

# Leading Edge SRL Clearance Distances

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# Purpose

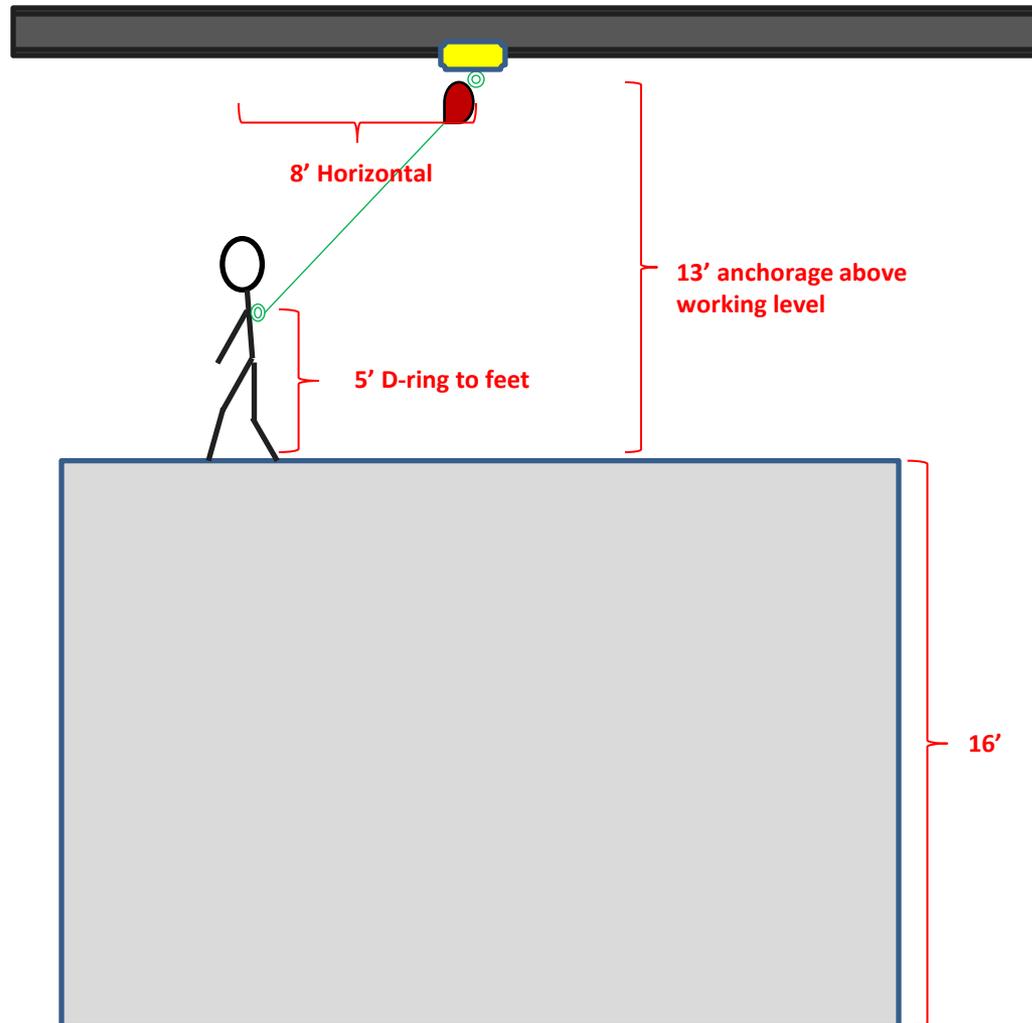
- Describe Leading Edge SRL White Paper
  - For Competent and Qualified Fall Protection personnel
  - When does a Competent person seek the input from a Qualified person?

# Topics

- Standard:
  - Attachments directly overhead
    - Swing hazard
- More Complicated:
  - Tying off below D-Ring
    - Increased free fall distance
    - Swing hazard

# Overhead Fall Protection With Swing

- Guardian Beamer (#00103) anchor on beam
- DBI-SALA Ultra-Lok 20' Web Style SRL



# Simple Overhead Fall Protection With Swing

A worker in this situation using this equipment would require 11.8' (24.8'-13') of clearance below the working level.

Swing Calc:  $A^2 + B^2 = C^2$

$$8^2 + 8^2 = C^2$$

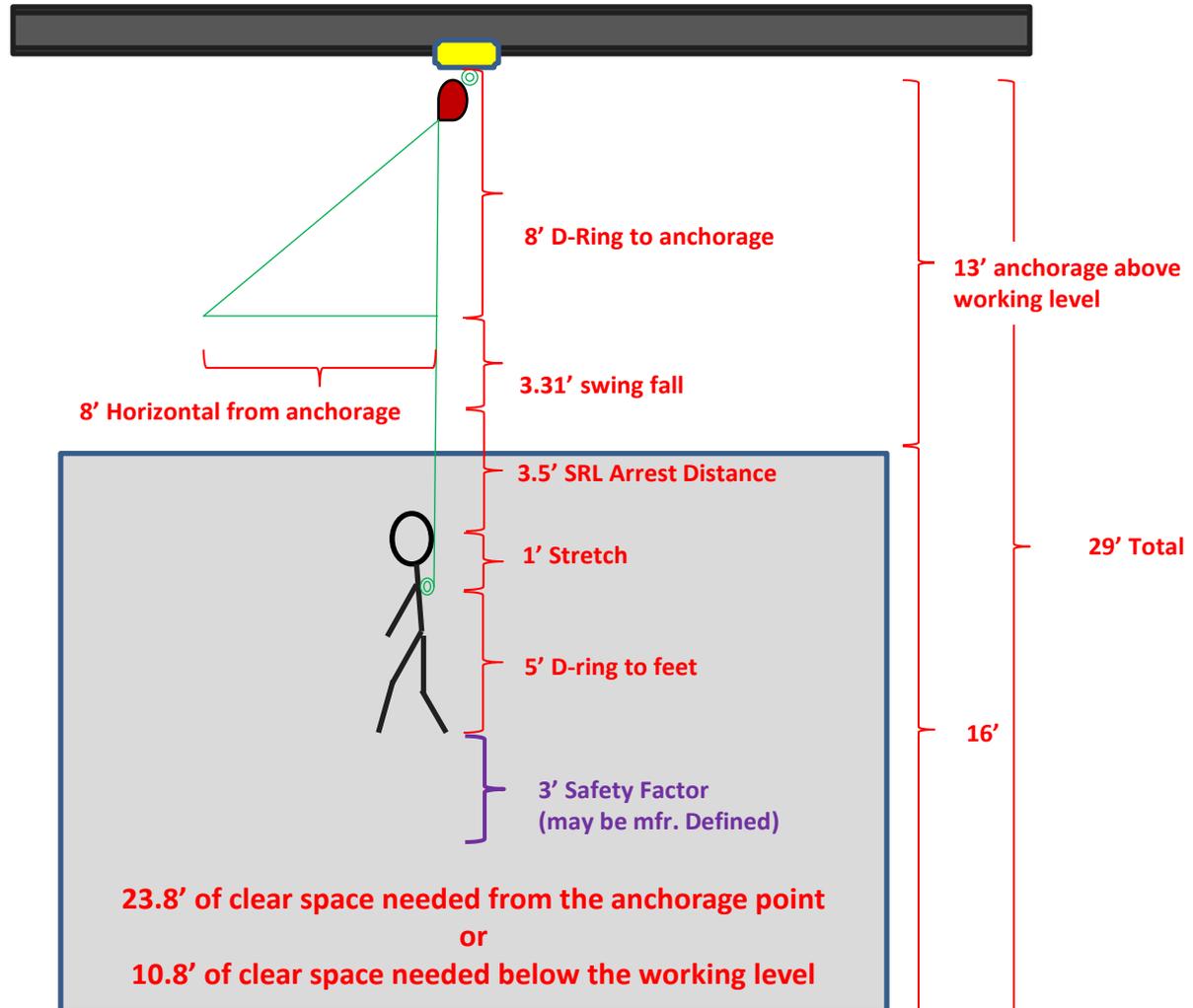
$$64 + 64 = C^2$$

$$128 = C^2$$

$$C = \sqrt{128} = 11.31 \text{ feet}$$

So swing fall distance will be

$$11.31' - 8' \text{ (D-ring to anchorage)} = 3.31 \text{ feet}$$



# Definitions

- Arrest Distance per Z359.0: The total vertical distance required to arrest a fall. Includes the deceleration distance and activation distance.
- Z359.14-2012: Defines all testing and certification protocols, including leading edge

# SRL Types

- **What are the key changes found in ANSI Z359.14?**
  - Increases the test weight for dynamic performance (from 220 to 282 lbs.)
  - Requires classification of SRDs as either Class A or Class B based on results of the dynamic performance test
  - Establishes testing requirements for Self-Retracting Lanyards with Leading Edge Capability (SRL-LE)
- ***SRD Classifications***
  - **Class A,**
    - The maximum arrest distance **must not exceed 24 inches**
    - average arresting force shall not exceed 1,350 lbs.
  - **Class B,**
    - The maximum arrest distance **must not exceed 54 inches**
    - average arresting force shall not exceed 900 lbs.
  - ***Self-Retracting Lanyard with Leading Edge (SRL-LE) Sharp-edge Testing***
    - Dynamic Performance Testing requires:
      - Dropping a 282 lb. weight over a sharp edge with the line of the SRL-LE fully extended.
      - Tested with line perpendicular to the edge
      - Tested with line at an off-set of 5 feet

# From ANSI Z 359.14

Figure 5a

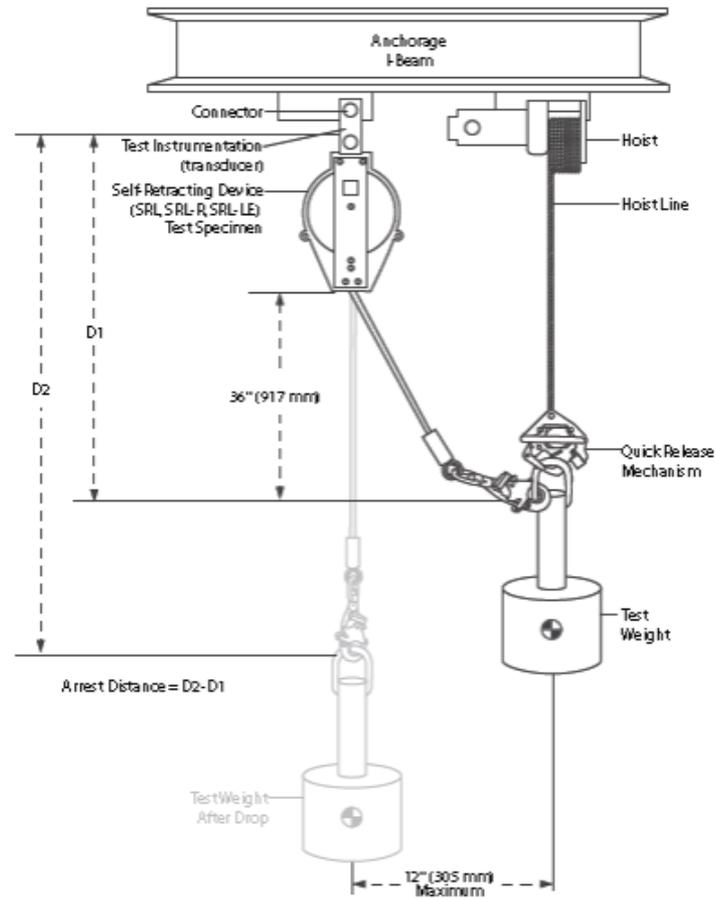


Figure 5a: Dynamic Performance Testing

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Figure 5b

# SRL Types

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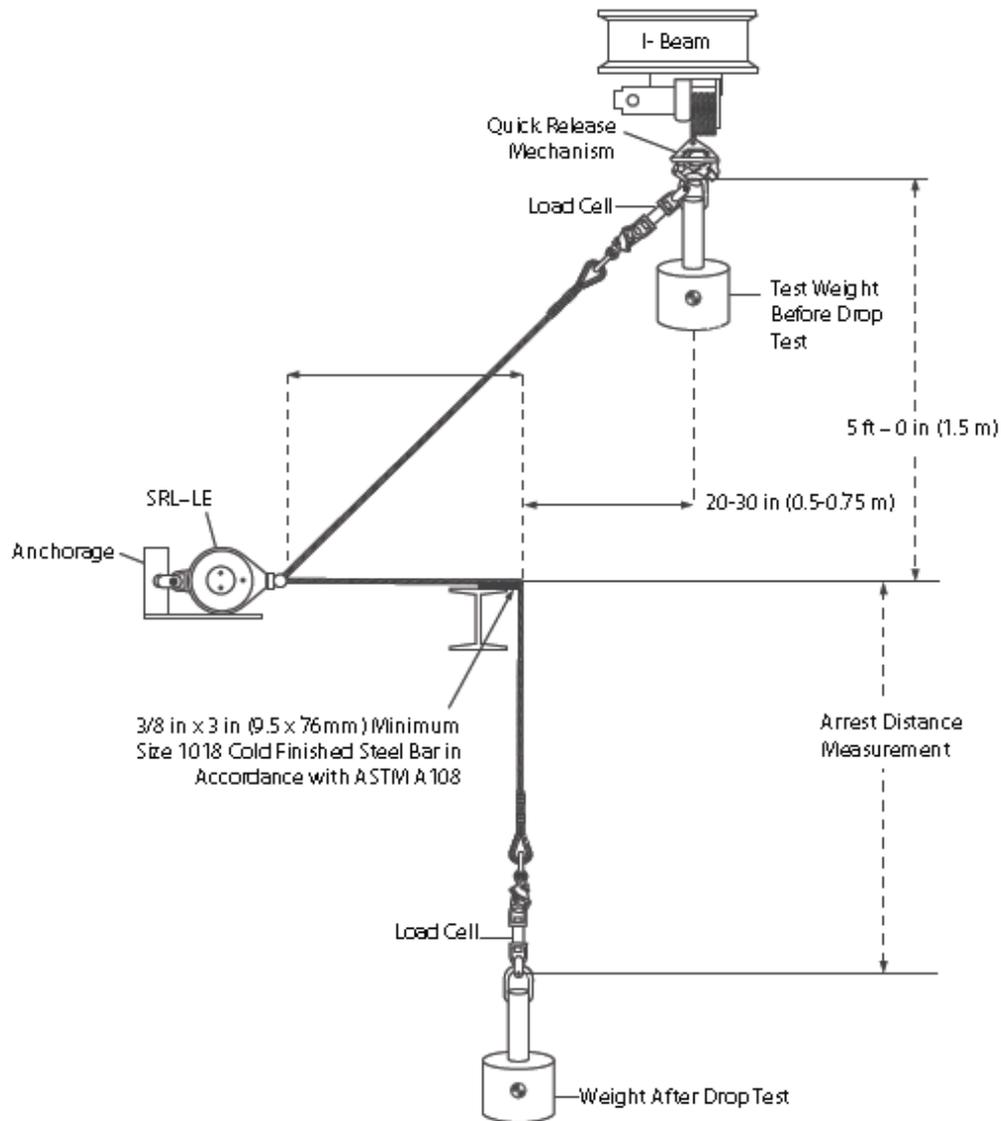


Figure 5b: Dynamic Performance Testing:  
SRL-Leading Edge

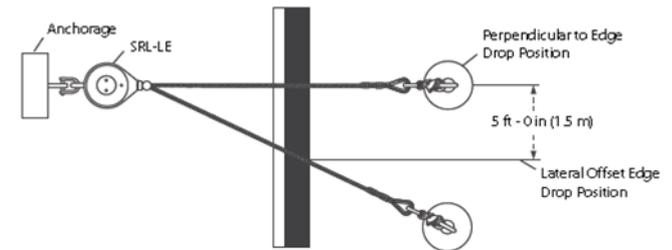


Figure 5c: Dynamic Performance Testing Mark  
on Figure: SRL-LE and Anchorage

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## Issues with Anchoring SRLs Below D-Ring

- Increased kinetic energy due to longer freefall
- May exceed OSHA 6' freefall maximum
  - OSHA interpretation M-3
- Increased swing fall potential

# OSHA Interpretation M-3 February 1995

Subject: §1926.502(d)(16) Personal fall arrest equipment

Question: The provision in §1926.502(d)(16) requires that free fall distance be limited to 6 feet. It is impossible to design an attachment point that will allow me to limit the free fall to 6 feet. What are my obligations?

Answer: §1926.502(d)(16) also requires that the maximum arresting force be limited to 900 pounds when the personal fall arrest system incorporates a body belt and 1800 pounds when the system incorporates a body harness. **If the employer has documentation to demonstrate that these maximum arresting forces are not exceeded and that the personal fall arrest system will operate properly, OSHA will not issue a citation for violation of the free fall distance.**

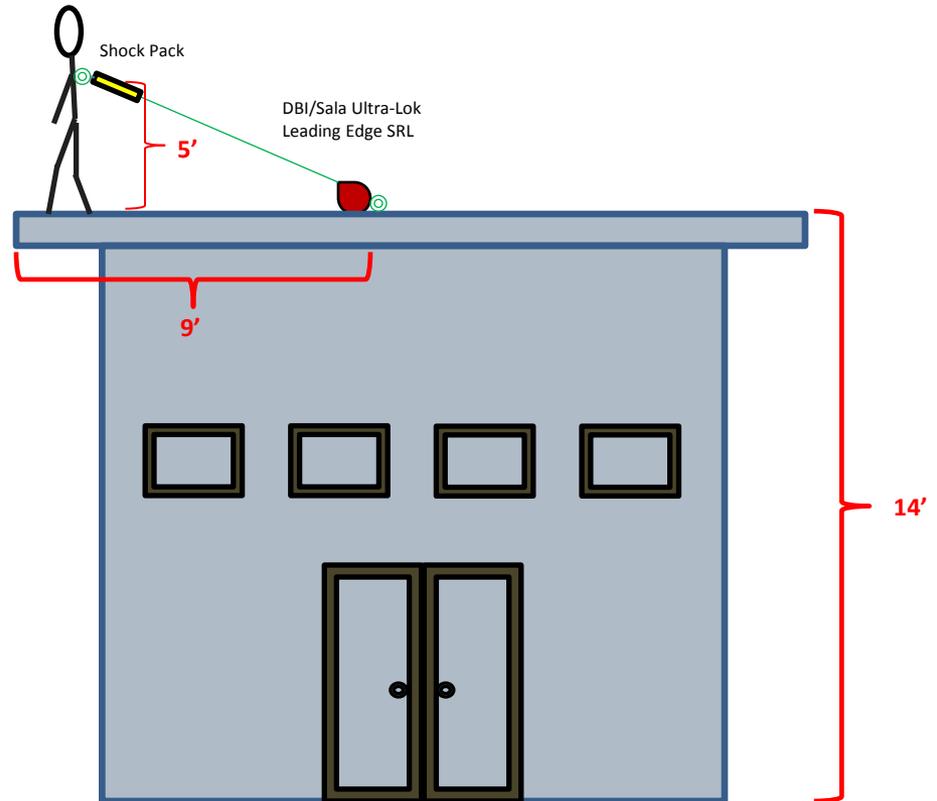
Basis for Decision: U.S. manufacturers of fall protection equipment test their equipment in accordance with test procedures prescribed in ANSI standards (ANSI A10.14 and ANSI Z359) which calls for equipment to be tested based on a **6 foot free fall distance**. Unless the equipment has been tested for a free fall greater than 6 feet, the results are unknown.

**Therefore, if an employer must exceed the free fall distance, the employer must be able to document, based on test data, that the forces on the body will not exceed the limits established by the standard, and that the personal fall arrest system will function properly.**

# SRL-LE with Shock Packs

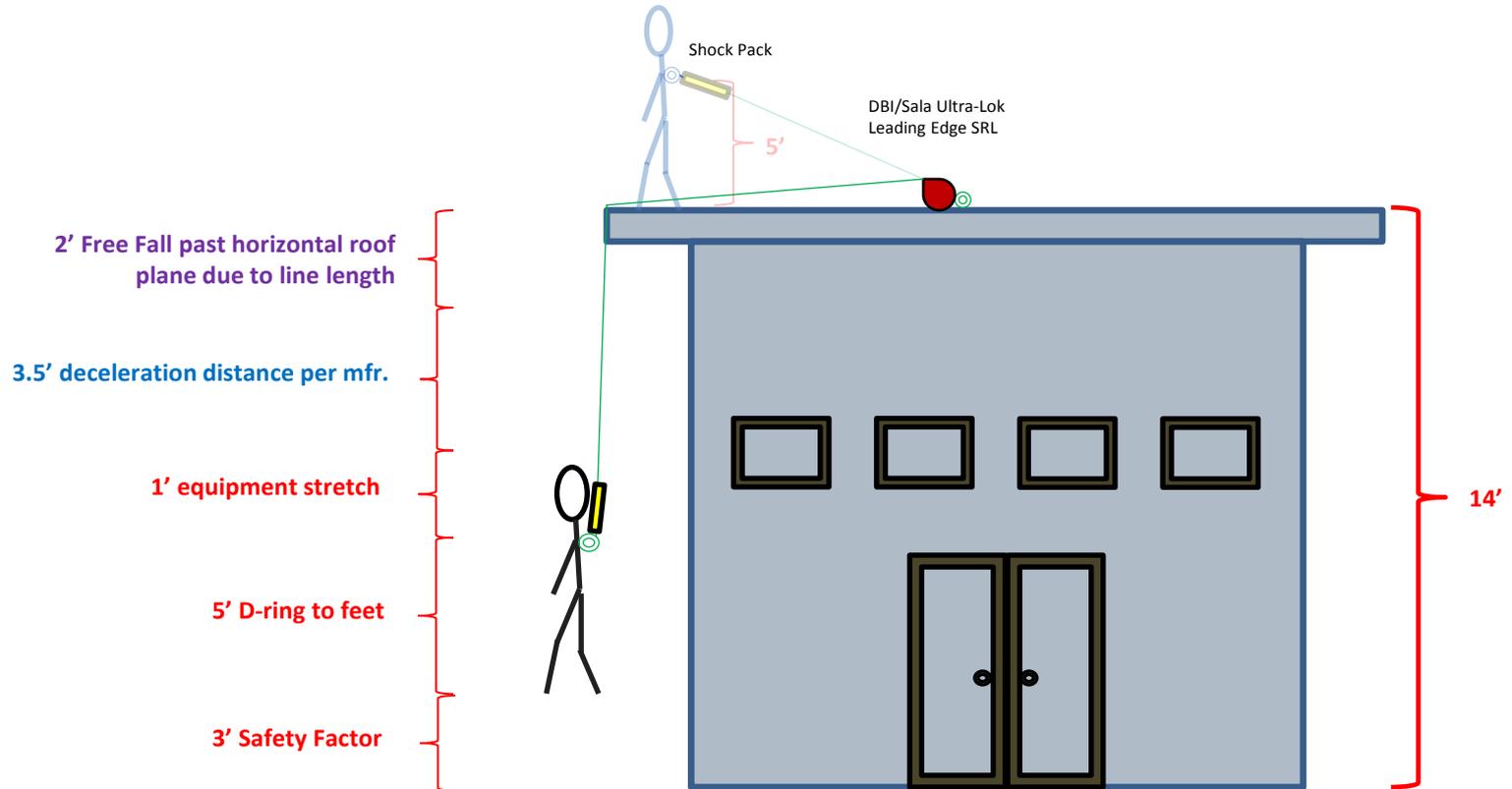
- The locking speed of the SRL may vary in the event of a fall due to friction between the lifeline and the platform edge
- SRL's need to be in a proper horizontal position (cradle?)
- If the cable of the SRL has the potential to travel over the edge of a flat surface, the potential for cable shear may exist due to a 90° bend in the lifeline against an abrasive surface.
- Why are shock packs required on SRLs used for leading edge work with the anchorage below the D-ring?
  - Drop test leading edge videos
    - <https://www.youtube.com/watch?v=r0Pst4Zjh8I>
    - <https://www.youtube.com/watch?v=rmLLagoE-bw>

# Leading Edge Roof Work



- Is SRL allowed for use at feet?
- Does SRL need cradle to keep orientation?
- What is Max Arrest Distance of SRL?
- What is the elongation of shock pack? How do you know?
- Is it a sharp edge or rounded?

# Leading Edge Roof Work Post Fall



Total clearance needed is 14.5' based on the manufacturer's cut sheet that states max arrest distance is 42" or 3.5' (same as the other SRLs in the series).

**Why does the LE version have a shock pack and how long is it?**

# Leading Edge Roof Work Post Fall With Deployed Shock Pack

- But what if the maximum arrest distance is really 8.5' instead of 3.5'?
- There is a shock pack that can elongate to 5'
- Assume worst case

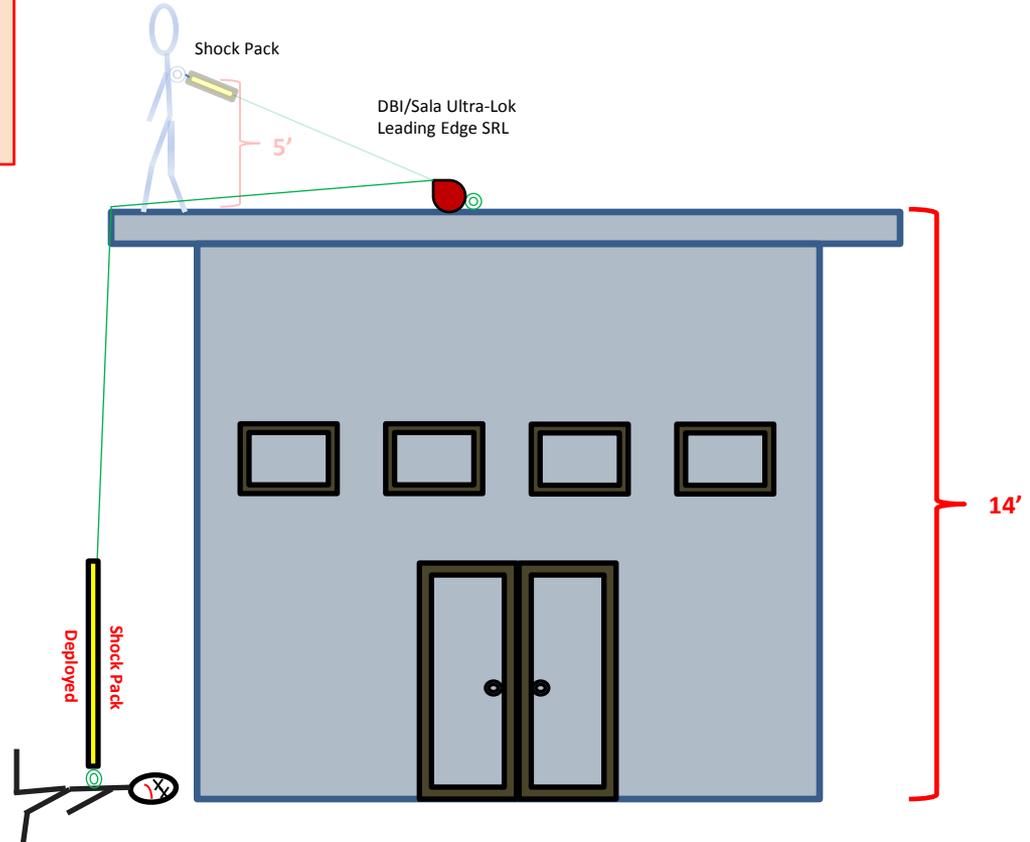
2' Free Fall past horizontal roof plane due to line length

8.5' Max arrest distance of eqpt.  
(3.5' SRL + 5' Shock Pack)

1' equipment stretch

5' D-ring to feet

3' Safety Factor



Total clearance needed is 19.5' if a worst case scenario with a full deployment of all the arrest components is assumed.

## Purpose of the Leading Edge SRL White Paper

- How do you know the maximum elongation of the shock pack? Not listed in the mfr. documentation for SRL-LEs
  - Depends on who you talk to (Tech “vs” Engineer)
  - Should get this information in writing, if possible.
- Competent FP SME vs Qualified FP SME

## Conclusion for Evaluating Leading Edge Elevated Surface Work Plans

- Competent SMEs: Assume **worst-case** scenario e.g. full deployment of arrest components
- If not enough clearance contact Qualified Fall Protection SME to do calculations

# System Deployment Calculation

(Qualified Fall Protection SME)

$$x = \frac{ff_{max} \times w}{F_{avg} - w}$$

$x$  = Calculated deployment of the arrest system in feet (SRL + Shock Pack).

$ff_{max}$  = Maximum freefall distance in feet. Height of the worker will affect the potential freefall distance when tied off below the dorsal D-ring.

$w$  = Weight of the worker, tools, and equipment in pounds. Include a safety factor.

$F_{avg}$  = Average arresting force in pounds. Most fall protection components limit arresting forces to 900 lbs., but some may begin to pay out at lower magnitudes so a Qualified person should contact a manufacturer's engineer to fully understand this variable.

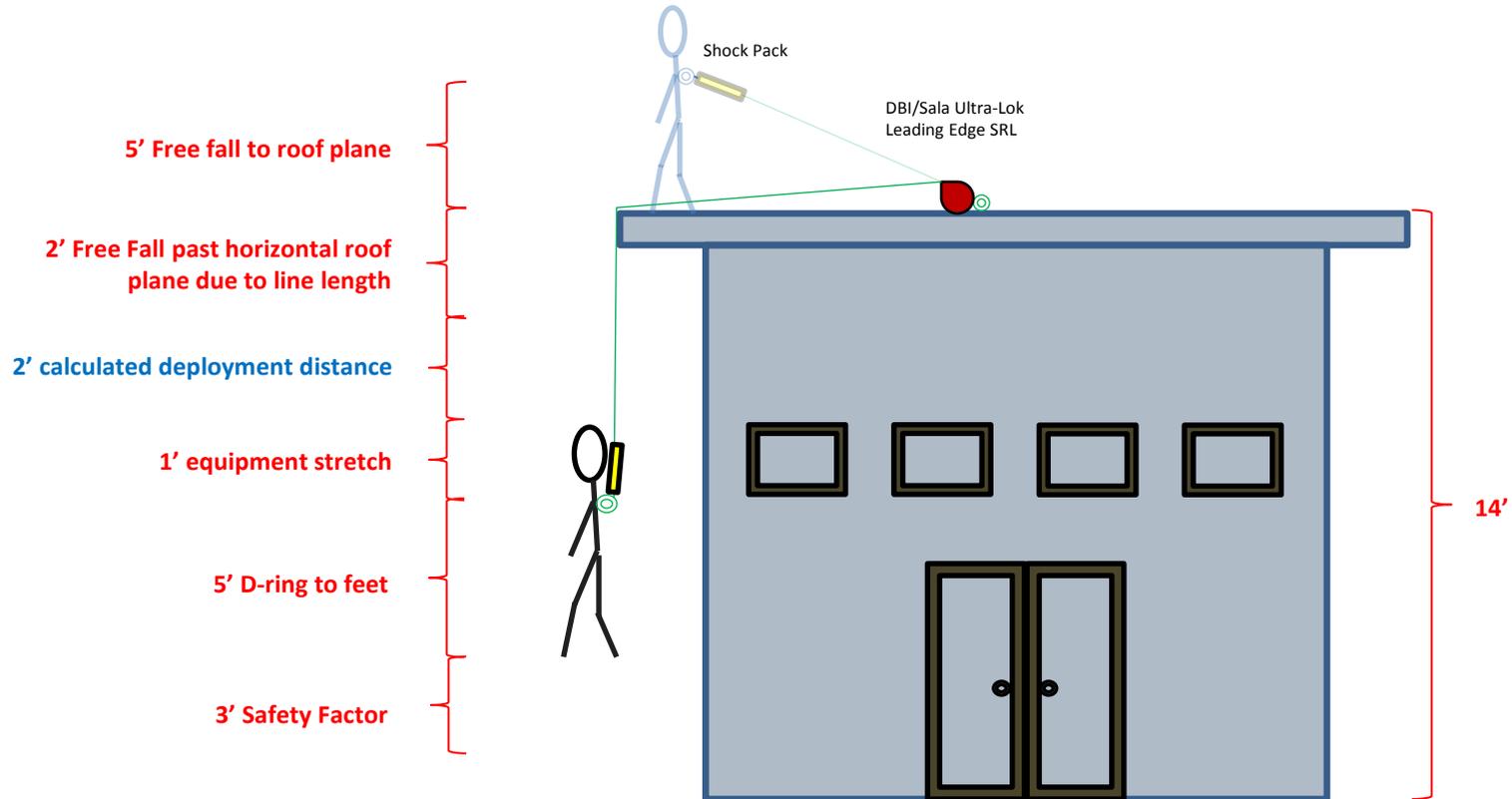
- **Example:**
- **Worker height = 5'9" => D-ring height = 5'**
- **Freefall  $\approx$  5' D-ring height + 2' excess line length = 7'**
- **Worker Weight = 170 lbs + 20 lbs tool & clothes + 10 lbs safety factor = 200 lbs**

**\*Note: Equation derived from ANSI Z359 max freefall equation.**

# System Deployment Calculation

(Qualified Fall Protection SME)

$$x = \frac{7' \times 200 \text{ lbs}}{900 \text{ lbf} - 200 \text{ lbs}} = 2' \text{ calculated deployment of arrest system}$$



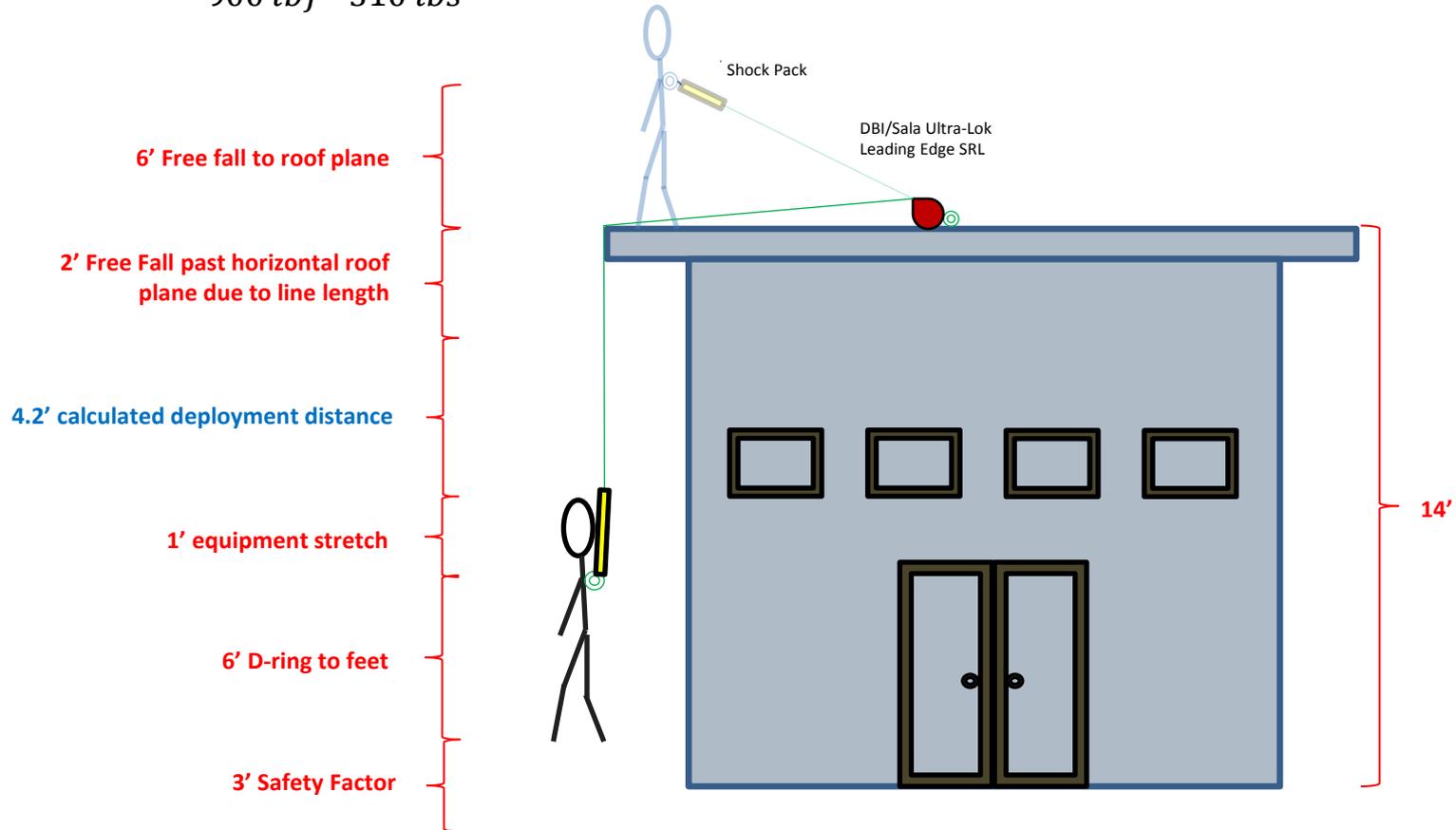
**Total clearance needed is 13' so based on the calculations.**

**This worker is okay, but what if the worker is taller and heavier? 6.5', 280 lbs.**

# System Deployment Calculation

(Qualified Fall Protection SME)

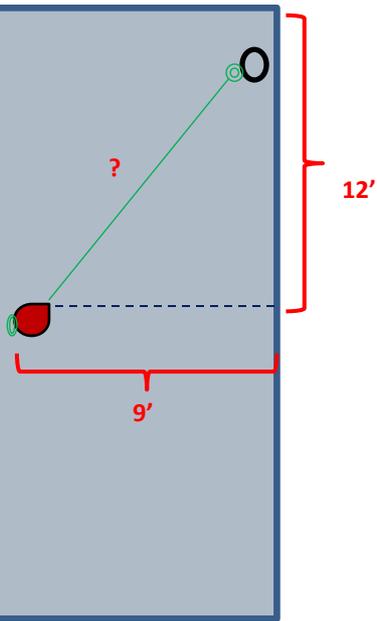
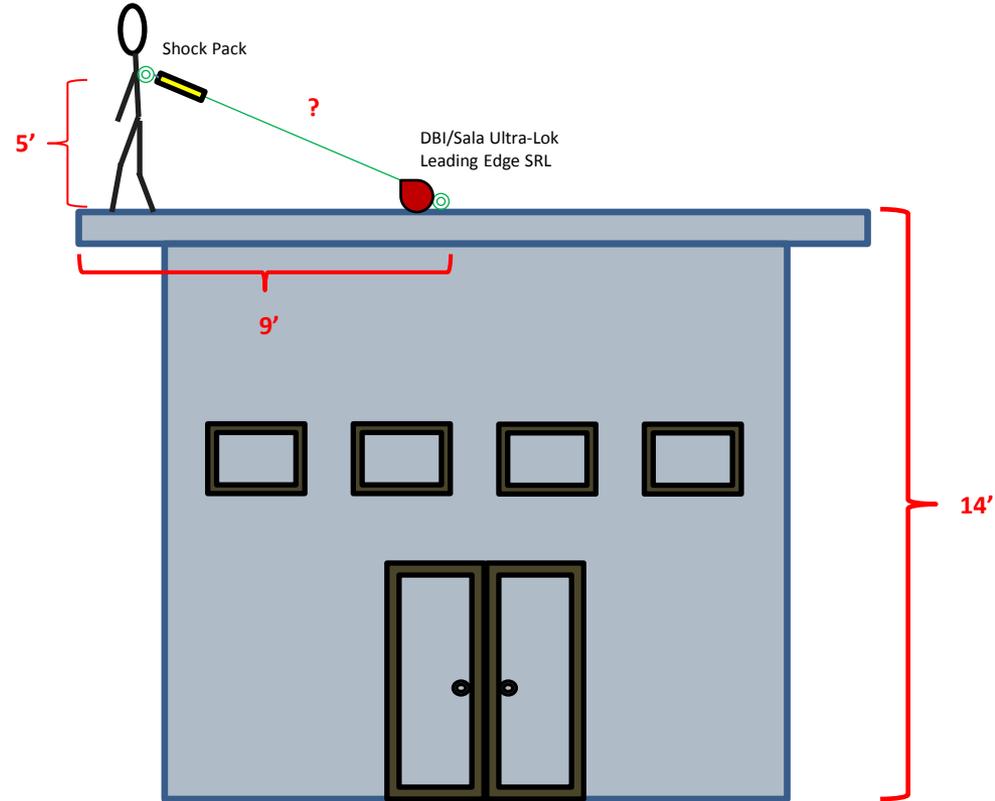
$$x = \frac{8' \times 310 \text{ lbs}}{900 \text{ lbf} - 310 \text{ lbs}} = 4.2' \text{ calculated deployment of arrest system}$$



**Total clear fall area needed is 16.2' (13.2' before adding safety factor). Based on the calculations, this worker is okay, but you have reduced your safety factor to 0.8' (9.6").**

# Leading Edge with Swing Fall

1. If allowed 12' horizontal working distance from anchorage, how long is the line attached to the D-ring?
2. How long is the additional swing fall?



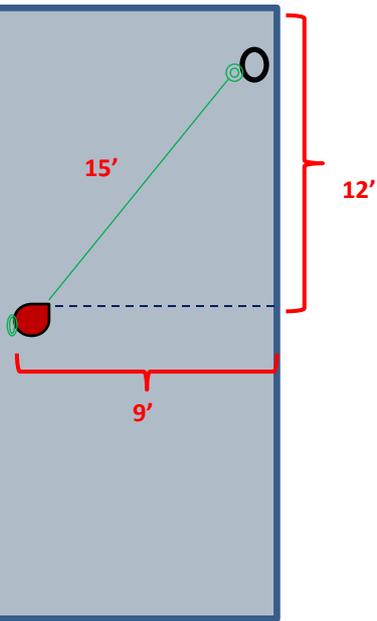
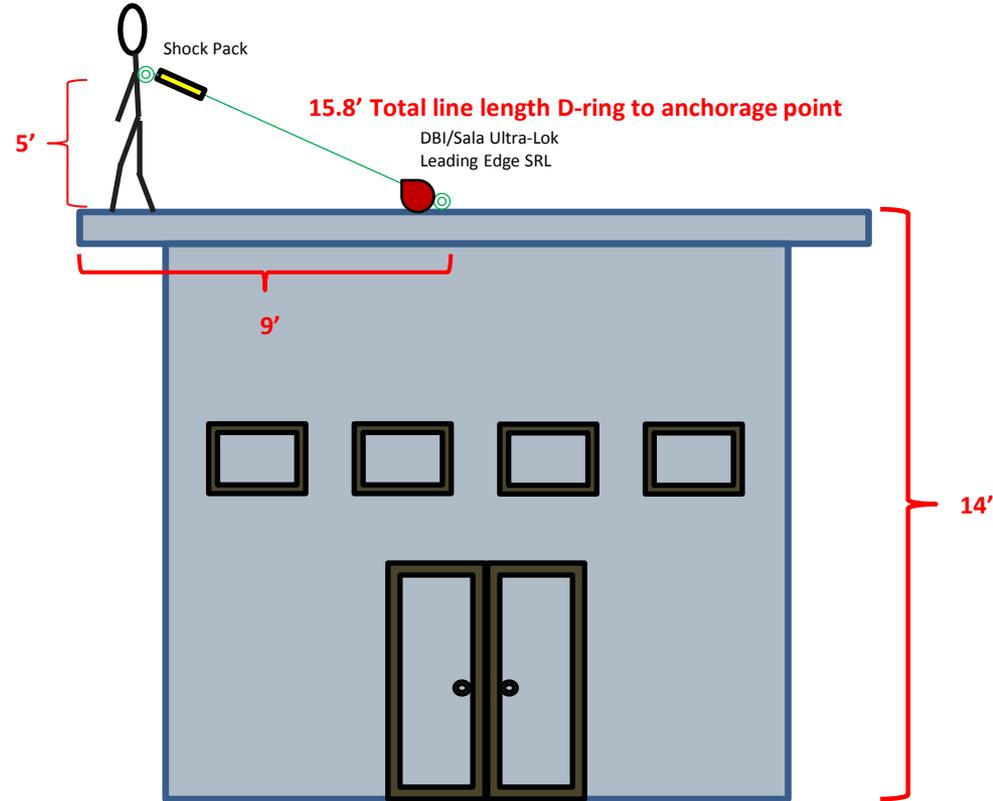
# Leading Edge with Swing Fall

1. If allowed 12' horizontal working distance from anchorage, how long is the line attached to the D-ring?

**Double hypotenuse = 15.8' ≈ 16'**

2. How long is the additional swing fall?

**16' - 9' = 7'**



# Leading Edge with Swing Fall

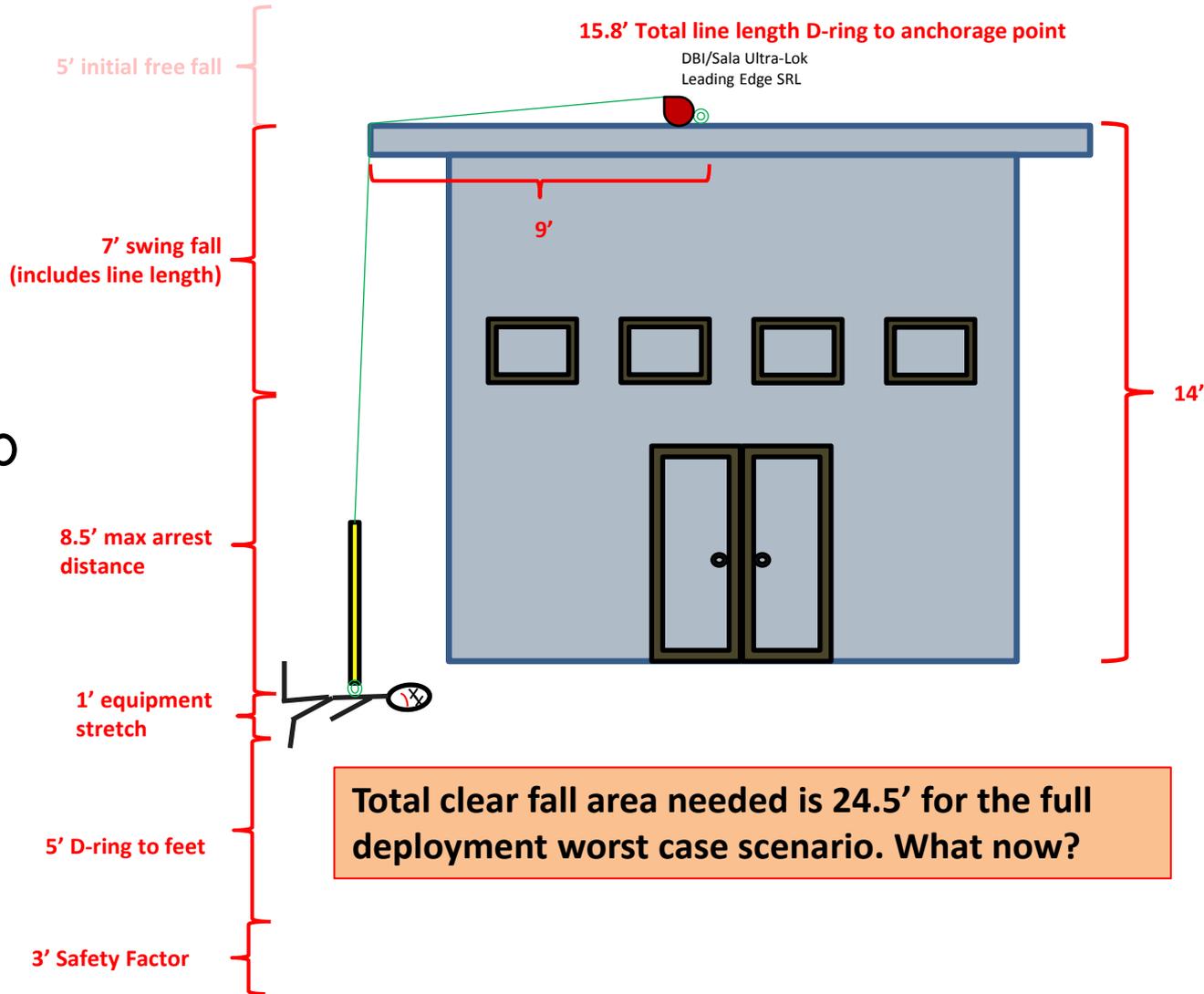
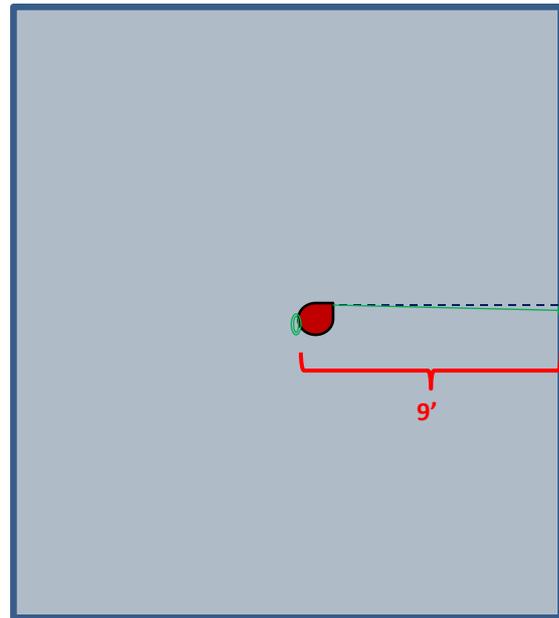
Assumed Full Deployment (Worst Case)

1. If allowed 12' horizontal working distance from anchorage, how long is the line attached to the D-ring?

**Double hypotenuse = 15.8' ≈ 16'**

2. How long is the additional swing fall?

**16' - 9' = 7'**



**Total clear fall area needed is 24.5' for the full deployment worst case scenario. What now?**

# Leading Edge with Swing Fall

## Calculated Deployment

$$x = \frac{12' \times 200 \text{ lbs}}{900 \text{ lbf} - 200 \text{ lbs}} = 3.4' \text{ calculated deployment}$$

1. If allowed 12' horizontal working distance from anchorage, how long is the line attached to the D-ring?  
**Double hypotenuse = 15.8' ≈ 16'**

2. How long is the additional swing fall?  
**16' - 9' = 7'**

5' initial free fall

7' swing fall  
(includes line length)

3.4' calculated  
arrest distance

1' equipment  
stretch

5' D-ring to feet

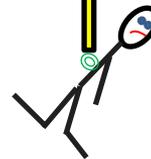
3' Safety Factor

15.8' Total line length D-ring to anchorage point

DBI/Sala Ultra-Lok  
Leading Edge SRL

9'

14'



Total clear fall area needed is 19.4' for the calculated deployment for this worker.  
What now?

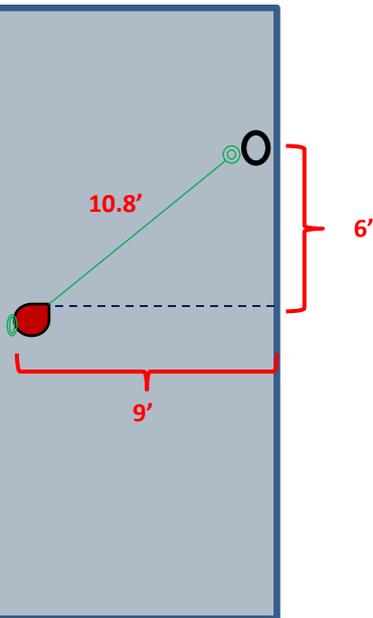
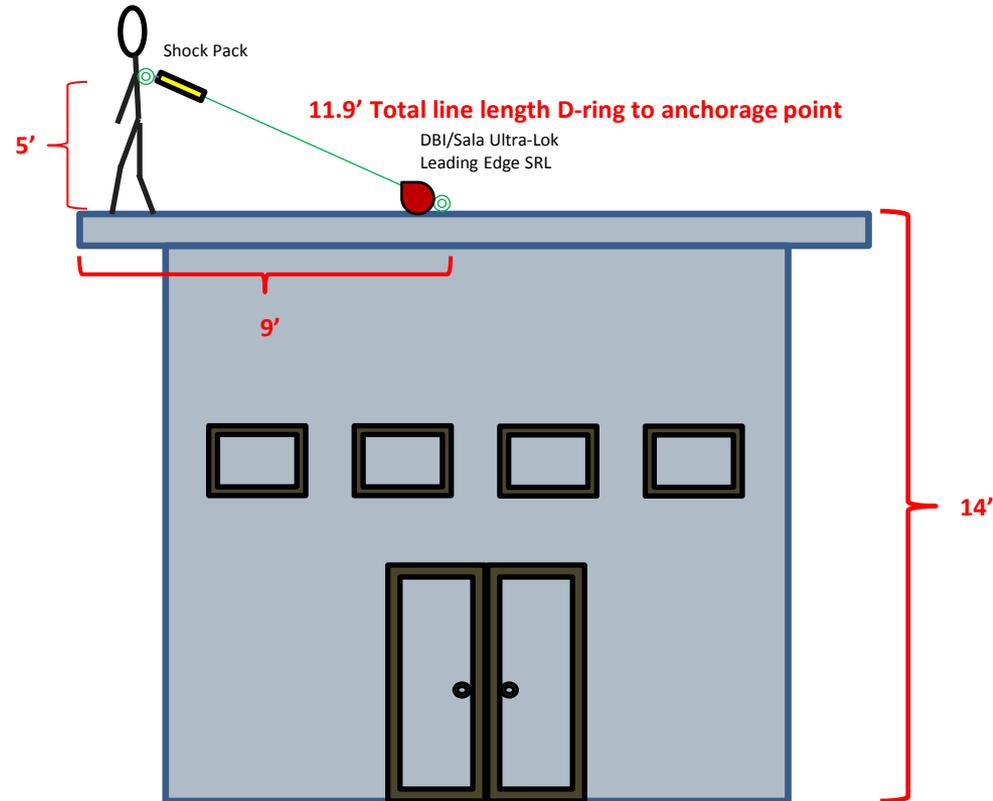
# Leading Edge with Swing Fall

1. If allowed **6' horizontal working distance** from anchorage, how long is the line attached to the D-ring?

**Double hypotenuse = 11.92' ≈ 12'**

2. How long is the additional swing fall?

**12' - 9' = 3'**



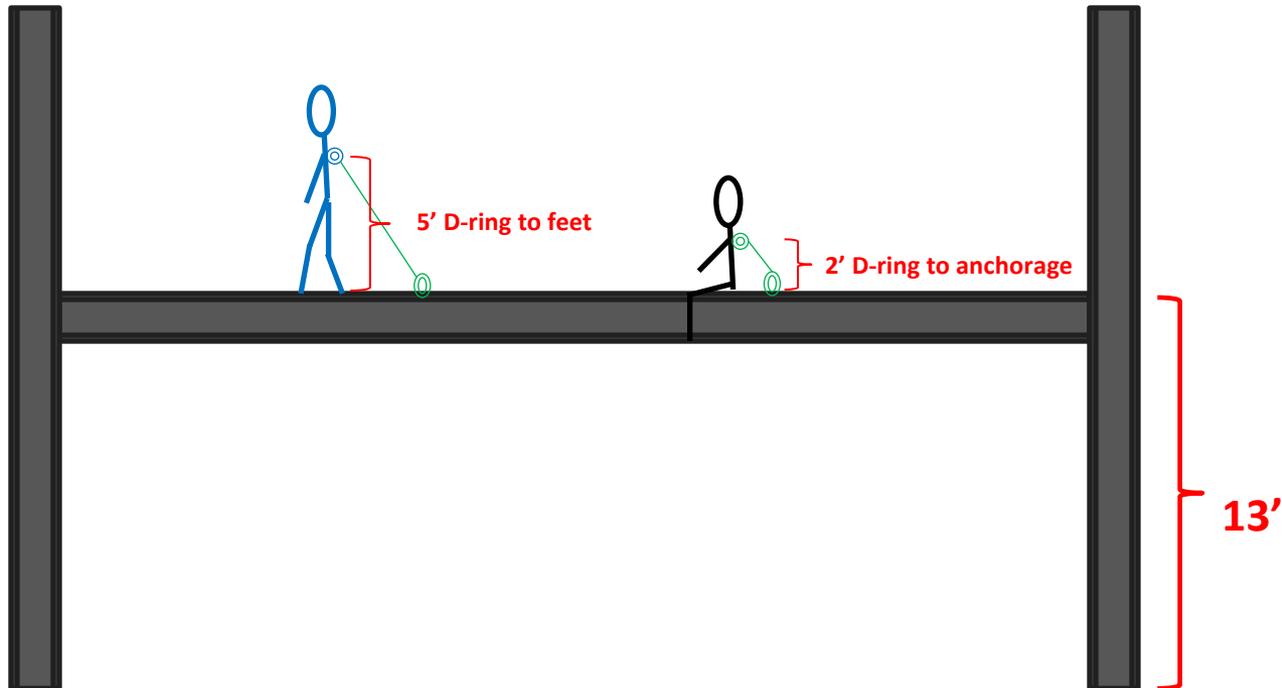


Questions?

# Other Scenarios

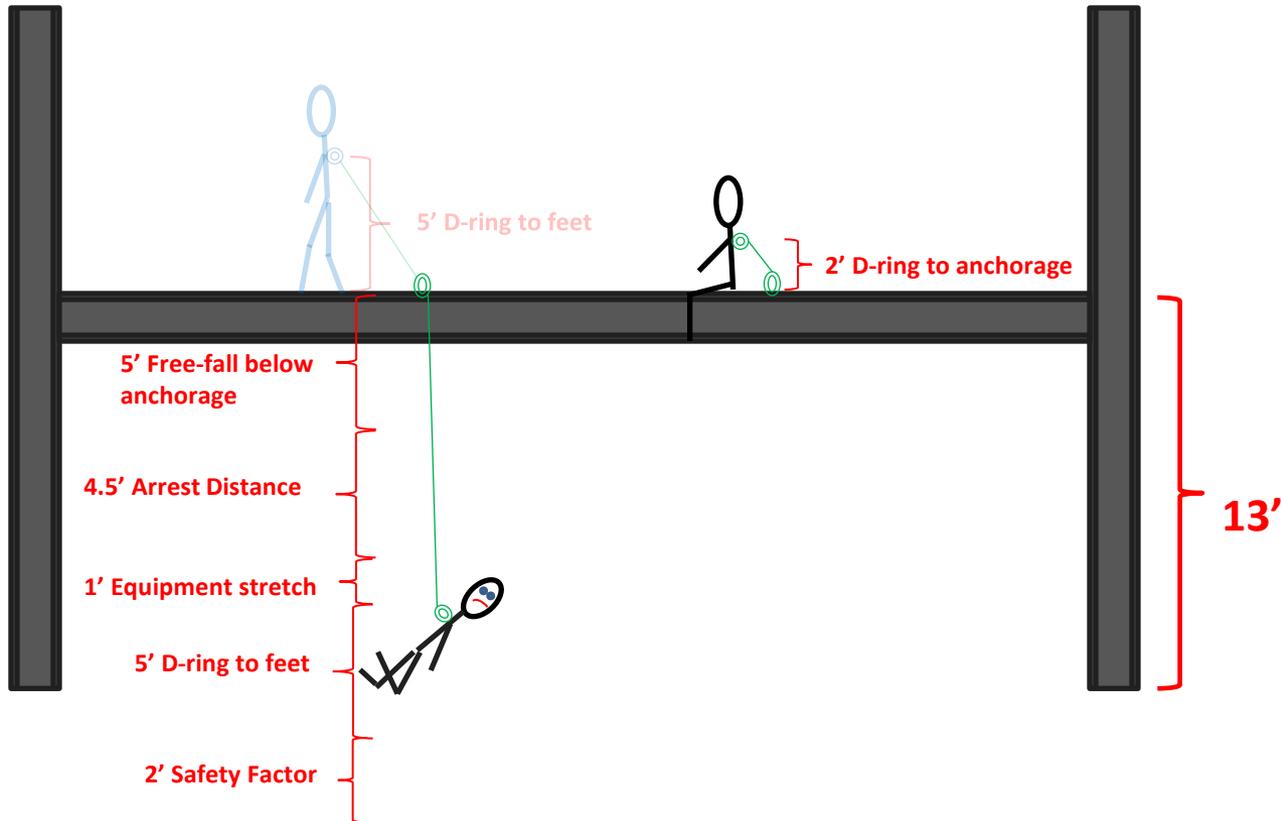
# Standing “vs” Cooning

- Assume:
- Guardian Beamer (#00103) anchor on beam
- 6' tall 220 lbs man
- Ultra-Safe Web Retractable Y-Lanyard 8'SRL (#US-HPSY8CA)



# Standing “vs” Cooning

- Assume:
- Guardian Beamer (#00103) anchor on beam
- 6' tall 220 lbs man
- Ultra-Safe Web Retractable Y-Lanyard 8'SRL (#US-HPSY8CA)

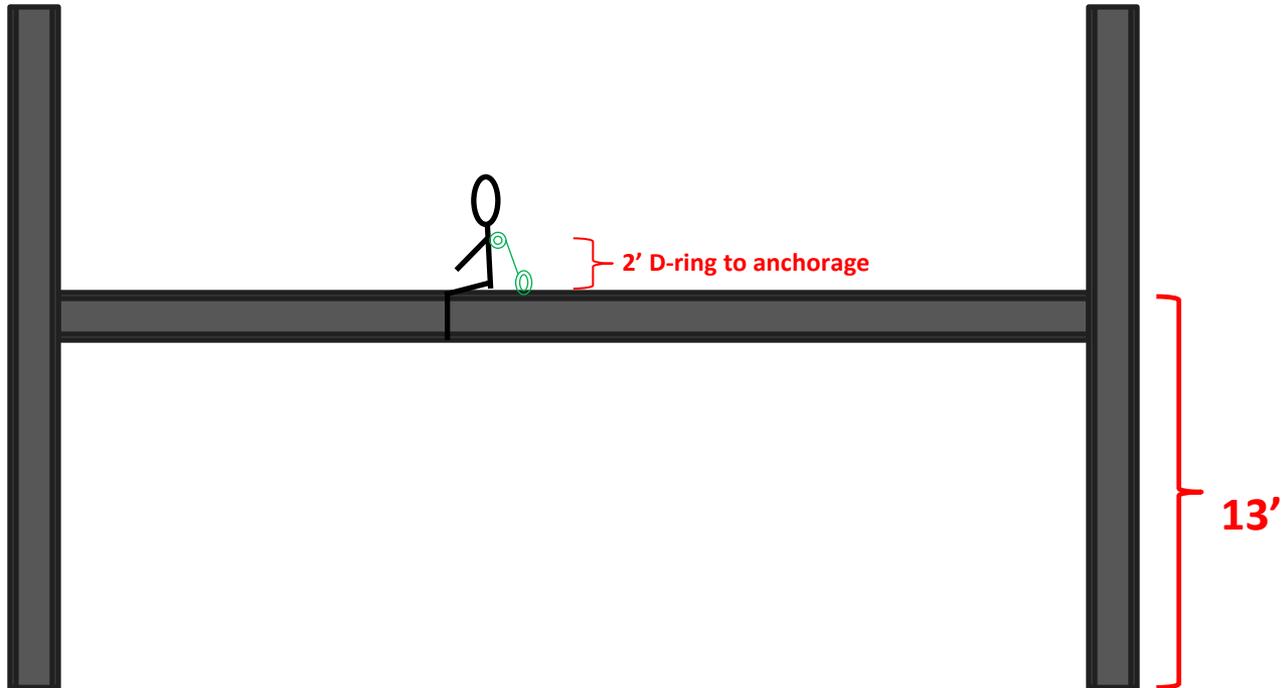


17.5' Total (Freefall below anchorage + Arrest Distance + Equipment Stretch + Worker D-ring to Feet + Safety Factor)

A worker walking the top flange of a beam would require 17.5' of clearance below anchorage point. The worker would likely strike the lower level. Why can't you count on SRL reel in?

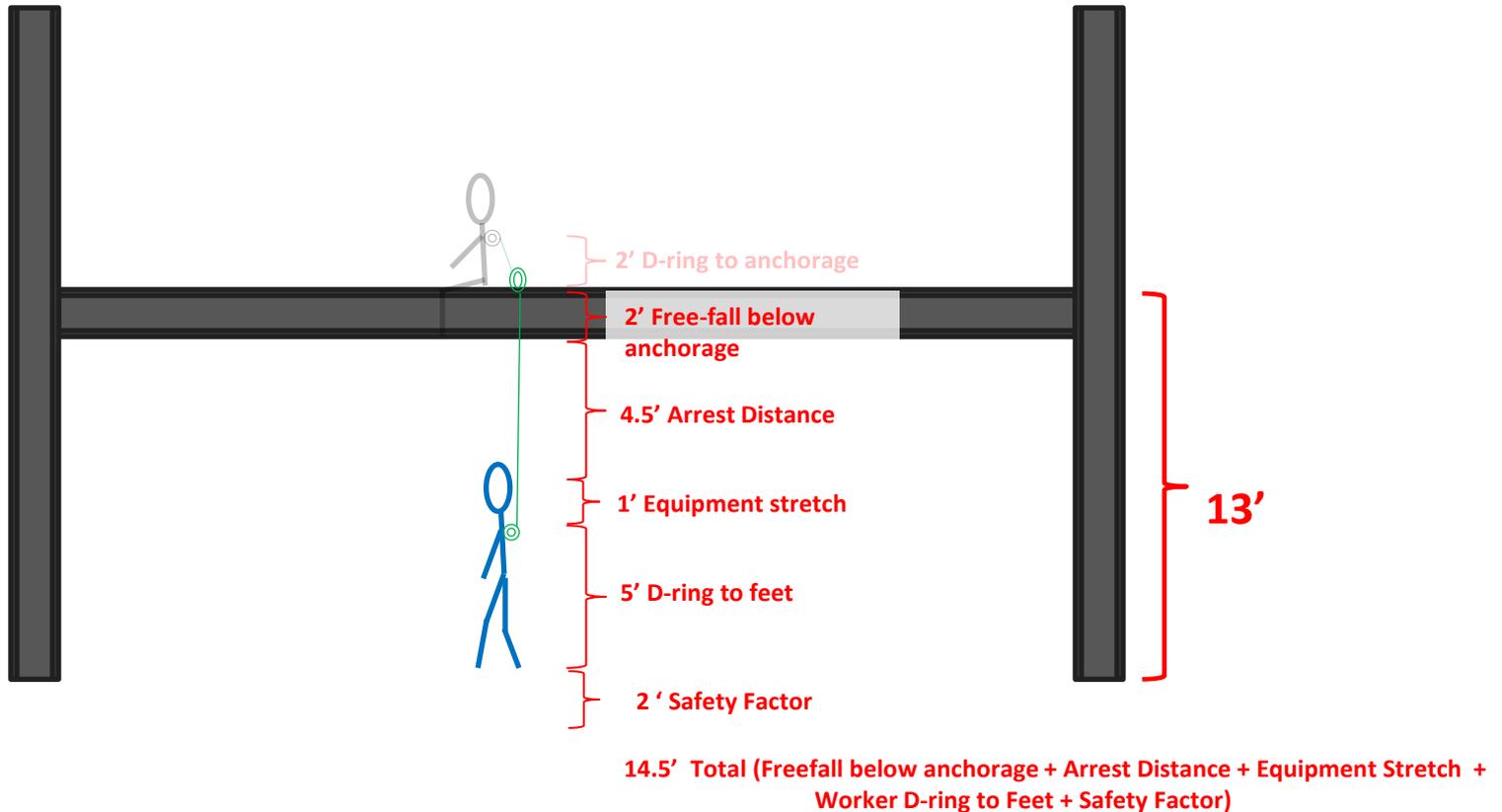
## Scenario 2: Cooning Clearance

- Assume:
- Guardian Beamer (#00103) anchor on beam
- 6' tall 220 lbs man
- Ultra-Safe Web Retractable Y-Lanyard 8'SRL (#US-HPSY8CA)



# Cooning Clearance Post Fall

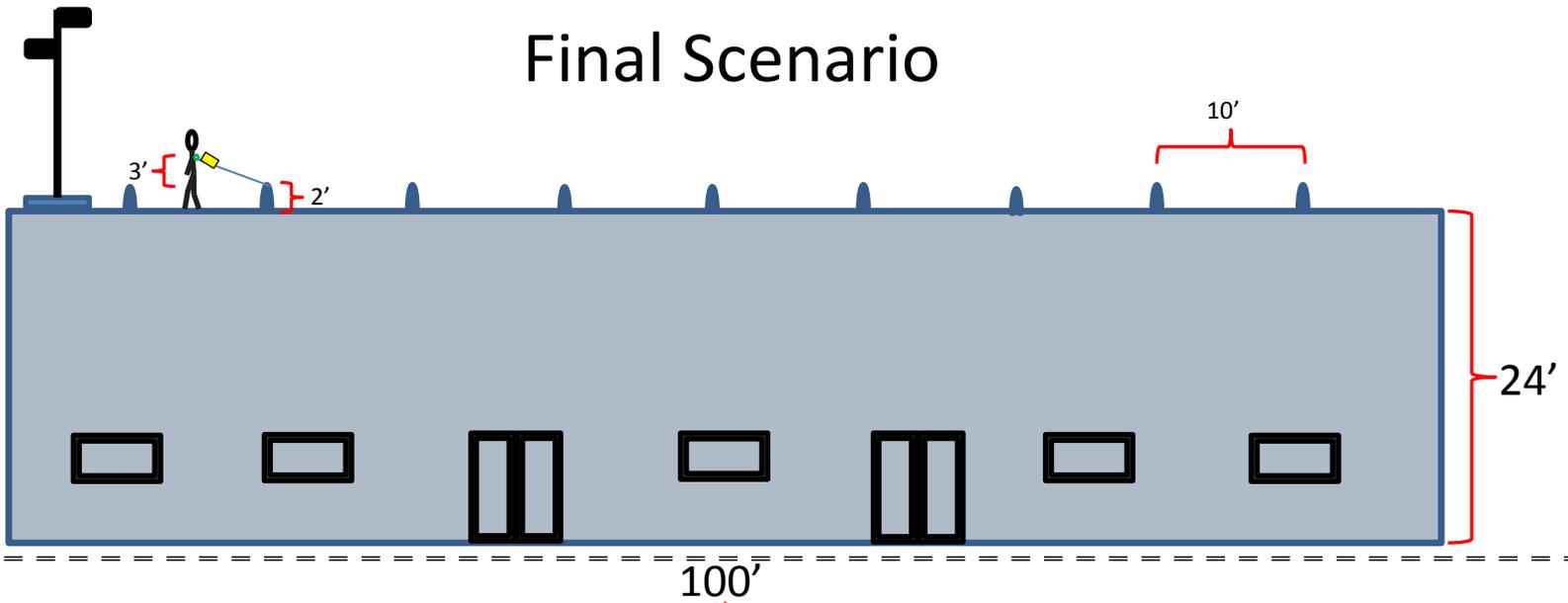
- Assume:
- Guardian Beamer (#00103) anchor on beam
- 6' tall 220 lbs man
- Ultra-Safe Web Retractable Y-Lanyard 8'SRL (#US-HPSY8CA)



What does this mean?

# Final Scenario

Elevation View



Birds-Eye View

