Basics of Fall Protection Training
Introduction

- Effective June 12, 2002, the Construction Regulation 213/91 requires that employers ensure that workers using a Fall Protection System are trained in its use.

- This training session will give you general information about common fall protection controls.

- The more that you know about Fall Protection the safer you and your co-workers will be.
Agenda

Theoretical component

- Basic Hazards and Controls
- Fall Prevention
- Fall Arrest
- Fall Arrest Planning
- Emergency Rescue
- Suspension Trauma

Module Review

- Multiple choice quiz at the end of each module

Practical component – at Levert Offices

- Inspection of Harness and Lanyard
- Fit-testing Harness
Overview

• Recent statistics, every week in Ontario
  – 5,400 workers suffer a preventable work-related injury.
  – 3 workers suffer amputations.
  – 2 workers die of work-related injuries.

• On average in Ontario 42 young workers are killed, injured or become ill everyday while on the job.
Overview

The Ministry of Labour has hired 200 plus additional Inspectors and increased their ticketing power as part of their program.

Workers and Supervisors can now receive a ticket (similar to a speeding ticket) for safety infractions.
Overview

- Potential fines imposed for failing to ensure a safe work surface Reg. 851, sec. 11.
  
  - Employer - $300.00
  
  - Supervisor - $200.00
  
  - Worker - $200.00
Overview

• The Basics of Fall Protection Training is just the basics only. This is general information about common fall protection controls.

• Your Employer, Supervisor must provide you with site specific training to cover the particular equipment and applications you will encounter on each job.

• If you work for a personnel agency, the client you are placed with must provide you with site specific training
MODULE 1

BASIC HAZARDS and CONTROLS
Basic Hazards and Controls

Some form of fall protection must be used wherever workers are exposed to the hazard of falling;

- More than 3 meters (10 feet)

- More than 1.2 meters (4 feet) if the work area is used as a path for a wheelbarrow or similar equipment
Basic Hazards and Controls

Some form of fall protection must be used wherever workers are exposed to the hazard of falling;

• Into operating machinery
• Into water or another liquid
• Into or onto a hazardous substance or object
• Through an opening in a work surface
Basic Hazards and Controls

Scaling Precautions

A worker barring loose rock, or scaling or cleaning on the face of a surface mine shall use and wear a fall arrest system.
Basic Hazards and Controls

There are 2 methods of Fall Protection

- Fall Prevention
- Fall Arrest
Basic Hazards and Controls

• Fall Prevention

Fall Prevention uses physical means to keep workers away from situations where they might fall.
Basic Hazards and Controls

• Fall Prevention
Basic Hazards and Controls

- Fall Prevention
Basic Hazards and Controls

- Fall Arrest

The fall arrest method includes 3 different systems

- Fall restriction system
- Safety net
- Fall-arrest system
Basic Hazards and Controls

• Fall Restriction System

A type of fall restriction system is designed to limit a worker’s free fall distance to 0.6 meters (2 feet)

One type uses a belt grab or belly hook that attaches to a safety rail on a fixed ladder
Basic Hazards and Controls

- Safety Net System

The system is a safety net that is installed below a work surface (bridge construction) and supported in such a way that it arrests the fall of a worker who may fall into it without endangering the worker.

A safety net system must be designed by a professional engineer.
Basic Hazards and Controls

• Fall Arrest

The fall arrest system is an assembly of components joined together so that when the assembly is connected to a fixed support, it is capable of arresting a worker’s fall.
Basic Hazards and Controls

• Fall Arrest – You do not want this to be you!
MODULE 2

FALL PREVENTION
Fall Prevention

- Ladders
- Three-point contact must be maintained
Fall Prevention

• Ladders
  • Centre of gravity must be kept between the side rails

Stop  and  Correct
Fall Prevention

- Ladders
  - Should never be used if ladder components are damaged
  - Portable ladders when used for regular access between levels must extend at least 900 millimeters (3 feet) above the upper landing and must be firmly secured at top and bottom to prevent movement
Fall Prevention

- Ladders – always use the proper device for the job!

Stop and Correct
Fall Prevention

• Ladders - always use the proper device for the job!
Safety Tip 1: Ladder Set-up

1. Minimum 1 metre above roof surface.
2. Secure ladder to roof.
3. For every 4-up, place the ladder base 1-out from the wall.
4. Check ladder is in good condition and strong enough for the job.
5. Use ladder with non-slip feet or spike, depending on terrain.
6. Make sure there is enough room to safely step off ladder and keep the area clear of equipment and materials.
7. Make sure base of ladder is level and secure to prevent side-slip or kick-out from base.

WorkSafe
WORKERS’ COMPENSATION BOARD OF BC
Fall Prevention

- Ladders
  - Proper ladder angles must be maintained
SPREADER ARMS SHOULD LOCK IN THE OPEN POSITION
Safety Tip 3: Stepladder Use

If possible, brace yourself with your free hand.

Stepladders should NEVER be used folded up and leaning against a surface.

The top two steps and bucket shelf are not safe to stand on.

Climbing or standing on the rear part of the ladder can cause it to collapse or tip over.

Fully open stepladder and lock spreaders in place.
How many things are wrong with this picture!!
Fall Prevention

• Scaffolds

  • Scaffold planks must be at least 48mm by 248mm (2” x 10”) and exceed requirements for Number 1 Grade SPF (spruce-pine-fir) or Douglas fir

  • If the platform is more then 2.4 meters (8 feet) high guardrails must be provided meeting the requirements of the current construction regulation
Fall Prevention

- Scaffolds (cont’d)
- Scaffold planks must be inspected regularly for damage or deterioration
Fall Prevention

- Scaffolds (cont’d)

  - Scaffold must have a safe, secure means of access such as a portable ladder, ramp, or stairway. Ladder rails must extend at least 900 millimeters (3 feet) above the platform.

  - Casters or wheels on rolling scaffolds must be equipped with brakes that can be applied before any worker mounts, uses, or dismounts from the scaffold.
Fall Prevention

• Protective Covers

Openings in floors, roofs, and other work surfaces must be protected by guardrails or covers if the opening poses a fall hazard

• It must be clearly identified as a cover

• The protective cover must completely cover the opening
Fall Prevention

• Protective Covers
  – Must be securely fastened together as well as to the sides of the opening
  – It must be capable of supporting a live load of at least 2.4 kilopascals (50 pounds per square foot)
Fall Prevention

- Warning Barriers and Bump Lines

Warning barriers and bump lines prevent falls by alerting workers to fall hazards

- Warning barriers and bump lines should be set up around the work area at least 2 meters (6 feet 6 inches) from unprotected edges

- Lines or barriers should be 1.07 metres (42 inches) high and consist of weighted posts, fiber rope, and warning flags or signs along their entire length
Guardrails

Guardrails must be installed no farther than 300 mm (1 foot) from an edge

Wood guardrails must have top rail, mid rail, and toe board secured to vertical supports
Fall Prevention

- Guardrails (cont’d)
  - Top rail between 91cm (3 feet) and 1.07 meters (3 feet 6 inches) high
  - Toe board at least 89 mm (3.5 inches) high
  - Posts no more than 2.4 meters (8 feet) apart
Travel Restraint System

- A fall protection system must be provided where work must be done within 2 meters (6 feet) of an open, unprotected edge that presents a fall hazard. A travel-restraint system can afford the protection required.
Fall Prevention

• Travel-Restraint System (cont’d)

  • The system lets a worker travel just far enough to reach the edge but not far enough to fall over

  • The lifeline and/or lanyard must be adjusted according to the work being done.
Fall Prevention

• The basic travel-restraint system consists of
  • CSA-approved full body harness
  • Lanyard
  • Lifeline
Fall Prevention

• The basic travel-restraint system consists of

  • Rope grab to attach harness or lanyard to lifeline

  • Rope grab and lifeline must be compatible

  • Adequate anchorage (capable of supporting a static load of 2 kilonewtons (450 pounds) with a recommended safety factor of 2, that is, 4 kilonewtons (900 pounds))
Fall Prevention
MODULE 3

FALL ARREST
Fall Arrest

Where workers cannot be protected from falls by guardrails or travel restraint, they must be protected by at least one of the following methods:

- Fall-restricting system
- Safety Net
- Fall-arrest system
Fall Arrest

- Fall-restricting system

A fall-restricting system is designed to limit a worker’s free fall distance to 0.6 meters (2 feet).

One type uses a belt grab or belly hook that attaches to a safety rail on a fixed ladder.
Fall Arrest – Safety Net System

A safety net system must be designed by a professional engineer.

The system is installed below a work surface to protect any location where a fall hazard exists.
Fall Arrest

- Fall-Arrest system
  - Must include a CSA-approved full body harness
  - Must include a lanyard equipped with a shock absorber unless the shock absorber could cause a falling worker to hit the ground or an object or level below the work
  - Must be attached to a lifeline or by the lanyard to an adequate fixed support
Fall Arrest

• Fall-Arrest system

• Must prevent a falling worker from hitting the ground or any object or level below the work

• Must not subject a falling worker to a peak fall-arrest force greater than 8 kilonewtons (1800 pounds).
Fall Arrest

Full Body Harness and Fall Arrest System
Fall Arrest

- Fall Protection Equipment
  
  - All fall protection equipment must be inspected for damage, wear, and obvious defects by a competent worker before each use (O. Reg. 213/91)

- Any worker required to use fall protection equipment must be trained in its safe use and proper maintenance
Fall Arrest

- Fall Protection Equipment
  - Any fall-arrest system involved in a fall must be removed from service until the manufacturer certifies all components safe to reuse
  - The manufacturer’s instructions for each piece of equipment should be carefully reviewed
Fall Arrest

The minimum strength of fall-arrest components depends on whether or not the system uses a shock absorber

• Without shock absorber, all components must be able to support a static load of at least 8 kilonewtons (1800 pounds)

• In systems with shock absorbers, the system support must be able to support a static load of at least 6 kilonewtons (1350 pounds)
Fall Arrest

The unwritten standard for replacement of fall-arrest components is 5 years from the manufacturer’s date on individual components.
Fall Arrest - Lifelines

There are 3 basic types of lifelines:

» Vertical

» Horizontal

» Retractable
Fall Arrest - Lifelines

All lifelines must be inspected daily to ensure that they are

- Free of cuts, burns, frayed strands, abrasions, and other defect signs of damage
- Free of discoloration and brittleness indicating heat or chemical exposure
Fall Arrest – Vertical Lifelines

• Only one person at a time may use a vertical lifeline

• A vertical lifeline must reach the ground or a level above ground where the worker can safely exit
Fall Arrest

• Vertical lifelines

  • A vertical lifeline must have a positive stop to prevent the rope grab from running off the end of the lifeline

  • Vertical lifelines are typically 16 millimeters (5/8 inch) synthetic rope (polypropylene blends)
Fall Arrest

The design for a horizontal lifeline system must

• Clearly indicate how the system is to be arranged, including how and where it is to be anchored

• List and specify all required components

• Clearly state the number of workers that can safely be attached to the lifeline at one time
Fall Arrest

The design for a horizontal lifeline system must

• Clearly spell out instructions for installation, inspection, and maintenance

• Specify all of the design loads used to design the system
Fall Arrest

• Horizontal Lifelines

Before each use, the system has to be inspected by a professional engineer or competent worker designated by a supervisor.

A complete and current copy of the design must be kept on site as long as the system is in use.

Note a Competent person is one who is qualified because of knowledge, training and experience; is familiar with the regulations that apply to this work and has knowledge of the potential or actual hazards in the workplace.
Fall Arrest

The system must be designed by a professional engineer
Fall Arrest

- Retractable Lifelines

Retractable lifelines consist of a lifeline spooled on a retracting device attached to adequate anchorage.

The retractable lifeline is similar to a seat belt system.

Always refer to the manufacturer’s instructions regarding the use, including whether a shock absorber is recommended with the system.
Fall Arrest
Fall Arrest – Anchor Systems

It is recommended that a safety factor of at least 2 be applied to the stated minimum load capacity. In practical terms, anchorage should be strong enough to support the weight of a small car (about 3600 pounds).
Examples of adequate anchorage
MODULE 4

FALL ARREST PLANNING
Fall Arrest Planning

Before deciding on a fall-arrest system, assess the hazards a worker may be exposed to in case of a fall.

Before the fall is arrested, will the worker “Bottom out”, that is, hit the ground, material, equipment, or a lower level of the structure?

Will the “Pendulum Effect” cause the worker to swing from side to side, possibly striking equipment, material, or structure?
Fall Arrest Planning
Fall Arrest Planning

Swing Fall or Pendulum Effect
**Fall Arrest Planning**

**Figure 10**

**Calculating Total Fall Distance and Minimum Fall Clearance**

- **E** Length of lanyard free fall
- **I** 3.5 ft shock absorber extension (max)
- **B** 2.0 ft D-ring slide
- **G** Harness D-ring to feet
- **D** Dynamic Deflection
- **S** Safety Margin 2.0 ft
- **F** Calculated Fall Distance

\[ F = E + I + (G + B) + D + S \]

**NOTE:** Anchorage points should be overhead and **MUST** be higher than waist height.
Fall Arrest Planning

- In our example let us assume the following values
  
  \[ E = 6.0 \text{ ft (1.8m)} \]
  
  \[ I = 3.5 \text{ ft (1.1m)} - \text{max. by law} \]
  
  \[ G = 5.5 \text{ ft (1.7m)} \text{ based on a 6.5 ft person} \]
  
  \[ B = 2 \text{ ft (0.6 m)} \]
  
  \[ D = 0 - \text{assume a fixed anchor point} \]
  
  \[ S = 2.0 \text{ ft (0.6m)} \]

Calculation for Total Fall Distance

\[ F = E + I + (G + B) + D + S \]
Fall Arrest Planning

• Calculate the Total Fall Distance

\[ F = E + I + (G + B) + D + S \]
\[ = 6 + 3.5 + 5.5 + 2 + 0 + 2 \]
\[ = 19 \text{ ft (5.8m)} \]

The Total Fall Distance is 19 ft
Fall Arrest Planning

- To calculate the minimum Fall Clearance “C”

Subtract “G” (distance of D-ring to work surface) from “F” (Total Fall Distance)

\[ C = F - G \]

\[ = 19 \text{ feet} - 5.5 \text{ feet} \]

\[ C = 13.5 \text{ feet} \text{ (4.1 m)} \]

This requires that the minimum distance from the working surface to the nearest (highest obstruction must be…… 13.5 feet or 4.1 meters
Fall Arrest Planning

• To calculate the height of the anchorage point above the work surface “H”

Subtract “C” (minimum fall clearance) from “F” (Total Fall Distance)

\[ H = F - C \]

\[ = 19 \text{ feet} - 13.5 \]

\[ H = 5.5 \text{ feet} (1.7\text{m}) \]

This requires that the minimum distance from the working surface to anchor point must be 5.5 feet.
MODULE 5

EMERGENCY RESCUE
Emergency Rescue

The employer must develop written rescue procedures before workers use any fall-arrest system on a project.

The rescue plan should cover the on-site equipment, personnel, and procedures for different types of rescue.

Any off-site rescue services that might be required should be contacted in advance to familiarize them with the project.
Emergency Rescue

Emergency response phone numbers should include fire, ambulance, and police services.

All workers on the project should be familiar with the rescue plan and know their role in the event of an emergency rescue.
MODULE 6

SUSPENSION TRAUMA
Suspension Trauma

A worker hanging suspended in a harness risks DEATH by suspension trauma.

Unconsciousness and eventual death can result if the victim’s brain is not receiving enough blood flow because of pooling in the suspended worker’s legs.
Suspension Trauma

Workers hanging in a harness

- Try to move their legs in the harness and try to push against any footholds
- Try to get their legs as high as possible and their heads as close to horizontal position

If the worker is suspended upright, emergency measures must be taken to remove the worker from suspension (under 10 minutes) and gradually brought to horizontal position
Summary

• The Basics of Fall Protection Training is just the basics only. This is general information about common fall protection controls.

• Your Employer, Supervisor must provide you with site specific training to cover the particular equipment and applications you will encounter on each job.
Summary

- The specifics of Suspension Trauma should be reviewed and communicated to other workers before each use.

- The Rescue Plan should be reviewed before each use.

- Inspect all of your Fall Arrest Equipment before each use.
MODULE 7

PRACTICAL TRAINING

HARNESS and LANYARD INSPECTION

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