LAYOUT GUIDELINES

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## References

- 1. The IWCA's I.14.1 1-2001 ANSI/IWCA Window Cleaning Safety Standard
- 2. OSHA's Walking-Working Surfaces Standard, 29 CFR Part 1910 Subpart D & I
- 3. The International Building Code (IBC)
- 4. ASME A120 Safety Requirements for Powered Platforms and Traveling Ladders and Gantries for Building Maintenance
- 5. OSHA Subpart D Walking and Working Surfaces and other OSHA related regulations and interpretation letters
- 6. ANSI Z459 Safety Requirements for Rope Access Systems
- 7. ANSI Z359 Fall Protection Code Package
- 8. Cal/OSHA Article 5 (California)
- 9. NYDL Title 12 (New York)

## The "300 foot rule"

a. When does OSHA permit a rope descent system above 300 feet?

(1) Use of rope descent systems. The employer must ensure: No rope descent system is used for heights greater than 300 feet (91m) above grade unless the employer demonstrates that it is not feasible to access such heights by any other means or that those means pose a greater hazard than using a rope descent system.

a. What are other means that may pose a greater risk than a rope descent system above 300 feet?

2) An ill-equipped davit system, e.g.: over 300 feet. The davit systems must be roof-rigged capable and provided with stabilization system for the platform on the façade of the building.

Note: At 490 feet, the A-120 Powered Platform Safety Standard requires a roof mounted hoist system, such as a Building Maintenance Unit.

a. According to OSHA Fact Sheet, why does the finale rule limit RDS use to 300 feet above grade?

3) "Evidence shows that using RDS at heights above 300 feet (greater than 30 stories) can be dangerous, particularly due to the effects of wind on longer ropes. OSHA adopted the 300-foot height limit from the ANSI/IWCA I.14.1-2001 national consensus standard on window cleaning. The final rule permits employers to use RDS above 300 feet only in cases where an employer demonstrates it is not feasible or creates a greater hazard to access such heights by any other means (e.g. powered platforms.)"

a. How do the states of California and New York regulate the use of RDS?

4) Rope descent systems are regulated by height by most states, except California which does not allow RDS use above 130 feet. New York's state regulations do not allow the use of RDS. However, New York does allow industrial rope access for those who qualify under its strict Industrial Rope Access Application Procedure. A rope descent system is not to be confused with industrial rope access systems, see Figure 3.



Figure 2 A rope descent worker uses rope descent system to clean the windows on a building in Baltimore, Maryland, that exceeds 300 feet in height.

# **OSHA REGULATED FALL PROTECTION EDGE DISTANCE GUIDE**

## REDZONE

(4) OF THE BELOW LISTED SYSTEMS.

(1) GUARDRAIL SYSTEM

(2) SAFETY NET SYSTEM

(3) TRAVEL RESTRAINT SYSTEM (4) PERSONAL FALL ARREST SYSTEM YELLOW ZONE

YEE IS ENSURED FROM FALLING BY (1), (2), (3), OR ENSURED FROM FALLING BY EITHER (1), (2), (3), OR (4) OF THE BELOW LISTED SYSTEMS. HOWEVER, FOR WORK THAT IS BOTH (A) INFREQUENT AND (B) TEM-TED AREA IS A DELINEATED AREA WITH WARNING LINE. SEE OSHA SUBPART D FOR MORE INFORMATION ON THE PROPER SETUP AND USE OF WARNING LINES.

WORK PERFORMED LESS THAN 6 FEET FROM THE WORK PERFORMED LESS THAN 6 FEET FROM THE ROOF EDGE BUT LESS THAN 15 WORK PERFORMED 15 FEET OR MORE FROM THE ROOF EDGE. EMPLOYER MUST ENSU-ROOF EDGE. EMPLOYER MUST ENSURE EACH EMPLO- FEET FROM THE ROOF EDGE. THE EMPLOYER MUST ENSURE EACH EMPLOYEE IS RE EACH EMPLOYEE IS ENSURED FROM FALLING BY EITHER (1).(2).(3). OR (4) OF THE BE-LOW LISTED SYSTEMS OR A \*DESIGNATED AREA. OSHA REQUIRES EMPLOYERS TO USE A \*DESIGNATED AREA AND TO IMPLEMENT AND TO ENFORCE A WORK RULE PROHIBITING PORARY, OSHA ALLOWS EMPLOYERS TO USE A DESIGNATED AREA. A DESIGNA- EMPLOYEES FROM GOING WITHIN 15 FEET OF THE ROOF EDGE WITHOUT USING FALL PRO-TECTION. ALSO, THE EMPLOYER IS NOT REQUIRED TO PROVIDE ANY FALL PROTECTION. PROVIDED WORK IS BOTH (A) INFREQUENT AND (B) TEMPORARY

ENTRY TO TRAVEL RESTRAINT LINE SHOULD START IN THE "GREEN ZONE" **ROOF ANCHOR ROOF HATCH WITH** HATCH GUARD FALL RESTRAINT OR TRAVEL RESTRAINT SYSTEM

(800) 372-1098

### GREEN ZONE

ROOF ACCESS DOOR

**ENTRY TO TRAVEL RESTRAINTE LINE** SHOULD START IN THE "GREEN ZONE"



# **OSHA REGULATED FALL PROTECTION EDGE DISTANCE GUIDE**

## REDZONE

OF THE BELOW LISTED SYSTEMS.

- (1) GUARDRAIL SYSTEM (2) SAFETY NET SYSTEM

# MORE INFORMATION ON THE PROPER SETUP AND USE OF WARNING LINES. PROVIDED WORK IS BOTH (A) INFREQUENT AND (B) TEMPORARY (3) TRAVEL RESTRAINT SYSTEM (4) PERSONAL FALL ARREST SYSTEM **OUTRIGGER ARM ONE MAN BASKET ROOF HATCH WITH** HATCH GUARD HORIZONTAL LIFELINE **TIE-BACK ANCHOR** SUSPENSION LINE SAFETY LIFE LINE **ROPE DESCENT** SYSTEM

## YELLOW ZONE

WORK PERFORMED LESS THAN 6 FEET FROM THE WORK PERFORMED LESS THAN 6 FEET FROM THE ROOF EDGE BUT LESS THAN 15 WORK PERFORMED 15 FEET OR MORE FROM THE ROOF EDGE. EMPLOYER MUST ENSURE ROOF EDGE. EMPLOYER MUST ENSURE EACH EMPLO- FEET FROM THE ROOF EDGE. THE EMPLOYER MUST ENSURE EACH EMPLOYEE IS EACH EMPLOYEE IS ENSURED FROM FALLING BY EITHER (1), (2), (3), OR (4) OF THE BELOW YEE IS ENSURED FROM FALLING BY (1), (2), (3), OR (4) ENSURED FROM FALLING BY EITHER (1), (2), (3), OR (4) OF THE BELOW LISTED SYSTEMS, HOWEVER, FOR WORK THAT IS BOTH (A) INFREQUENT AND (B) TEM-PORARY. OSHA ALLOWS EMPLOYERS TO USE A DESIGNATED AREA. A DESIGNA-TED AREA IS A DELINEATED AREA WITH WARNING LINE. SEE OSHA SUBPART D FOR

Figure 4 OSHA Regulated Fall Protection Edge Distance Guide for Accessing Suspended Access Equipment with Various Anchorage Applications

CONTACT US FOR MORE INFORMATION:

POWERED PLATFORM

SWING STAGES

**RIGGING SLEEVES** 

### GREEN ZONE

LISTED MENTION SYSTEMS OR A \*DESIGNATED AREA. OSHA REQUIRES EMPLOYERS TO USE A \*DESIGNATED AREA AND TO IMPLEMENT AND TO ENFORCE A WORK RULE PROHIBITING EMPLOYEES FROM GOING WITHIN 15 FEET OF THE ROOF EDGE WITHOUT USING FALL PRO-TECTION. ALSO. THE EMPLOYER IS NOT REQUIRED TO PROVIDE ANY FALL PROTECTION.

ROOF ACCESS DOOR

STANDARD DAVIT ASSEMBLY FOR **ROPE DESCENT** SYSTEM

#### PARAPET CLAMP

OUTRIGGER FOR ROPE **DESCENT SYSTEM** SINGLE WORK CAGE

**BOATSWAIN CHAIR** (RDS) SAFETY LIFE LINE

SUSPENSION LINE

#### STANDARD DAVIT ASSEMBLY

#### EDGE PROTECTION TO PREVENT ROPE ABRASION

(800) 372-1098

## Anchorage Layout Guidelines

a. What requirements and guidelines should be followed to produce a compliant rope descent system anchor layout? Please comment individually on each of the guidelines 1-7.

- 1. Anchorages should be identified on a plan of maintenance, typically posted on the inside of the roof door so that the worker can easily locate them.
- 2. Each worker must be tied off to two independent anchorages one for fall arrest and one for suspension rope.
- 3. Anchors must be placed in line with the work area requiring service and there should be no objects obstructing the path of the rope from the anchorages to the work area. Further, the point of suspension is most often at the window mullion for window cleaners using RDS, see image in next page. Properly aligned anchors prevent unsafe lateral rope movement or displacement, which damages the rope proportionate to load.
- 4. Anchorages should be placed to allow for at least two workers to make rope descending system descents in the same area of the building façade for both suspension line (or mainline) and fall arrest line (or backup line).
- 5. Consideration should be given to providing sufficient anchorage for rescue workers to access window cleaners in the event that they are stranded on the façade of the building.
- 6. Anchor must not be placed within six (6) feet (1800 mm) of an unprotected roof edge unless fall protection is provided. In most cases, anchors can and should be placed farther than six (6) feet (1800 mm) back from the edge to reduce risk of falling.

Note: Outside corners of the roof are of particular concern. Anchors must be located to prevent the rope from being displaced on the parapet/guardrail. The diagram below illustrates the standards governing a safe placement of roof anchors:



Figure 5 Tie back angles for one worker using a Rope Descent System

# Maximum allowed anchorage spacings for various anchorages from the roof edge (one anchorage in line with the drop point)



Figure 6 Maximum allowed anchorage spacings for various anchorages from the roof edge (Anchor Layout Reference Guide to I.14.1 2001 Window Cleaning Safety Standard)

Max. anchor spacing = 12ft; max. tie-back distance from roof edge = 50ft; max. angle from perpendicular = 150 for both suspension rope and fall arrest rope; window cleaner shall not reach farther than six (6) feet in any direction.

# What is the 15-Degree Rule that Designers Need to Consider?

a. How many degrees may anchors be offset from perpendicular according to the I.14.1?

Design for new construction: Locating anchorages in line with the intended location of descent is best. The 2001 ANSI/ IWCA I.14 Window Cleaning Safety Standard stipulates, "Anchorages should be placed in line to the work area to prevent displacement of lines under load and/or a fall greater than 6 feet."

Design for existing buildings: The I.14 says that anchors should be placed in line with the suspended worker. Where this is impracticable, anchors may be offset no more than 15 degrees from in line (perpendicular), provided displacement of the rope under the load can be prevented. The I.14 emphasizes that worker safety is of utmost importance when designing an anchor system to be installed on an existing building.

Based on our experience, locating anchors in line is easily done on concrete buildings for both new construction and existing buildings, and may not pose a significant cost increase. Locating anchorages in line on existing steel frame buildings can be expensive because of additional bracing required to support the loads from the anchorages.

**Clearing up a Common Misconception:** Often, people think the ANSI IWCA I.14 Window Cleaning Safety standard applies only to workers using RDS systems. However, section 5.8.22, Fall Arrest Systems for Suspended Scaffolding states the following: "The lifeline of the system shall always be anchored in line (within 15 degrees of perpendicular) with the suspended worker or platform." The appendix reference states that anchors are to be placed in line with the suspended worker, and where this is impracticable, may be offset no more than 15 degrees.

Considering the two above references, it is clear the standard intends that workers attach ropes to an anchorage located perpendicular to the suspension point or directly above them, regardless of whether their work platform is a bosun's chair or a suspended platform. If impracticable, the allowance is 15 degrees offset maximum. Bear in mind that the word "impracticable" is not the same as "impractical."

a. Where should the anchor be located to allow window cleaners to comply with OSHA requirements?



Best practice for the design of RDS systems is to locate anchorages in line with the workers' anticipated point of suspension, which is most often at <u>a</u> window mullion for window cleaners.



## General Rope Descent System (RDS)

#### Layout Reference Diagram with fall protection zones



ANCHOR LOCATION PLAN

Figure 8 General Rope Descent System (RDS) Layout Reference Diagram mullions a. What restricts workers within the red, yellow and green zone?

**-Green zone:** Work performed 15 feet or more from the roof edge. Employer must ensure each employee is ensured from falling by either (1), (2), (3), or (4) of the below listed systems or a \*designated area. OSHA requires employers to use a \*designated area and to implement and to enforce a work rule prohibiting employees from going within 15 feet of the roof edge without using fall protection. The employer is not required to provide any fall protection, provided the work is both (a) infrequent and (b) temporary.

Yellow zone: Work performed at least six feet but less than 15 feet from the roof edge. The employer must ensure each employee is ensured from falling by either (1), (2), (3), or (4) of the below listed systems. However, for work that is both (a) infrequent and (b) temporary, OSHA allows employers to use a designated area. A designated area is a delineated area with a warning line. See OSHA Subpart D for more information on the proper setup and use of warning lines.

**Red zone:** Work performed less than six feet from the roof edge. Employer must ensure each employee is ensured from falling by either of the below listed systems:

- (1) Guardrail system
- (2) Safety net system
- (3) Travel restraint system
- (3) Personal fall arrest system



a. What is the maximum reach for rope descent workers and how does that limitation influence a designers to locate anchors?

#### \*\*ANSI/IWCA I-14.1

Rope descent system (RDS)

**5.7.10** While suspended, window cleaners shall not reach further than six (6) feet (1.8m) in any direction as measured from plumb line of the suspension point on the bearing point on the building. Rapid descents, excessive swinging and sudden stops are prohibited.

**9.1.6** Anchorages shall be unobstructed and located behind and in line with the equipment or portion of the building they are intended to service and shall be free of sharp edges that may cause damage to the appurtenances attached to them.

\*\*\* **OSHA's SUBPART D** - Walking - working surfaces requires "each employee to use a separate independent fall arrest system." This means that each worker must have their own primary support line connected to one anchorage and an independent fall arrest system connected to an independent anchorage. An independent fall arrest anchorage is required for RDS.

\*\*\*\* **OSHA's SUBPART D** - Walking-working surfaces requires stabilization at the specific work location when descents are greater than 130 feet. OSHA has determined that stabilization can be something as simple as a suction cup.

Review question: How many anchors are required for each rope descent for each worker? Answer: Two independent anchors capable of supporting 5,000 lbs. located in line with the work area.



**Figure 10** Common suction cup used by window cleaners. The typical capacity ranges from 25 lbs to 35 lbs.

## Outside Corner (RDS)



Layout Reference

- 1. Maximum anchor spacing = 12 ft.
- 2. Maximum tie-back distance from roof edge = 50 ft.
- 3. Maximum angle from perpendicular = 15° for both main suspension line and back up line.
- 4. Perimeter guarding 42-inches in height (see section 9.2 Fall protection of ANSI 1.14.1) or a personal fall arrest system is required when installing or rigging to an anchor within 6 ft, of a roof edge (see 1.14.1 2001 Appendix), so the designer may need to design a fall protection system to protect workers working within 6'-0" of the roof edge.
- 5. At outside corners, anchors shall be located to prevent a rope from sliding/slipping around the roof edge.
- 6. While suspended, window cleaners shall not reach further than 6 ft. (See rope descent systems [RDS] Section 5.7.10.)
- A qualified person is required to design the anchor layout system (see section 9 of ANSI I.14.1-2001 and refer to federal and local OSHA regulations as these are more stringent.)

Figure 11 General Rope Descent System (RDS) at Outside Corners

## Reference Anchorage Layout and Usage Guide – 20'–0" Column Spacing and one Worker

#### To I.14.1 2001 Window Cleaning Safety Standard

#### NOTES:

- 1. Maximum tie-back distance from roof edge = 50 ft.
- 2. Maximum angle from perpendicular = 15° for both suspension rope and fall arrest rope.
- 3. Window cleaner shall not reach further than six (6) feet in any direction.

#### LEGEND

- Orange zone: 3 anchors centered on every other window mullion at 4'-0" ft on center with 20'-0" column spacing. (See Figure 12)
- Purple zone: anchors at 8'-0" spacing with 20'-0" column spacing. (See Figure 13)

For clarity, these zones address the locating of anchorages solely for rope descent systems and does not address the OSHA-required fall protection required to approach anchorages when a 42-inch-tall parapet or guardrail does not exist. **See Figure 3, Figure 4, Figure 8, Figure 16 & Figure 6** for OSHA regulations for fall protection requirements for safe approach to anchorages for suspended access.

**Typical note for retrofit applications:** Do not locate anchors within 3'-0" of center of column line intersections to avoid drilling into concentration of reinforcing bar.



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## Reference Anchorage Layout and Usage Guide -20'-0" Column Spacing and two Workers

#### To I.14.1 2001 Window Cleaning Safety Standard

#### NOTES:

- 1. Maximum tie-back distance from roof edge = 50 ft.
- 2. Maximum angle from perpendicular = 15° for both suspension rope and fall arrest rope.
- 3. Window cleaner shall not reach further than six (6) feet in any direction.

#### LEGEND

- Orange zone: two anchor pairs centered on the mullions with 20'-0" column spacing. (See Figure 14)
- Purple zone: anchors at 6'-8" spacing with 20'-0" column spacing. (See Figure 15)

For clarity, these zones address the locating of anchorages solely for rope descent systems and does not address the OSHA-required fall protection to approach anchorages when a 42-inch-tall parapet or guardrail does not exist. See Figure 3, Figure 4, Figure 8, Figure 16 & Figure 6 for OSHA regulations for fall protection requirements for safe approach to anchorages for suspended access.

**Typical note for retrofit applications:** Do not locate anchors within 3'-0" of center of column line intersections to avoid drilling into concentration of reinforcing bar.



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## Reference Anchorage Layout and Usage Guide – 20'–0" Column Spacing for four Workers

#### To I.14.1 2001 Window Cleaning Safety Standard

#### NOTES:

- 1. Maximum tie-back distance from roof edge = 50 ft.
- 2. Maximum angle from perpendicular = 15° for both suspension rope and fall arrest rope.
- 3. Window cleaner shall not reach farther than six (6) feet in any direction.

**Typical note for retrofit applications:** Do not locate anchors within 3'-0" of center of column line intersections to avoid drilling into concentration of reinforcing bar.



SEE TYP. NOTE FOR RETROFIT APPLICATIONS

## Reference Anchorage Layout and Usage Guide – 24'–o" Column Spacing and two Workers

#### To I.14.1 2001 Window Cleaning Safety Standard

#### NOTES:

- 1. Maximum tie-back distance from roof edge = 50 ft.
- 2. Maximum angle from perpendicular = 15° for both suspension rope and fall arrest rope.
- 3. Window cleaner shall not reach farther than six (6) feet in any direction.

#### LEGEND

- Orange zone: for placing two anchor pairs centered on the mullions with 24'-0" column spacing. (See Figure 17)
- Orange zone: for placing anchors at 8'-0" spacing with 24'-0" column spacing. (See Figure 18)

For clarity these zones address the locating of anchorages solely for rope descent systems and does not address the OSHA-required fall protection to approach anchorages when a 42-inch-tall parapet or guardrail does not exist. See Figure 3, Figure 4, Figure 8, Figure 16 & Figure 6 for OSHA regulations for fall protection requirements for safe approach to anchorages for suspended access.

**Typical note for retrofit applications:** Do not locate anchors within 3'-0" of center of column line intersections to avoid drilling into concentration of reinforcing bar.



## Reference Anchorage Layout and Usage Guide -30'-0" Column Spacing and two Workers

#### To I.14.1 2001 Window Cleaning Safety Standard

#### NOTES:

- 1. Maximum tie-back distance from roof edge = 50 ft.
- 2. Maximum angle from perpendicular = 15° for both suspension rope and fall arrest rope.
- 3. Window cleaner shall not reach further than six (6) feet in any direction.

#### LEGEND

- Purple zone: anchors at 10'-0" spacing with 30'-0" column spacing. (See Figure 19)
- Blue zone: anchors at 7'-6" spacing centered at the window mullion with 30'-0" column spacing. (See Figure 20)
- Orange zone: anchor pairs centered on any other window mullion at 2'-0" center with 30'-0" column spacing. (See Figure 21)

For clarity these zones address the locating of anchorages solely for rope descent systems and does not address the OSHA-required fall protection to approach anchorages when a 42-inch-tall parapet or guardrail does not exist. See Figure 3, Figure 4, Figure 8, Figure 16 & Figure 6 for OSHA regulations for fall protection requirements for safe approach to anchorages for suspended access.

**Typical note for retrofit applications:** Do not locate anchors within 3'-0" of center of column line intersections to avoid drilling into concentration of reinforcing bar.



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Figure 21 Reference Anchorage Layout and Usage Guide - 30'-0" Column Spacing for two workers

## Reference Anchorage Layout for Rope Descent & Davit Systems

Workers' lines need to circumvent these building features to avoid damaging them. One way to accomplish this is with a davit system, which allows workers to suspend lines above and outboard from the glass guardrail or other building features (see Figure 22.) Building owners should incorporate both RDS and powered platforms in design plans to protect building features and the maintenance workers using RDS.



Davit systems for RDS can have other uses, too. Workers can use davits for major maintenance projects, such as pairing with a powered platform to replace glass. A building owner can save costs by designing a davit system for both RDS and powered platforms (see Figure 23.) Over the life of the building, an investment in a davit system will pay off. Fewer man hours are spent on heavier maintenance work when using suspended powered platforms facilitated by a good davit system.



#### Note: Guardrails and parapets must be capable of supporting impact loads from workers lines without collapsing.

Summit Anchor's davit arms rotate 360 degrees, which allows workers the flexibility to set up their equipment on the rooftop and then swing out over the parapet wall to various points along the radius of the davit booms rotation. (See Figure 24 and Figure 25.)



Figure 24 Above Layout of a Davit system for Swing Stage



Figure 25 Same Layout as Figure 24 for Rope Descent System

## Laying out Davits with Anchorages for Rope Descent Systems

RDS workers require two independent anchorages at minimal tie-back angles to comply with OSHA requirements. OSHA Says: When tiebacks and anchorages are not perpendicular to the building face, it may be necessary for worker safety for employers to install opposing tiebacks to support and firmly secure the RDS, have at least a 30-degree sag angle for opposing tiebacks, or ensure that no angle exists on single tiebacks.

#### What is the 15-degree rule that designers should consider for anchorages used in conjunction with davits?

For existing buildings, the 2001 ANSI/IWCA I.14.1 Window Cleaning Safety Standard says that anchors should be placed in line with the suspended worker. Where this is impracticable, anchors may be offset no more that 15 degrees from in line (perpendicularly,) provided displacement of the rope under load can be prevented. The I.14.1 emphasizes that worker safety is of utmost importance when designing an anchor system from an existing building.

However, the I.14.1 stipulates the following for new construction: "Anchorages should be placed in line to the work area to prevent displacement of lines under load and/or a fall greater than 6 feet." Still, locating anchorages in line with the intended location of descent is best.

#### **Rope Descent System - Recommended Sequence of Design SOP**

Steps in Sequence	
1	Determine if the BLDG construction is concrete or steel frame. If the roof is a steel frame, lay out steel work on the roof level so as to determine where anchors can be located to avoid adding new steel if possible.
2	Determine how the column line pattern fits within the window's frame pattern.
3	Determine the height of the parapets and glass guardrails by section view. If less than 42 inches in height, add fall protection zone to plan view. If more than 6'-0" tall, address fall protection inboard from the parapet.
4	Check representative section views cut from building drawings of parapets and glass guardrails where suspended work will be performed.
5	Lay out anchors in building corner first.
6	Lay out anchors on the rest of the building according to the pattern you have selected.

#### **Rope Descent System - Design Check-Off**

Check Off	
	Is the anchor spacing no more than 12'-0"?
	Determine window washer's point of suspension. (e.g.: typically a vertical window mullion or center of a window bay)
	Is there safe access to all anchors, especially when the anchors are located within 6'-0" and 15'-0" of the building edge?
	Are there sufficient anchor points for multiple workers working side by side?
	Is the angle of attachment from the supposed focal point of rope descent to the anchor point as in line as possible, without exceeding 15 degrees?
	Are there sufficient anchors located so that window cleaners do not have to reach more than 6'-0" from plumb?
	Has access to the façade for maintenance other than window cleaning such as glazing and waterproofing been considered?
	Are areas red-lined around the perimeter of all roofs where no suspended access and/or fall protection is provided?