
Fall Protection for Schools – Building Your Plan

Presented by:

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How Do I Comply?



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Compliance

After extensive discussions with Saskatchewan OH & S, it is recognized that building owners and operators cannot install these systems in the short term and maintenance activities must continue on the roof.

Bottomline, they want to see a plan for compliance in the short and long term

Compliance

- The Amendments to Sask OH & S regulations for fall protection came into force in 2007 and applied to all temporary (under construction) and permanent work sites.
 - Most workplaces immediately concentrated on assessing their facilities in order to develop a capital requirements plan for installing the fall protection systems.
 - This process alone does not provide adequate coverage from a due diligence defense if a fall incident were to occur.
 - Workplaces must have a written fall protection plan that mitigates fall risks even prior to the installation and/or procurement of a fall protection system.
-

Critical Focus

**Get the risk management issues
(aka People Issues) in place
FIRST, before the design of
the Fall Protection Systems!**

Categorizing Fall Risk – FALL RISK ZONES



Fall Risk Zones

In order to better understand fall risks, we have developed 5 categories for describing different levels of fall risk.

FALL RISK ZONES

Before we discuss the zones, we need to ensure there is clear understanding on a few definitions:

- **Control Zone** – This is a 2 metre wide zone around the outside unguarded edge of a flat roof.
- **Flat Roof** – Slope of roof must be less than or equal to 1/2" per foot or 4%.
- **Sloped Roof** – Slope of roof must be greater than 1/2" per foot or 4%.

FALL RISK ZONES

- **ZONE 1** – Located in the interior of a Flat Roof, not in the control zone. Low fall risk.
- **ZONE 2** – Located within the Control Zone on a Flat Roof. Moderate Fall Risk.
- **ZONE 3** – Sloped Roof with no roof top equipment that requires ongoing maintenance. Moderate Fall Risk.
- **ZONE 4** - Sloped Roof with roof top equipment that requires ongoing maintenance. Major Fall Risk.
- **ZONE 5** – Restricted access roofs due to fall risk. Steep sloped roofs, narrow flat roofs with significant fall risk exposure. Serious Fall Risk

ZONE 1 - EXAMPLE



ZONE 2 - EXAMPLE



ZONE 3 - EXAMPLE



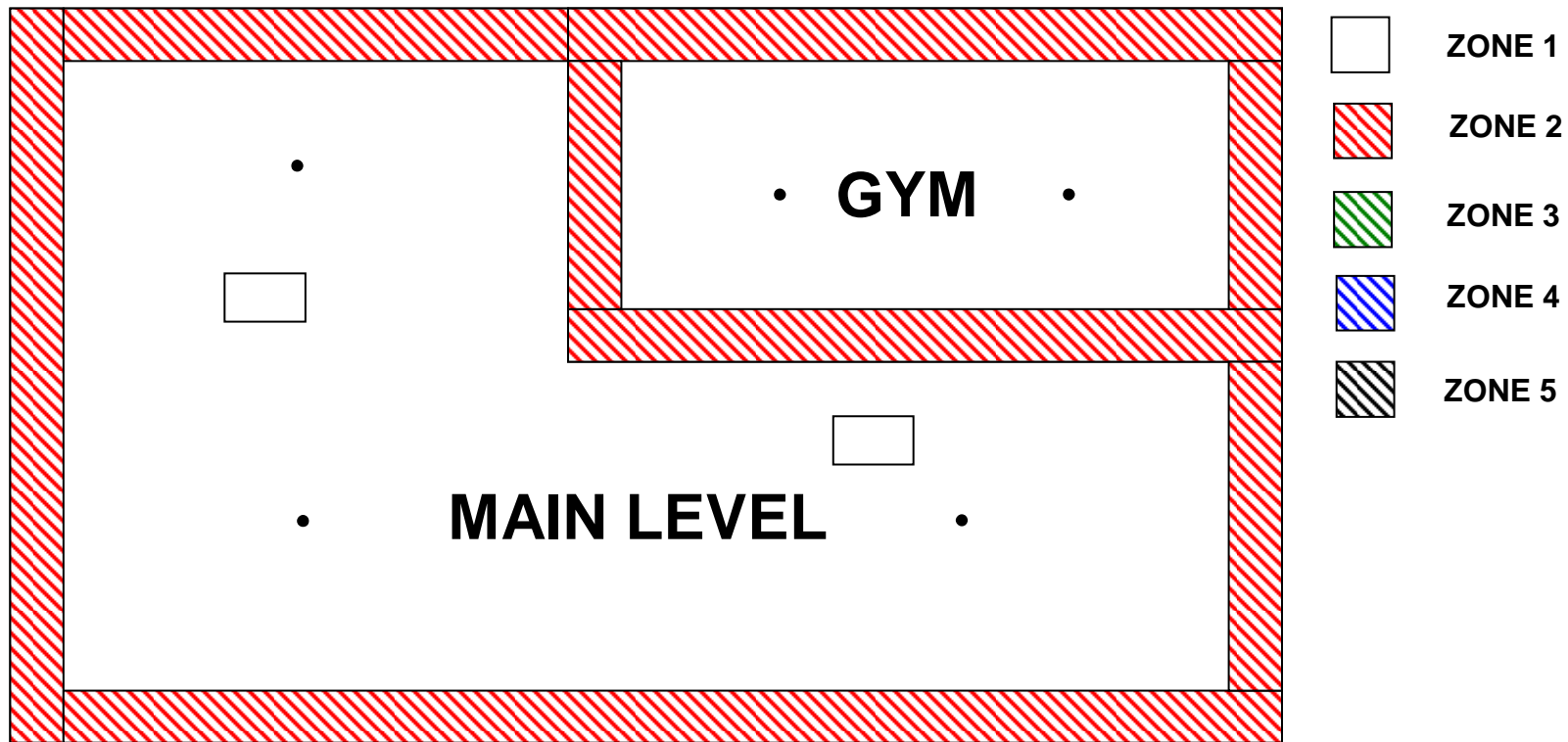
ZONE 4 - EXAMPLE



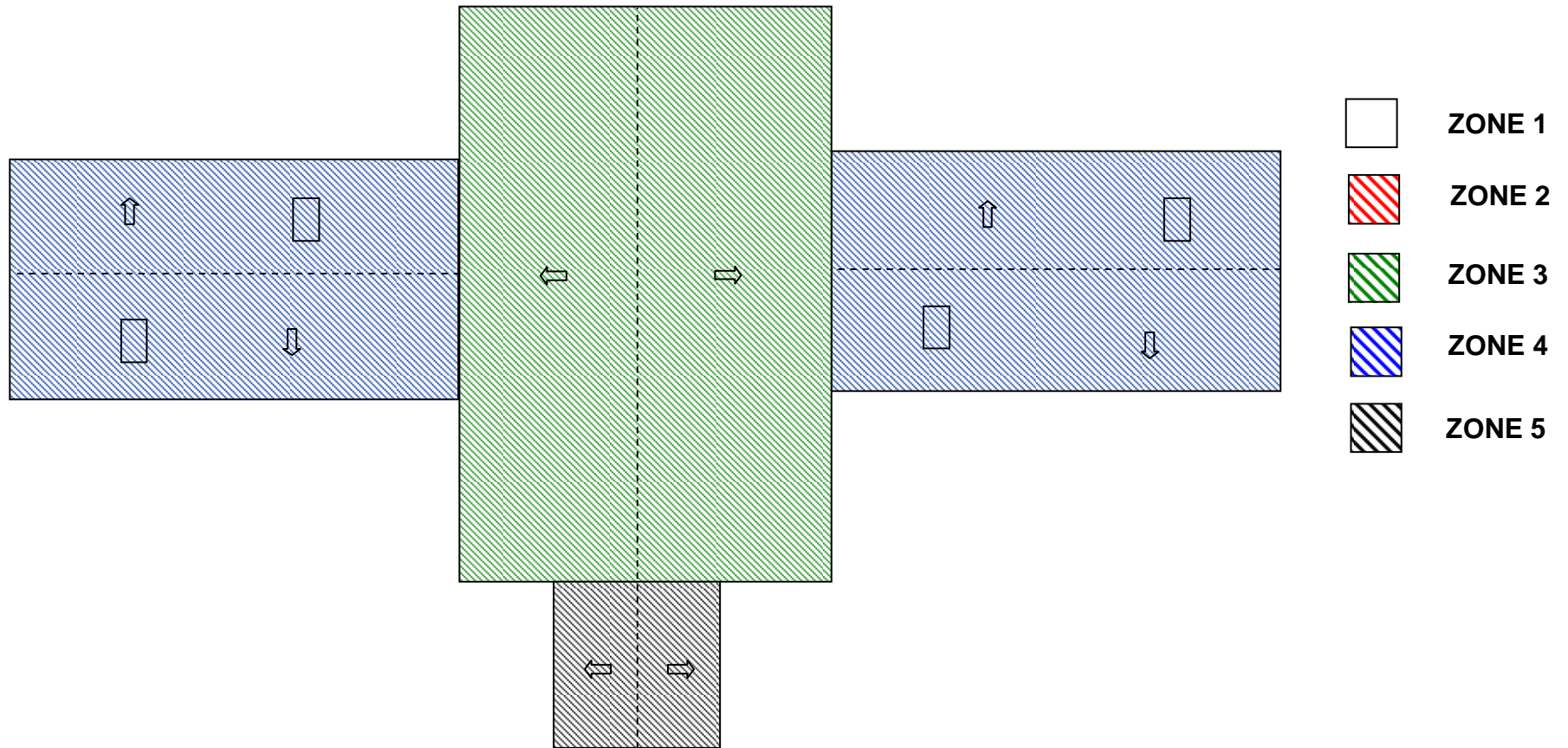
ZONE 5 - EXAMPLE



Fall Risk Zone Layout – Flat Roofs - Example



Fall Risk Zone Layout – Sloped Roofs - Example



Fall Risk Management Methods by FALL RISK ZONES



ZONE 1 – Fall Risk Management

- **Staff Fall Protection Technical Knowledge Requirement** – Low to Moderate Risk, area is safe for caretakers, custodians, etc.
- **Training Requirements** – 2-3 Hour Classroom Session consisting of ladder safety, assessing fall risks, understanding fall risk zones, marking the control zone.
- **Equipment or Materials Required** – Temporary method for marking the control zone such as pylons, painted blocks, 2 metre measuring device, etc.
- **Personal Fall Protection Equipment Required - NONE**

ZONE 2 – Fall Risk Management

- **Staff Fall Protection Technical Knowledge Requirement** – Moderate Risk, area is generally restricted to maintenance personnel, certified roofers and other trained trades people.
- **Training Requirements** – Minimum 8 Hour Classroom and Practical Training Session consisting of ladder safety, assessing fall risks, understanding fall risk zones, marking the control zone, methods of fall protection & utilizing fall protection equipment.
- **Equipment or Materials Required** – Weighted pylons with 3/8” Nylon rope strung between to mark control zone. Also need fall protection system such as portable guard rail, portable fall protection anchor, perimeter scaffold or lift.
- **Personal Fall Protection Equipment Required** – Full Body Harness, Lanyard & Lifeline if required.

ZONE 3 – Fall Risk Management

- **Staff Fall Protection Technical Knowledge Requirement** – Moderate to Serious Risk, area is restricted to maintenance personnel, certified roofers and other trained trades people.
- **Training Requirements** – Minimum 8 Hour Classroom and Practical Training Session consisting of ladder safety, assessing fall risks, understanding fall risk zones, marking the control zone, methods of fall protection & utilizing fall protection equipment.
- **Equipment or Materials Required** – Workers need be attached or protected by a fall protection system at all times they are on the roof. Protection is usually a permanent anchor point on the roof. Before permanent anchor points are installed, methods such as ground based anchorage or perimeter scaffold can be used.
- **Personal Fall Protection Equipment Required** – Full Body Harness, Lanyard & Lifeline is required.

ZONE 4 – Fall Risk Management

- **Staff Fall Protection Technical Knowledge Requirement** – Moderate to Serious Risk, area is restricted to maintenance personnel, certified roofers and other trained trades people.
- **Training Requirements** – Minimum 8 Hour Classroom and Practical Training Session consisting of ladder safety, assessing fall risks, understanding fall risk zones, marking the control zone, methods of fall protection & utilizing fall protection equipment.
- **Equipment or Materials Required** – Workers need be attached or protected by a fall protection system at all times they are on the roof. Protection is usually a permanent anchor point on the roof. Before permanent anchor points are installed, it is recommended that some form of anchorage such as a cable run between roof top units or other such approach be installed.
- **Personal Fall Protection Equipment Required** – Full Body Harness, Lanyard & Lifeline is required.

ZONE 5 – Fall Risk Management

- **Staff Fall Protection Technical Knowledge Requirement** – Serious Risk, area is restricted to highly skilled maintenance personnel or certified roofers.
- **Training Requirements** – Minimum 8 Hour Classroom and Practical Training Session consisting of ladder safety, assessing fall risks, understanding fall risk zones, marking the control zone, methods of fall protection & utilizing fall protection equipment.
- **Equipment or Materials Required** – Workers need be attached or protected by a fall protection system at all times they are on the roof. Protection is must be a permanent anchor point on the roof. No access is recommended to these roofs until fall protection systems are installed.
- **Personal Fall Protection Equipment Required** – Full Body Harness, Lanyard & Lifeline is required.

Fall Risk Zones – The Benefits

- This approach allows employers to align the technical capability of their work force to a specific fall risk zone.
- It significantly reduces the training requirements for a school division.
- It significantly reduces the amount of Fall Protection Personal Protective equipment (ie. Harness, Lanyard, Lifeline, etc.) that has to be provided to workers.

Fall Protection Regulations – Potential Exemptions



Sask OH & S – Potential Exemptions

In the Fall of 2009, RMIS initiated discussions with Sask OH & S officials to determine if there was an opportunity to obtain exemptions for sections of the Sask. OH & S regulations.

The Exemptions Occurred In two areas:

- Alternative Approach for Marking a Control Zone on a Flat Roof.
- Alternative Approach for Managing Fall Risks on Low Risk Flat Roof Systems.

After several discussions, Sask OH & S was supportive of the approaches proposed by RMIS.

EXEMPTION DESCRIPTION

MARKING OF CONTROL ZONES:

The Sask OH & S Regulations states the following in terms of Marking a Control Zone:

116.2(3) *An employer or contractor shall ensure that a control zone is clearly marked with an effective raised warning line or other equally effective method if a worker is working more than two metres from an unguarded edge.*

In the past, many approaches have been used for marking control zones including:

- Permanent markers
- Temporary markers such as pylons, traffic cones, etc.

All of these approaches were acceptable. However, for short term activities in the interior of the roof (Zone 1), they seemed too onerous.

EXEMPTION DESCRIPTION

MARKING OF CONTROL ZONES (Cont'd):

RMIS proposed that there needed to be a distinction for short term versus long term work activities. As a result, the following proposal was developed:

- Minor Work Activities – for work activities that require less than 1 hour of activity on the roof such as clearing of roof drains, changing of filters in roof top HVAC units, de-icing of plumbing vents, minor roof repairs, etc., workers can use a rake or other such device equipped with a handle 2 metres in length so they can gauge their distance from the roof edge and stay out of the control zone.
- Major Work Activities – for activities that require more than 1 hour of activity such as major roof repairs, renovations to HVAC systems or skylights etc., workers will use weighted pylons interconnected with nylon rope to mark the control zone.

EXEMPTION DESCRIPTION

The Benefits of this Exemption are:

- The time spent in placing and transporting the control zone markers is saved by having the rake with a 2 metre handle. This saves significant time for the worker and makes compliance to the new procedure more probable.
- The cost of supplying significant numbers of temporary control zone markers is greatly reduced.
- The improved marking of the control zone for major work activities provides improved warning to workers of potential fall risk if they are to inadvertently enter the control zone while they are working.

EXEMPTION DESCRIPTION

LOW RISK ROOFS:

The Sask OH & S Regulations require that fall protection systems be installed on all roofs with a fall risk greater than or equal to 3.0 metres.

RMIS proposed that an alternative approach could be developed and implemented for lower risk, flat roof systems.

This approach was designated at flat roof systems with a fall risk of less than or equal to 5.0 metres.

EXEMPTION DESCRIPTION

LOW RISK FLAT ROOF (Cont'd):

This new approach to managing fall risks on these roofs would require the employer to implement the following approach:

- For work activities in Zone 1:
 - For minor work activities (less than 1 hour) within the interior of the roof (not in the control zone), the workers will mark the control zone by using a rake (or other such device) equipped with a handle that is 2 metres in length to gauge their distance from the edge of the roof.
 - For major repair or renovation activities in the interior of the roof, workers will be instructed to use weighted pylons interconnected with nylon rope to mark the control zone.

EXEMPTION DESCRIPTION

LOW RISK FLAT ROOF (Cont'd):

- **ZONE 2 - Minor Work Activities Close to an Unguarded Edge** - For minor work activities (less than 1 hour) close to an unguarded edge such as repairs to parapets, perimeter flashings, perimeter lighting, etc.; all of these activities will occur with one or a combination of the following methods:
 - Unguarded edge will be protected with a portable guard rail system.
 - Work will be performed from a ladder.
 - Work will be performed from a portable scaffold
 - Work will be performed from a hydraulic lift operated by a certified operator.

EXEMPTION DESCRIPTION

LOW RISK FLAT ROOF (Cont'd):

- **ZONE 2 - Major Work Activities Close to an Unguarded Edge** - For major work activities close to an unguarded roof edge such as complete roof replacement, major renovations, major repairs to perimeter flashings etc.; the entire unguarded edge will be protected with a portable guard rail system. All work on perimeter parapet details that require the removal of the portable guard rail system to gain access to the parapet will be conducted from a ladder, a portable scaffold or hydraulic lift.

EXEMPTION DESCRIPTION

LOW RISK ROOFS (Cont'd):

In addition to these procedures, the employer would be committed to:

- Developing and implementing Fall Risk Management Plan that would include:
 - Identification of Fall Risk Areas by Facility
 - Acceptable Methods for Mitigating Fall Risks
 - Requirements for Personal Protective Equipment
 - Inspection and Maintenance Criteria for PPE
 - Training Requirements for workers.
 - Sign In/Sign Out Process for Third Party Service Providers

This will be completed within the first year of implementation of the plan.

EXEMPTION DESCRIPTION

LOW RISK ROOFS (Cont'd):

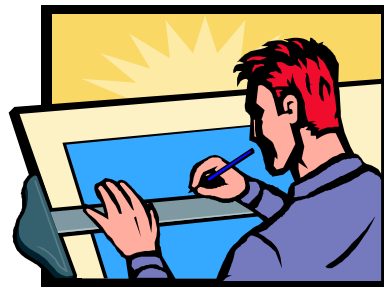
- Installing a permanent, protective guard rail or relocate all roof top units or other high frequency service equipment located closer than 2 metres to an unguarded edge. This will be completed within first year of implementation of the plan.
- Installation of permanent fall protection systems on all remaining roof systems (sloped roofs, and flat roofs greater than 5.0 m) over a ten year period, prioritized based upon risk.

EXEMPTION DESCRIPTION

The Benefits of this Exemption are:

- The projected cost for installing fall protection on facilities of two of the largest school divisions in the province was estimated at over \$17.0 M.
- With this exemption, this cost will be cut by about 50%.
- In addition, there will be significant ongoing savings for less inspection of the anchors and fall protection systems.

Role of the Fall Protection System Designer



Role of the Fall Protection System Designer

It is critical to involve a certified Fall Protection System Design professional in the development of your fall protection system.

They will ensure that your fall protection systems:

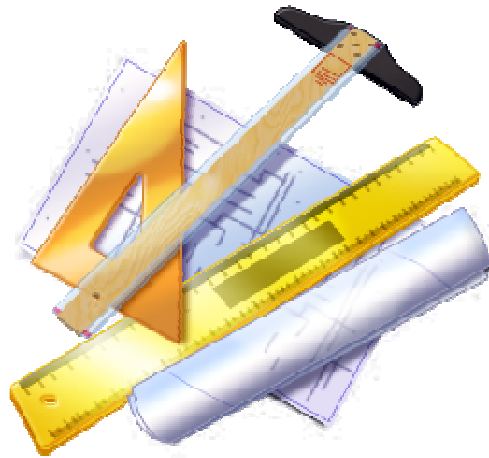
- Have been designed based upon actual work place risk
- Have been designed to limit impact on worker's productivity.
- Have been designed to be cost effective.
- Are designed in accordance with all applicable codes and standards.
- Have written specifications defining the limitations of the system.
- Have defined specifications for all components of your fall protection system including personal protective equipment and connecting components.
- Have specifications defining the training requirements for the workers using the system.
- Have been certified once they are installed.

Role of the Fall Protection System Designer (cont'd)

In addition, the Fall Protection System Designer can assist you with the following:

- Development of the Interim Fall Protection Plan to be used at the facility to manage and mitigate fall risks until the Fall Protection System is installed.
- Development of a implementation strategy for Fall Protection Systems based upon fall risk.
- Filing for any exemptions.

The Design Process for Fall Protection Systems



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ISSUES

- Many designers have specified systems that have not adequately assessed the loads in the fall protection system or the potential impact of systems component selection and/or loadings from falls on the system.
- Too many designers are simply utilizing the load standards specified in the Sask. OHS regulations.

Recommended Design Process

- Design of the fall protection system should first look at the loads generated by the worker during a fall and the implications that may have on the fall protection system.
- The CSA Z259 Series defines:
 - The load assumptions that should be used in the design of a fall protection system.
 - Selection criteria for fall protection equipment.
 - Analysis of Maximum Arrest Force (MAF) and Maximum Fall Distance (MFD)
 - The calculation process for determining how the energy generated from the workers fall is dissipated in order to determine the load on the system.
- As part of this process, the designer must:
 - Specify the components of the system and their proper use and configuration.
 - Specify the limitations in the system.
 - Specify the resulting loads applied to the fall protection system.
- Once this analysis is completed, the structural engineering of the attachment of the fall protection system to the building structure can begin.

General Design Approach Findings

- On flat/low slope roofs, balance the complexity and expense of the system against the expected utilization.
- The major fall risk on a flat/low slope roof increase significantly once a worker enters the control zone.
- The expected frequency of a worker entering the control zone should be a consideration in the decision to invest in more expensive items like a continuous lifeline system, retractable lifelines, guardrails, etc.
- Our analysis indicates that the average school would have a worker exposure average of 4% per year maximum in terms of annual work hours for workers entering the control zone.

General Design Approach Findings (Cont'd)

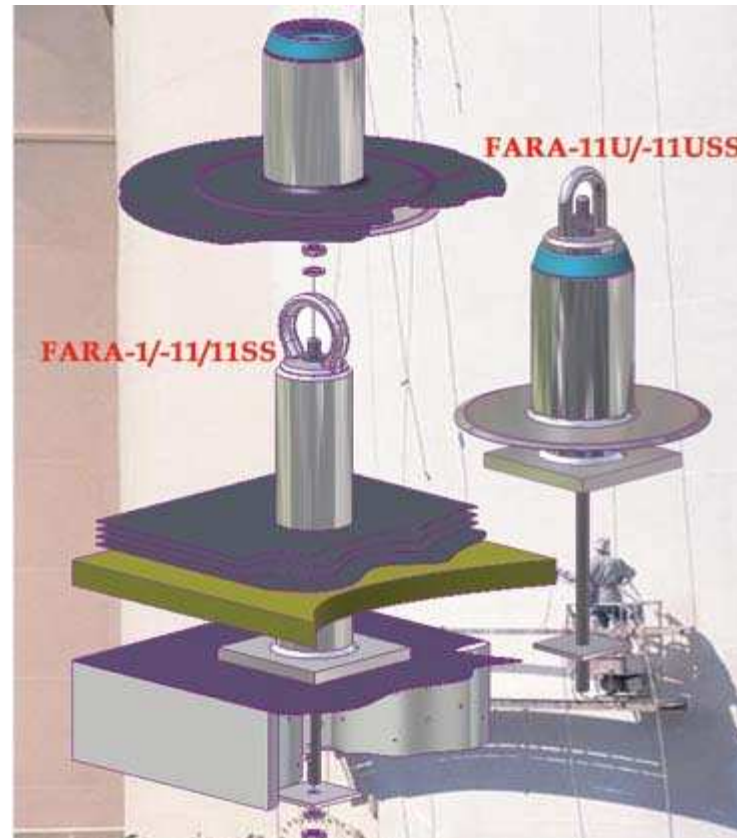
- Standard selection for fall protection component material is usually stainless steel. Standard galvanized components can be significantly cheaper and perform just as well.
- Annual inspections of more complex fall protection systems (ie. Lifelines) often must be done by the manufacturer. These inspections can be expensive in terms of ongoing life cycle costing. Annual inspections for basic anchor systems can often be completed by maintenance personnel.

Permanent Fall Protection Anchor Types



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Typical Roof Anchor



Differences in Fall Protection Anchor Types

Fall Arrest Anchor:

- ❑ Rated at minimum 5,000 lb.f.
- ❑ Can withstand the load of a falling person.
- ❑ Worker who is reaching over the roof edge must be connected to a fall arrest anchor.
- ❑ Worker who is working on a boatswain chair or scaffold (Window Washers) must be connected to a fall arrest anchor.

Travel Restraint Anchor:

- ❑ Rated at minimum 2,000 lb.f.
- ❑ Designed and intended to restraint a worker from falling, not arresting (stopping) their fall.
- ❑ Restraint system must prevent worker from reaching over the roof edge.
- ❑ **CANNOT BE USED FOR FALL ARREST!**

Travel Restraint Limitations on Sloped Roofs

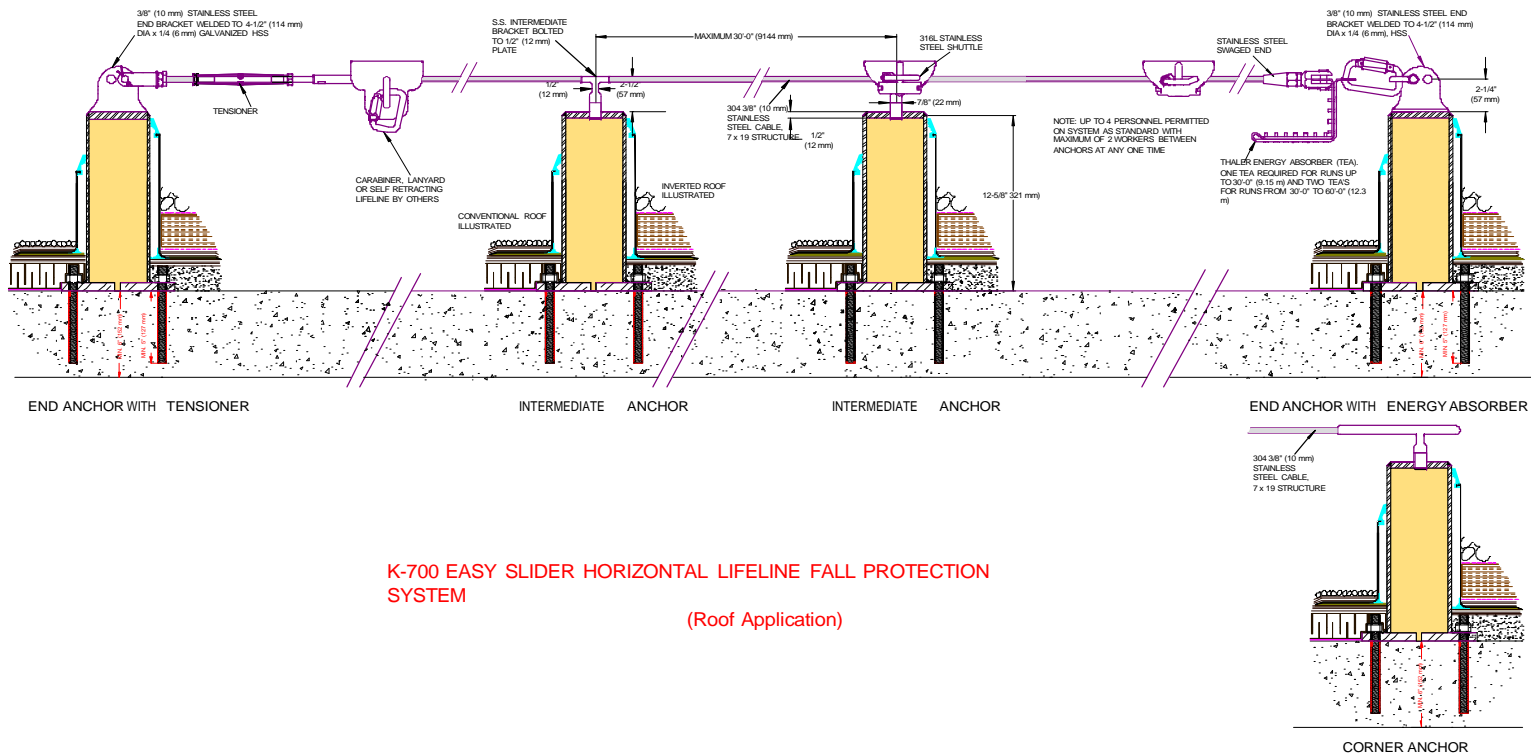
Can a Travel Restraint Anchor be used on a sloped roof?

- ❑ Lifelines are often slack and not kept tight as required by travel restraint.
- ❑ Slopes less than 2:12 fairly safe to walk on.
- ❑ Risk is primarily falling not restraint on roofs greater than 2:12 slope.

General Recommendation:

- ❑ Only use Travel Restraint approach for roof slopes 2:12 and lower.

Other Types of Roof Anchors – Lifeline System



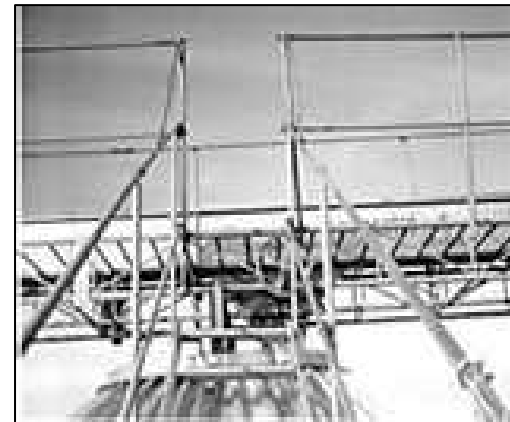
K-700 EASY SLIDER HORIZONTAL LIFELINE FALL PROTECTION SYSTEM

(Roof Application)

Other Types of Roof Anchors – Anchor System for Wood Trusses



Guardrails & Catwalks



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Guardrails & Catwalks

National Building Code:

- **Guardrails** – *not* designated for use means of egress in grandstands, stadia, bleachers and arenas:
 - A 225 lbs.f (1.0 kN) load applied horizontally at the top member.
 - A vertical load of 340 lbs.f (1.5 kN).
 - The a load of 113 lbs.f (0.5 kN) anywhere on the element.
 - Must be equipped with balusters if in a work place not categorized as industrial in accordance with the NBC

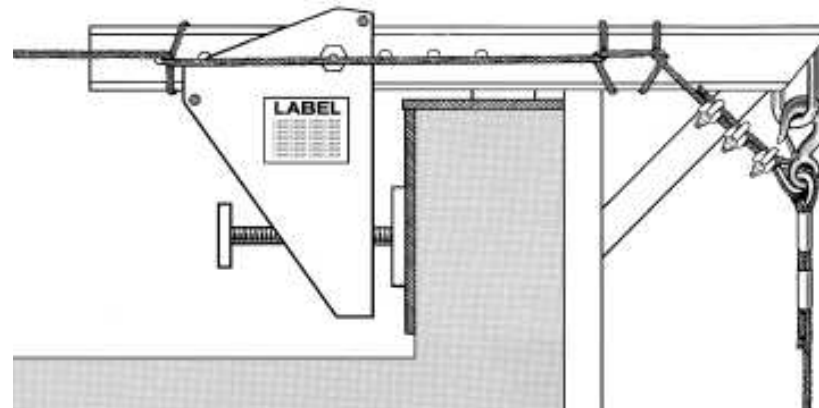
Sask OH & S:

- **Guardrails:**
 - **Height** - horizontal top member not less than 920 mm (36 in) and not more than 1070 mm (42 in) above the work surface
 - **Spacing Vertical Supports** - supported for the entire length of the guardrail by vertical members that are 2.4 metres (94.5 in) maximum spacing.

Analysis:

- 225 lb.f load at top member results in moment of 675 ft lbs at the base of a 36 inch guardrail and a moment of 788 ft lbs at the base of a 42 inch guardrail.

Temporary Fall Protection Systems



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Temporary Work Positioning and Fall Protection System Categories

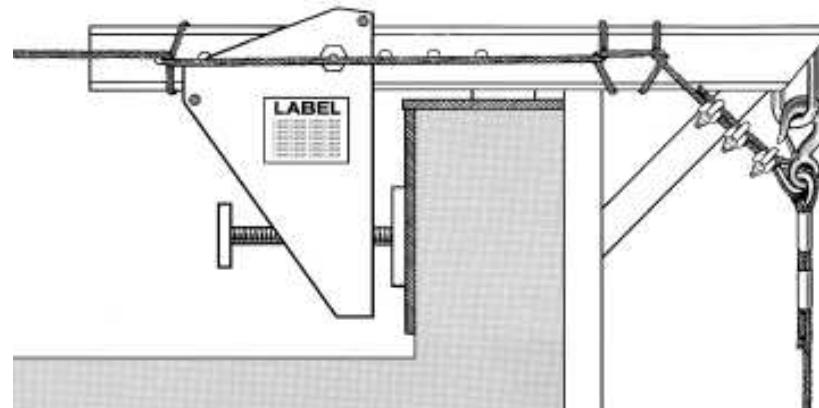
- **Work Positioning**

- Clamp on Access Systems
- Ballasted Access Systems

- **Fall Protection**

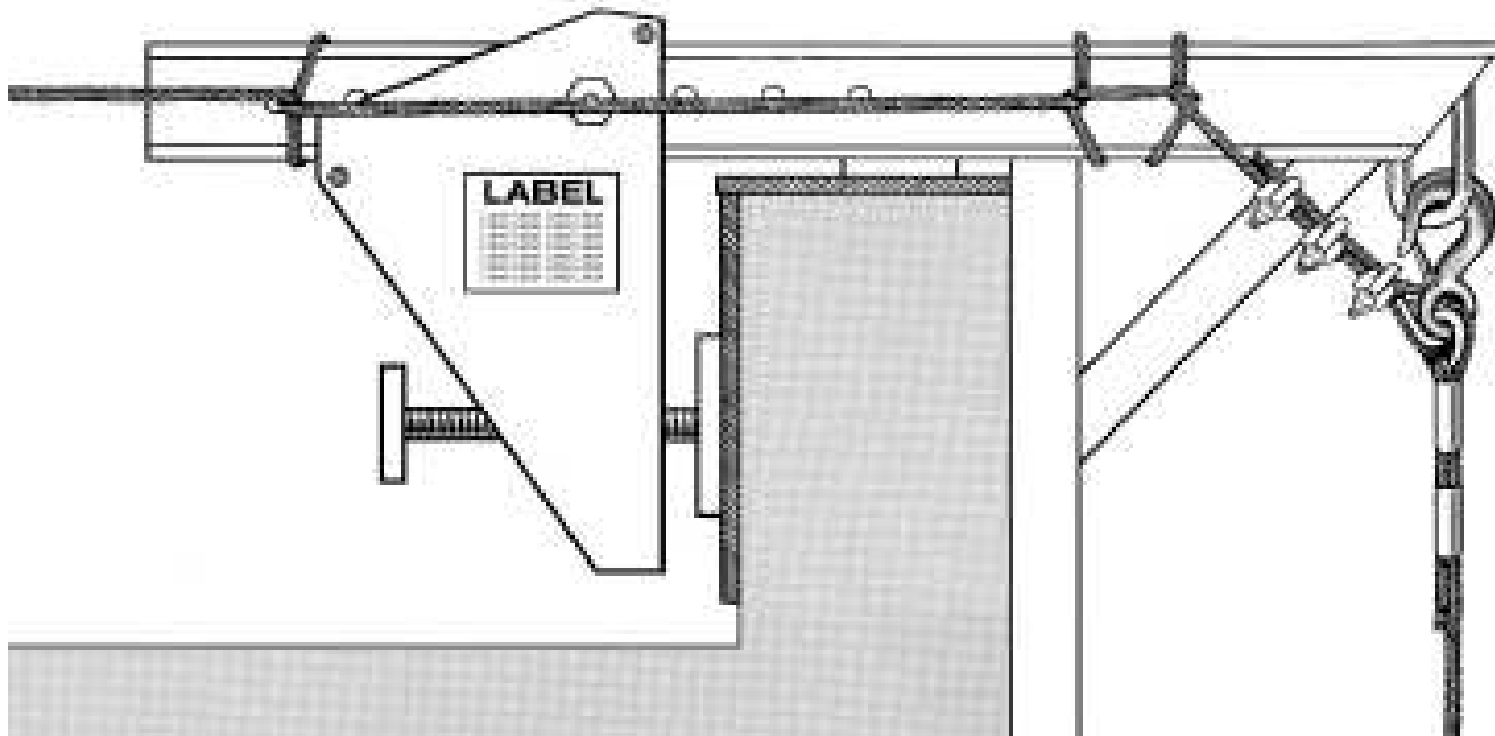
- Ballasted Fall Arrest Systems
- Temporary/Portable Railing Systems

Clamp on Access Systems

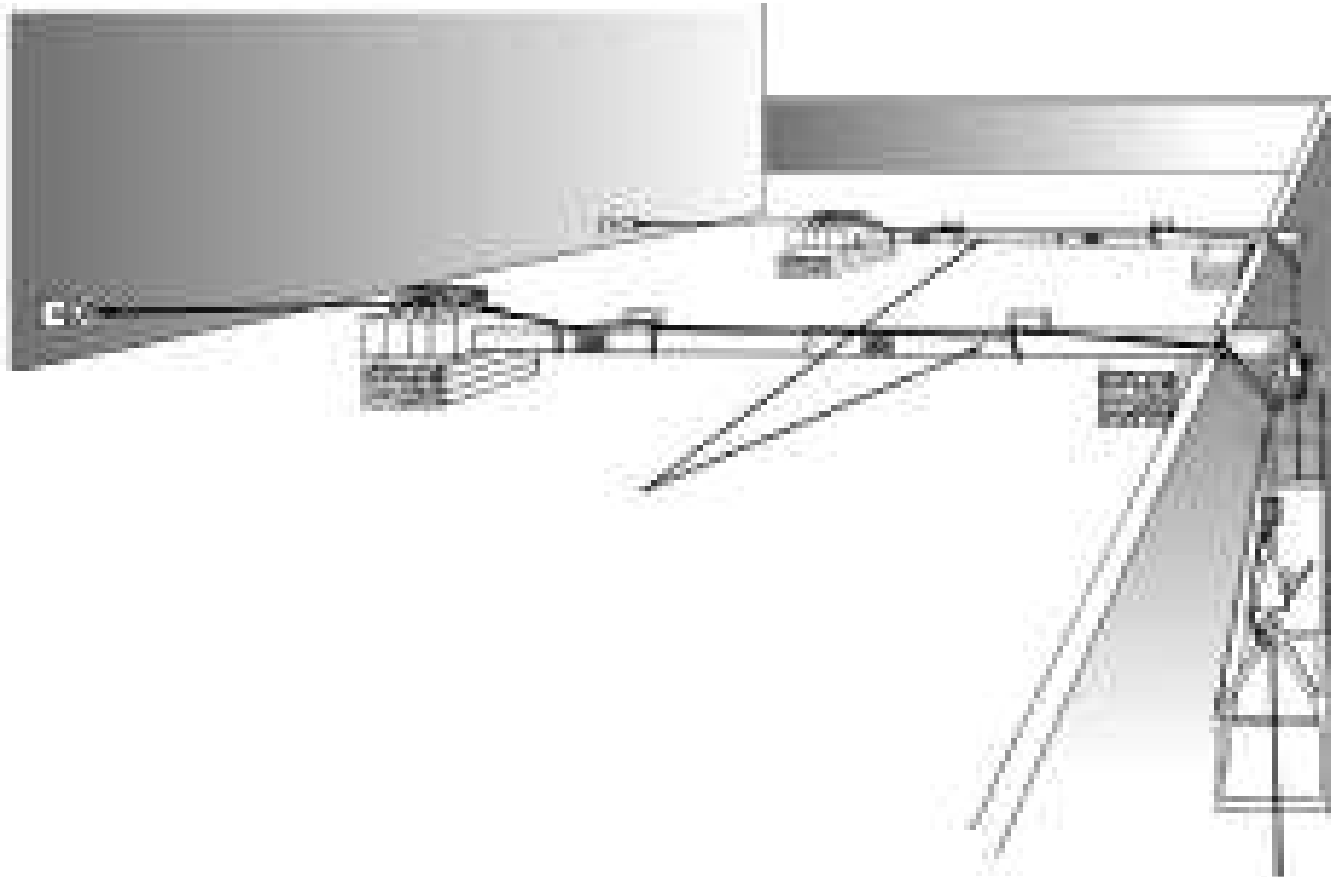


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Clamp on Access Systems – Typical Configurations



Clamp on Access Systems – Typical Configurations

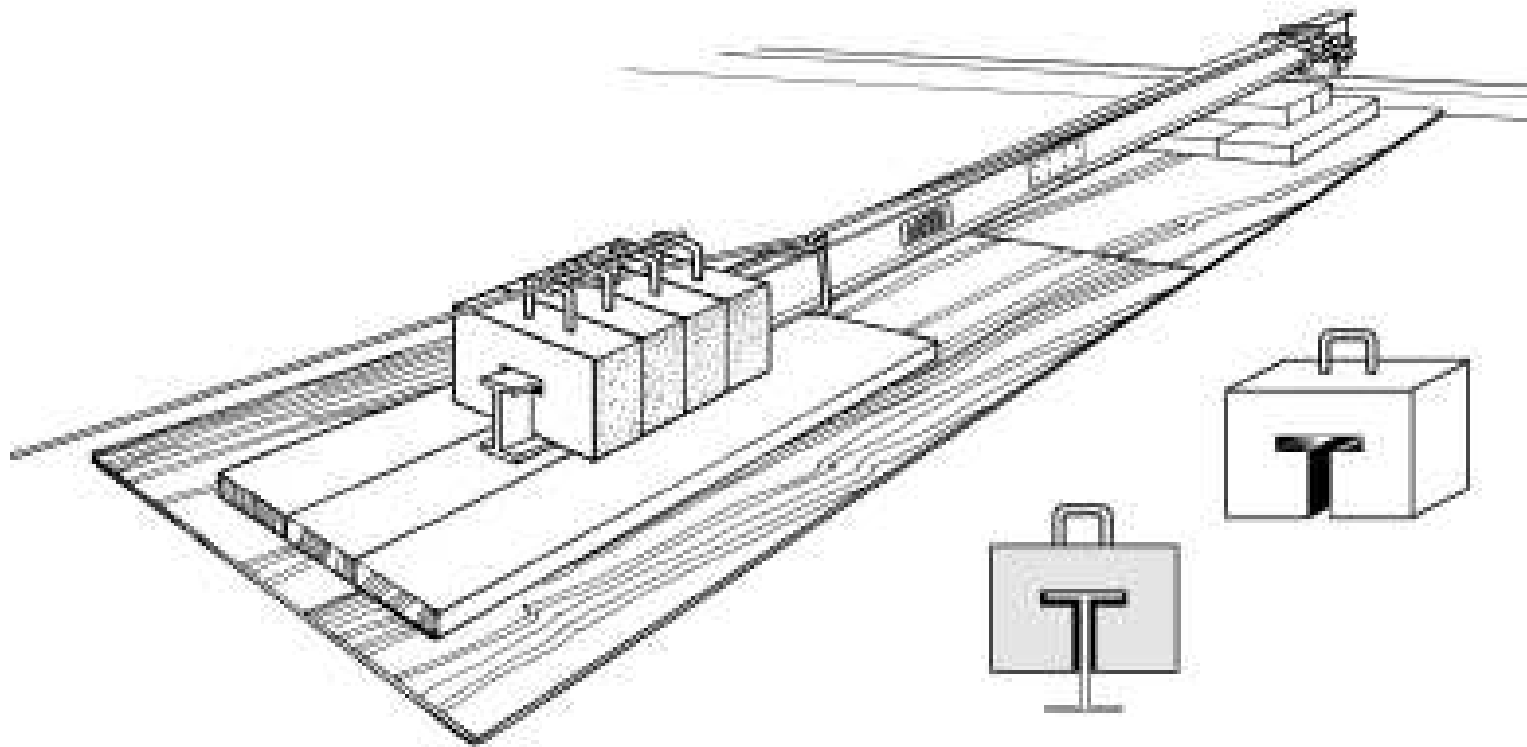


Clamp on Access Systems – Requirements and Limitations

- Are Work Positioning NOT Fall Arrest systems.
- Clamps on to parapet (usually concrete) and utilizes a tie back cable.
- Design load for system is based upon weight of worker, weight of scaffold, etc.
- Worker must have independent tie off point from access system.
- Must be moved around perimeter to accommodate different work areas.
- Primary application is for work on exterior face of large buildings
- Still require a certified tie back point on the roof for cable.

Ballasted Access Systems

Ballasted Access System – Typical Configuration



Ballasted Access Systems – Requirements and Limitations

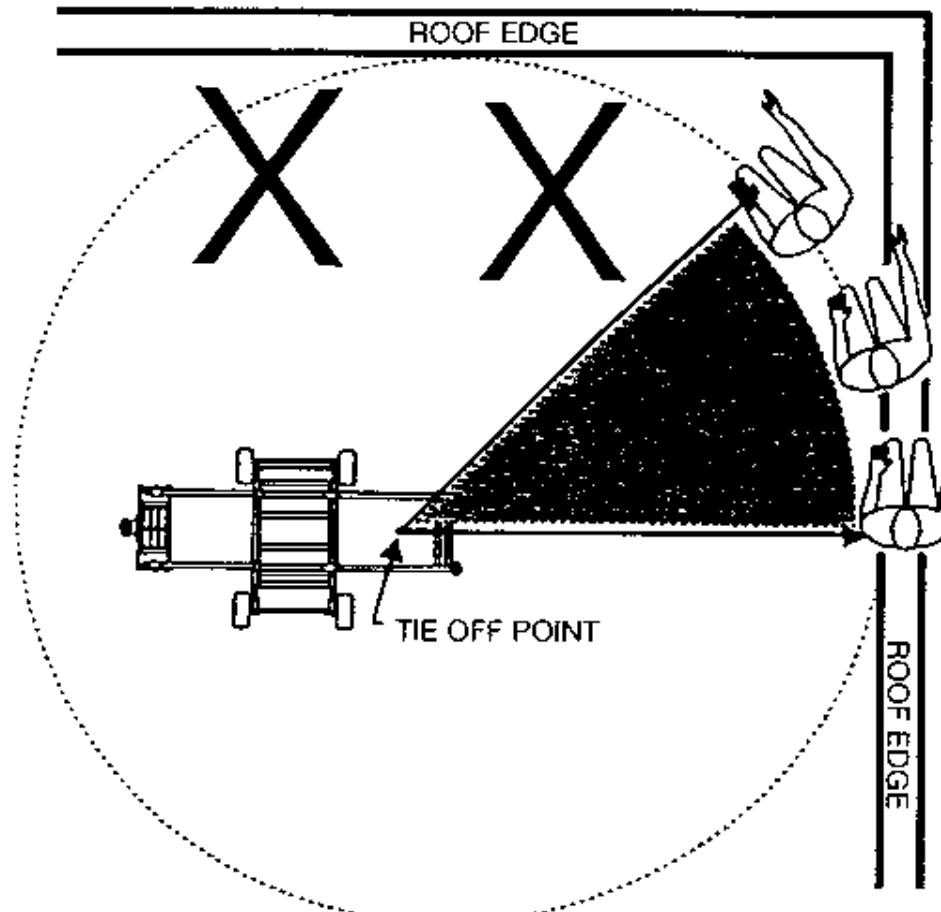
- Are Work Positioning NOT Fall Arrest systems.
 - Ballasted suspension beams are positioned over the parapet wall with ballast placed on roof end of beam.
 - Utilizes a tie back cable.
 - Design load for system is based upon weight of worker, weight of scaffold, etc.
 - Worker must have independent tie off point from access system.
 - Must be moved around perimeter to accommodate different work areas.
 - Primary application is for work on exterior face of large buildings
 - Still require a certified tie back point on the roof for cable.
 - Parapet and roof construction must be professionally verified to ensure they will accept the applied loads.
-

Ballasted Fall Arrest Systems

Ballasted Fall Arrest Systems – Typical Configuration



Ballasted Fall Arrest Systems – Typical Configuration



Ballasted Fall Arrest Systems – Typical Configuration



Ballasted Fall Arrest Systems – Requirements and Limitations

- Are mobile and must be assembled on site as work is required in a fall risk area.
- Design load for system is based upon 5,000 lb load.
- Must be moved around perimeter to accommodate different work areas.
- Roof construction must be professionally verified to ensure they will accept the applied loads.
- Systems have limitation for use in terms of roof slope, roof conditions (slippery or icy), roof system types (aggregate covered, etc.)
- Systems flexibility of use requires careful instruction of workers to ensure that the systems are properly employed.

Temporary/Portable Railing Systems

Temporary/Portable Railing Systems— Typical Configuration



Temporary/Portable Railing Systems— Typical Configuration



Temporary/Portable Railing Systems— Requirements and Limitations

- Are mobile and must be assembled on site as work is required in a fall risk area.
- Design load for system is based upon Sask OH & S and National Building Code requirements.
- Must be moved around perimeter to accommodate different work areas or can cover entire perimeter of roof.
- Systems that clamp onto parapet should be reviewed to ensure the parapet can withstand the applied load.
- Roof construction should be professionally verified to ensure they will accept the applied loads on ballasted systems.
- Systems have limitation for use in terms of roof slope.
- Systems do not provide adequate access for repairs to outside perimeter of roof. Worker cannot lean through openings in railing.

Fall Protection Systems

- **All of these systems have their application as long as they are used within their limits.**
- **Ensure that you work with a Fall Protection Design Professional so you get the correct system.**

QUESTIONS?

- **Copies of Presentation available.**
- **Please call if you have any questions or we can help you with your Fall Protection System Planning**