Material Handling, Storage, Use, and Disposal

• Welcome to this training module on Introduction to Material Handling, Storage, Use, and Disposal!

• Module is intended to provide:
  – Overview of Hazards
  – Real life examples
  – General safe practices
  – Methods to help protect you from injury
Introduction

Material Handling

• Module is designed for:
  • Foremen
  • Crew Leaders
  • Employers
  • General Workforce
  • Anyone looking to improve their safety knowledge
• Engage in all interactive exercises to proceed through the training
Introduction

Additional On-line Resources

• OSHA eTools
• OSHA Publications
• OSHA Quick Cards
• OSHA Safety & Health Topic Page
• NIOSH Safety & Health Topic Page
• NIOSH Fatality Assessment and Control Evaluation (FACE) Program:
• Electronic Library of Construction Occupational Safety & Health materials
Introduction

Objectives

• Provide information that highlights common construction hazards with material handling.

• The lesson will focus on the following four areas:
  1. What are material handling hazards?
  2. What are the common types of material handling hazards in construction?
  3. How can I protect myself from material handling hazards?
  4. What is my employer required to do to protect workers from material handling hazards?
Introduction

Additional Training

• This training course:
  – provides basic occupational safety and health information
  – is not intended to be a substitute for knowledge of OSHA and other standards
  – is not a substitute for site-specific, hands-on training and information
Introduction

Hazards of Material Handling

• Improper Material Handling:
  – Accounts for 30% of work-related injuries
  – Results in:
    • Back Injuries
    • Crushing Injuries
    • Cuts & lacerations
    • Amputations

• 100% Preventable
Introduction

Hazards of Material Handling

- Methods range from mechanical to manual
- Understand the hazards for each method
- Sprains and strains = 45% of all nonfatal occupational injuries and illnesses in the construction industry.
- Employers & employees should evaluate their workplace and methods

Safety Tip
Of the over 600,000 sprain and strain injuries that occur annually, nearly 30% are back related. That means there are over 185,000 back injuries every year.
Introduction

Training & Education

• Keys to Working Safely
  – Training & Education
  – Safety Knowledge and Principles
  – Proper:
    • Work Practices
    • Procedures
    • Equipment
    • Safety Controls

Safety Tip
Handling heavy and awkward materials can increase the risks of injury and incident and will require additional planning and resources to ensure a safe outcome.
Material Handling Hazards

**Hazards:**

- Very Common & Predictable
- Found in Handling & Storing Materials
- Increased risk by improper storage:
  - Improperly stored
  - Stacked too high
  - Unstable base
  - Uneven ground

**Safety Tip**

Where applicable, all materials stored overhead should utilize a method for securing the materials in case of an earthquake.
Material Handling Hazards

• Improper handling of materials can result in:
  – Short-term injuries that last weeks or months
  – Long-term injuries that last years or lifetimes

• Proper techniques and utilizing mechanized equipment can and will prevent injuries!
Material Handling Hazards

Injury Causation

• Long and short term injuries due to:
  – Overexertion
  – Incorrect or over lifting
  – Dropped and falling objects
  – Pinch and crush points
  – Loss of control
  – Trip, slips and falls
  – Many others
Material Handling Hazards

Overexertion

• Overexertion is the #1 cause of workplace injuries.
  – Overexertion is caused by exerting excessive effort or force when:
    • Lifting
    • Pushing
    • Pulling
    • Holding
    • Carrying or
    • Throwing

Safety Tip
Overexertion maintains its first place rank every year and has a total cost to businesses of $13.40 billion, in direct costs, annually.
Material Handling Hazards

Back Injuries

Causes for back Injuries:

- Lifting improperly or too much weight
- Turning upper body while lifting or carrying
- Lowering too quickly or improperly
- Material slip or dropped
- Slips and Falls while carrying material
- Frequency of activities
- Load center of gravity
Preventive Measures

• Preventive Measures
  – Most Injuries occur when you least expect it
  – Pre planning is key to preventing injuries
Preventive Measures

Understanding the Hazards and Risks
• Safe Lifting Considerations
  • Weight of the Object
  • Location (position of load)
  • Frequency of Lifts
• The time you need to move the load - wrong
• Stability of the Load
• Size of material and hand grip
• Address on Package – wrong
• Avoidance of Twisting & Stooping
• Other Environmental Factors
Preventive Measures

Preventing Accidents and Injuries

• Preparing your ”Safe Plan of Action”

— Ask the right questions:

• Can engineering reduce or eliminate the need for manual handling?

• Can material be moved by mechanical equipment?

— Hand Truck
— Cart
— Conveyor
— Lift truck

Safety Tip
Plan ahead. Often times it takes many days, if not weeks, to schedule large moving equipment such as cranes and lift trucks.
Preventive Measures

Preventing Accidents and Injuries

• Before moving the materials:
  – Inspect for poor packaging or damage
  – Sharp edges
  – Chemical hazards

• Evaluate your Travel Path:

• Look for hazards in your Pathway:
  – slipping/tripping, poor lighting, floor openings, etc.
  – Destination level, available, clean?

Safety Tip
If the answer to any of these questions is no, then a safe plan of action must be taken before the move begins to ensure a safe outcome.
Manual Material Handling

Manual Handling of Material

- When lifting/carrying cannot be avoided:
  - Break load into smaller, manageable parts
  - Get help with heavy or odd shaped objects
  - Keep load close to your body
Manual Material Handling

Manual Handling of Material

• Best Practices when lifting/carrying:
  o Avoid lifting above shoulder
  o Use step stool, stepladder, or platform
  o Move slowly and maintain clear line of vision

Safety Tip: Did you know that the leading cause of accidental death in the home is from falls from ladders... less than 6 feet in the air!
Manual Material Handling

Manual Material Handling Techniques

• Best Practices
  • Let your legs do the work, not your back!
  ◆ Do not twist your body, move your feet
  ◆ Bend at knees, keeping your back straight
  ◆ Keep fingers, hands, feet away from bottom of object
  ◆ Inspect object first for jagged edges
  ◆ Consider its weight, shape, length, as well as pinch point and other hazards
Manual Material Handling

Specialized Lifting

• When lifting Bags or Sacks:
  • Grip at opposite top and bottom corner
  • Raise load and rest on hip, then move to shoulder
  • If the load is heavy, awkward, or very long, get help before lifting
  • Never twist your body!
Manual Material Handling

Specialized Lifting

- When moving drums, barrels, or cylinders:
  - Use appropriate equipment/tools
  - Remove gauges and replace valve caps from compressed gas cylinders
  - Secure to cart and roll
  - If no cart, then two person lift and carry: Never carry a cylinder by yourself!
  - For crane lift, use approved cart/basket
Two Person Manual Lift and Carry

• Basic guidelines:
  • Work with someone close to your own height
  • Review lifting procedures and the direction of travel
  • Avoid walking backwards
  • One person should control and give the signal to lift
Manual Material Handling

Two Person Lift and Carry

• The Lift:
  – Lift load together, keeping it level to reduce chance of overloading one person
  – Carry long objects over opposite shoulders
  – Prevent ends from hitting people or objects!

Safety Tip
Material over 10 feet in length should always be carried by two people so that the ends can be controlled and prevent contact with people or equipment.
Manual Material Handling

Non-Powered Equipment

• Using Hand Trucks, Dollies, and Carts
  – Familiarize yourself with safe operating procedures before use
  – Inspect the equipment:
    • Never use damaged/defective equipment
    • Remove/secure attachments before moving
Manual Material Handling

Hand Trucks, Dollies, Carts

• Additional Guidelines:
  – Maintain a low center of gravity
  – Heavy objects on the bottom and Secure the load
  – Maintain clear line of vision
  – Push, DO NOT Pull or walk backwards
  – Maintain control at all times
  – Watch for:
    • Drop-offs
    • Uneven surfaces
    • Stairs
Mechanized Material Handling

Forklifts

• Unsafe Operations
  – Hundreds killed
  – Thousands injured
  – Property damage (overhead sprinklers, racking, pipes, walls, and machinery)
  – Why?
    • lack of operating procedures
    • lack of following safe operating procedures
    • inadequate training

Safety Tip
Did you know that 22% of forklift fatalities are due to overturning and an almost equal number, 20%, die from being struck by forklift?
Mechanized Material Handling

Forklifts
- OSHA requires specific training
- See OSHA Standard 1926.602
- Trained, qualified operator required
- Inspect equipment prior to use; read instructions
- Wear seat belt
- Use forklifts equipped with ROPS (Rollover Protective Structure)
Forklifts

- Further Guidelines:
  - Face direction of travel
  - Have clear line of sight
  - Do not carry load that obstructs your view
  - Inspect the work area: check for uneven surfaces, floor openings, protrusions and blind corners
Mechanized Material Handling

Equipment Safety Guidelines

• Safety Devices
  – Safety devices in good working order:
    • Back up warning devices must be operational
    • Horns, mirrors, seatbelts, fire extinguisher
Mechanized Material Handling

Equipment Safety Guidelines

• Indoor or Confined Area Operations
  – For work indoors or in confined areas with internal combustion engines:
    • Air quality must be monitored
    • Electric or propane powered equipment may be required
    • Refer to confined space and tunneling regulations for additional and specific requirements

Safety Tip
Beware of using diesel powered fork lifts indoors. Diesel exhaust is a suspected carcinogen.
Mechanized Material Handling

Material Handling Equipment

• Rules of the Road
  – No riders unless equipped with approved seat
  – Obey speed limits, signs and floor markings
  – Drive slowly, looking ahead and scanning the horizon

Safety Tip
Regardless of the location or situation, remember that pedestrians always have the right-of-way!
Mechanized Material Handling

Rules of the Road
- Don’t let anyone stand or walk under elevated forks
- Don’t drive with forks raised
- Go up and down slopes slowly
- Keep the load pointed up the slope
- Raise the load just high enough to clear the road surface
- Always keep your hands, arms, and legs inside the equipment
Mechanized Material Handling

Parking & Securing Equipment

• Parking Equipment:
  – Park away from traffic on a flat surface
  – Chock wheels if on a slope
  – Don’t block aisles, doors, exits, electrical panels or fire extinguishers
  – Lower forks to ground and tilt them flat
  – Put control in neutral, set brake, and remove key

• Lock the doors if applicable.

• Don’t allow equipment to become an attractive nuisance.
Mechanized Material Handling

- **Load Capacity**
  - The operator should know:
    - Weight of materials to be moved
    - Limitations of equipment
    - Load capacity chart
  - The operator should ensure:
    - Surfaces are level, free of hazards, and designed to withstand load
  - At no time should equipment be modified without approval from the manufacturer.
Mechanized Material Handling

Refueling/Recharging

- General rules for refueling:
  - Turn off equipment and set brake
  - Bond and ground equipment and fuel container/hose
  - Use only approved safety containers
  - Wear PPE to protect against battery acid
  - Always connect and disconnect the negative cables first!
Conveyance Systems

Conveyors

• Common hazards include:
  • pinch points
  • moving rollers and belts that can catch clothing, jewelry, or long hair
  • falling materials
  • stored energy
  • falls and many others
Conveyance Systems

Conveyors

• Avoiding Hazards
  – Do not wear loose clothing around conveyor systems
  – Don’t walk beneath a conveyor while it is operating!
  – Keep hands, arms, legs, and clothing away from moving parts
  – Inspect before use; never operate if guards are not in place

Safety Tip
Before approaching a conveyor, ensure all guards are in place and that it is safe to access that area of the conveyor.
Conveyance Systems

Conveyors

• Other Considerations
  – You must Lockout & Tagout (LOTO) before maintenance
  – Know location of emergency shut-off switches, which should be clearly labeled
  – No one should ever ride on conveyor
  – Fall Protection procedures must be established as required
Cranes & Rigging

Cranes and Hoists

• Cranes & Hoists:
  – Mobile and Tower Cranes most widely used
  – Each type has special benefits & hazards
  – Require specialized training and knowledge

Safety Tip
For more details and future reference on cranes and derricks you can review the OSHA standard 1926.1400. For additional information on hoists and conveyors, research OSHA standard 1926.550.
BRIEF DESCRIPTION OF ACCIDENT:
• A crew of ironworkers and a crane operator were unloading a 20-ton steel slab from a low-boy trailer using a 50-ton crawler crane with 90-foot lattice boom. The operator was inexperienced on this crane and did not know the length of the boom. Further, no one had determined the load radius.
• During lifting, the load moved forward and to the right, placing a twisting force on the boom. The boom twisted under the load, swinging down, under and to the right. Two employees standing 30 feet away apparently saw the boom begin to swing and ran.
• The boom struck one of the employees - an ironworker - on the head, causing instant death. Wire rope struck the other -- a management trainee -- causing internal injuries. He died two hours later at a local hospital.

Cause: Improper planning, unqualified operator, unsafe work practices.

PREVENTIVE MEASURES:
• 1. Train, test and certify crane operators, signalmen and riggers to determine qualifications:
• 2. Require proper written procedures to insure the method for lifting is within manufacturer's specifications
• Implement crane “lift plan” procedure to ensure all questions are asked and addressed before lift begins
Fatal Facts Lessons Learned

• What Lessons can we learn from this tragic loss of life?

• Check your knowledge by answering the following questions:
Cranes & Rigging

Rigging

- Qualified Rigger:
  - Inspect load for sharp edges
  - Pad to prevent cutting of slings
  - Identify the center of the load
  - Limit the angle of slings and chains
  - Distribute load equally
  - Never tie knots in chains for hoisting

Safety Tip
Riggers must be a qualified person for the performance of specified hoisting activities such as during assembly/disassembly work and those that require employees to be in the fall zone to handle a load. The rigger would be considered qualified through possession of a recognized degree, certificate, or professional standing; or by extensive knowledge, training, and experience, successfully demonstrating the ability to solve/resolve problems related to rigging work and related activities.
Cranes & Rigging

Rigging

- **Wire Ropes, Slings, Chains,, Grabs, Hooks, Shackles, and Ropes**
  - Each piece of rigging has specific rated capacities:
    - must be clearly marked
    - must not be exceeded
  - Inspect rigging before and after use
    - Minimum of every 12 months
    - By a competent person
    - Don’t use if damaged!
Cranes & Rigging

Rigging Inspection

• Inspection & Maintenance of Wire Rope Slings
  – Check for:
    • abrasions, “bird caging”, stretching, corrosive and rusting, nicks, gouges or other abuse and damage
    • ten randomly distributed wires in one lay or five wires in one strand are broken
  – Never leave a damaged sling lying around for some one else to use.

Safety Tip
Remove damaged slings from service immediately and destroy them... or someone else will use it again.
Cranes & Rigging

Steel Alloy Chains

• Guidelines:
  – Stamped “A”
  – Require a permanent tag - size, grade, rated capacity and manufacturer’s name
  – No tag--don’t use!
  – Attachments must have rated capacity equal to chain’s
  – Clean before and after use
  – Competent Person to inspect every 12 months
  – Document all inspections
Cranes & Rigging

Synthetic Fiber Slings

- Inspect and clean before and after use
- Inspect for:
  - Abnormal wear
  - Powdered fiber between strands
  - Broken or cut fibers
  - Variations in the size or roundness of the strands
  - Discolored or rotted
  - Distortion of hardware in the sling

- Tag must be attached to sling:
  - Tag states size, grade, rated capacity, manufacturer’s name

Safety Tip
If an equipment tag is not found affixed to the sling, do not use the sling for hoisting materials
BRIEF DESCRIPTION OF ACCIDENT:
• Two employees were moving structural steel building beams to a storage area. After setting the fourth beam on the crib, the signal man signaled the crane operator to pull the sling from around a cribbed structural beam which was set on its flange side. The second employee then attempted to remove the shackle from the beam when the swaged fitting of the sling apparently caught and caused the steel beam to roll off the cribbing, crushing the second employee.

CAUSE: Improper Work Procedures, Unsafe Act

PREVENTION RECOMMENDATIONS:
1. The signal man should have insured that the area around the load was clear of personnel
2. Communicated his intentions more effectively before directing the crane to move.
3. Ensure effective safe work procedures are developed and all personnel are trained in their use.
Fatal Facts Lessons Learned

• What other lessons can we learn from this tragic loss of life?

• Review Questions - Interactive Module:
Cranes & Rigging

Rigging Lifting Capacity

• Grabs, hooks, spreader-bars, etc
  – Grabs, hooks, spreaders or any other attachment should:
    • Have lifting capacity equal or greater to slings in use
  – Job or shop built hooks/links should not be used for hoisting
  – All lifting devices clearly marked and proof-tested at 125%
Material Storage

- **Material Storage**
  - **Evaluate route and storage location -- Consider:**
    - load capacity of flooring
    - location of emergency equipment i.e.; fire extinguishers, exits, sprinklers
    - Ease of loading/unloading and general access and egress
    - Compatibility of materials/activities in area
    - Ventilation is adequate
Material Storage

Stacking & Storing Stackable Materials

• General Guidelines
  – Masonry blocks should not exceed the rated capacity of the scaffold
  – The stack must be tapered on a one-half block per tier over 6 foot
  – Lumber must not be stacked any higher than
    • 20 feet with mechanical equipment
    • 16 feet when stacked manually
Material Storage

General Storage

• Cylindrical Material
  – Stack and block to prevent rolling and tilting
  – Do not stack pipe over 5 feet high, unless racked
  – Using chocks to prevent movement
  – Keep personnel away during unloading
Additional Preventative Measures

Housekeeping

• Clean & Safe Jobsite
  – Clean & Organized job site is a safer jobsite
  – Jobsites must be clean & organized at all times
  – Daily inspections required for compliance
  – No work is allowed in areas of non-compliance
  – Clean up as you work, not just at end of shift
Additional Preventative Measures

Housekeeping
Access & Egress

• Stairways, access and egress must be kept clean and clear of debris
• Never allow materials, supplies or obstructions to block an access or egress route
• Secure all loose or light material
• Keep tools, materials, cords, hoses or debris off the floor
• Protect electrical cords at all times
Additional Preventative Measures

Housekeeping

- General
  - Secure all unstable materials to prevent falling
  - Remove:
    - Empty dust producing bags
    - Nails from all scrap & reusable lumber
    - Scrap lumber and debris daily
  - Do not allow combustible materials to accumulate
  - Clean all chemical spills up immediately
Additional Preventative Measures

Nets

• Debris Nets
  – Must be located on top of safety nets
  – Cannot compromise safety nets
  – Competent Person responsible for design
  – Design for size & weight of expected debris
  – Must remove all debris at end of each shift
Additional Preventative Measures

Nets

• Debris Nets
  – Must be inspected by Competent Person
  – Must be protected from damage
  – Inspect:
    • After installation
    • Every week thereafter
    • Following alterations, repairs or damage
  – Remove defective nets from service immediately
Additional Preventative Measures

Material Disposal

• Recycling Waste
  – Recycling saves money and the environment
  – Recycle as much waste as possible
  – Waste shall:
    • Placed in piles or containers for disposal
    • Be removed daily so as not create a health hazard

Safety Tip
An MSDS will typically state that waste must be disposed of in accordance with Federal, State and or Local regulations and that contacting a licensed waste disposal contractor provides additional protection.
Additional Preventative Measures

Disposal of Waste Material

• Prior to disposing of materials, consult the MSDS:
  – Ensure proper PPE
  – Proper disposal methods

Safety Tip
According to OSHA, the employer shall maintain in the workplace copies of the required MSDSs for each hazardous chemical, and shall ensure that they are readily accessible during each work shift to employees when they are in their workarea(s)."
Additional Preventative Measures

Disposal Chutes

– Must be used for waste disposal above 6’
– Chutes must be made from wood or equivalent
– Enclosed completely except for access openings
– Openings not to exceed 4’ in height
– Openings kept closed when not in use
Additional Preventative Measures

Material Drop Zone

• Used when material won’t fit in chutes

• Drop zone:
  – Must be barricaded on the ground and at each working level
  – Warning signs posted at landing areas
Final Considerations

Summary

– This course has addressed:
  • OSHA requirements
  • Best industry practices
  • How to prevent back injuries
  • Safe handling of debris and other waste
  • Safe Manual and Mechanical material handling techniques

• Use a “Safe Plan of Action” in all of your work!
Materials Handling - Lifting

• Heavy Lifting

Lifting heavy items is one of the leading causes of injury in the workplace.

– The BLS reported that over 36% of injuries involving missed workdays were the result of shoulder and back injuries. Overexertion and cumulative trauma were the biggest factors in these injuries.

– When employees use smart lifting practices and work in their "power zone," they are less likely to suffer from back sprains, muscle pulls, wrist injuries, elbow injuries, spinal injuries, and other injuries caused by lifting heavy objects.

– Lifting heavy object issues:
  • Weight of Objects
  • Awkward Postures
  • High-Frequency and Long-Duration Lifting
  • Inadequate Handholds
  • Environmental Factors

TIP: The power zone for lifting is close to the body, between mid-thigh and mid-chest height. Comparable to the strike zone in baseball, this zone is where arms and back can lift the most with the least amount of effort.
Materials Handling - Lifting

• Heavy Objects

• Potential Hazards:
  – Some loads, such as large spools of wire, bundles of conduit, or heavy tools and machinery place great stress on muscles, discs, and vertebrae.
  – Lifting loads heavier than about 50 pounds will increase the risk of injury.

At 117 lbs, this large spool would be dangerous to lift. Even rolling it can pose a hazard due to the heavy weight and momentum.
Materials Handling - Lifting

- Heavy Objects
- Possible Solutions of moving heavy objects:
  - Use mechanical means such as forklifts or duct lifts to lift heavy spools, transformers, switch gear, service sections, conduit, and machinery.
  - Use pallet jacks and hand trucks to transport heavy items.
  - Avoid rolling spools. Once they are in motion, it is difficult to stop them.
• Heavy Objects
• Possible Solutions of moving heavy objects:
  – Use suction devices to lift junction boxes and other materials with smooth, flat surfaces. These tools place a temporary handle that makes lifting easier.
  – Use ramps or lift gates to load machinery into trucks rather than lifting it.
  – Materials that must be manually lifted should be placed at "power zone" height, about mid-thigh to mid-chest. Special care should be taken to ensure proper lifting principles are used. Maintain neutral and straight spine alignment whenever possible. Usually, bending at the knees, not the waist, helps maintain proper spine alignment.
Materials Handling - Lifting

- Heavy Objects
- Possible Solutions of moving heavy objects:
  - Order supplies in smaller quantities and break down loads off-site. When possible, request that vendors and suppliers break down loads prior to delivery.

Yes, they are balanced and neutral, don’t appear to be struggling with an excessive weight and are splitting the load.
Materials Handling - Lifting

• Heavy Objects
• Possible Solutions of moving heavy objects:
  – Prefabricate items in a central area where mechanical lifts can be used. Only transport smaller, finished products to the site.
  – Limit weight you lift to no more than 50 pounds. When lifting loads heavier than 50 pounds, use two or more people to lift the load.
  – Work with suppliers to make smaller, lighter containers.
Materials Handling - Lifting

- Awkward Postures
- Potential hazards of awkward postures:
  - Bending while lifting forces the back to support the weight of the upper body in addition to the weight you are lifting. Bending while lifting places strain on the back even when lifting something as light as a screwdriver.
  - Bending moves the load away from the body and allows leverage to significantly increase the effective load on the back. This increases the stress on the lower spine and fatigues the muscles.
Materials Handling - Lifting

• Awkward Postures
• Potential hazards of awkward postures:
  – Reaching moves the load away from the back, increases the effective load, and places considerable strain on the shoulders.
  – Carrying loads on one shoulder, under an arm, or in one hand, creates uneven pressure on the spine.
  – Poor housekeeping limits proper access to objects being lifted, and forces awkward postures.
• Awkward Postures
• Possible solutions to avoid awkward postures:
  – Move items close to your body and use your legs when lifting an item from a low location.
  – Store and place materials that need to be manually lifted and transported at "power zone" height, about mid-thigh to mid-chest.
  – Minimize bending and reaching by placing heavy objects on shelves, tables, or racks. For example, stack materials on pallets to raise them into the power zone.
Materials Handling - Lifting

• Awkward Postures
• Possible solutions to avoid awkward postures:
  – Avoid twisting, especially when bending forward while lifting. Turn by moving the feet rather than twisting the torso.
  – Keep your elbows close to your body and keep the load as close to your body as possible.
  – Keep the vertical distance of lifts between mid-thigh and shoulder height. Do not start a lift below mid-thigh height nor end the lift above shoulder height. Lifting from below waist height puts stress on legs, knees, and back. Lifting above shoulder height puts stress on the upper back, shoulders, and arms.
• Awkward Postures
• Possible solutions to avoid awkward postures:
  – Use ladders or aerial lifts to elevate employees and move them closer to the work area so overhead reaching is minimized.
  – Break down loads into smaller units and carry one in each hand to equalize loads. Use buckets with handles, or similar devices, to carry loose items.
  – Keep the load close to the body. When lifting large, bulky loads, it may be better to bend at the waist instead of at the knees in order to keep the load closer to your body.
Materials Handling - Lifting

• Awkward Postures

• Possible solutions to avoid awkward postures:
  – Optimize employee access to heavy items through good housekeeping and preplanning.
  – Use roll-out decks installed in truck beds to bring materials closer to the employee and eliminate the need to crawl into the back of a truck.
Materials Handling - Lifting

- High-Frequency - Long-Duration Lifting
- Potential Hazards: High-Frequency and Long-Duration Lifting
  - Holding items for a long period of time, such as when installing fixtures or j-boxes, even if loads are light, increases risk of back and shoulder injury, since muscles can be starved of nutrients and waste products can build up.
  - Repeatedly exerting, such as when pulling wire, can fatigue muscles by limiting recuperation times. Inadequate rest periods do not allow the body to rest.

Even though this tool is rather light, the length and frequency of activity can create a hazard.
• High-Frequency - Long-Duration Lifting
• Possible Solutions to high frequency and long duration lifting:
  – Use a template made of a lightweight material such as cardboard to mark holes for drilling when mounting heavy items such as junction boxes and service panels. This ensures that the heavier item does not need to be held in place to level and measure for anchor mounts.
  – Provide stands, jigs, or mechanical lifting devices such as duct lifts to hold large, awkward materials such as junction boxes and service panels in place for fastening.
Materials Handling - Lifting

- High-Frequency - Long-Duration Lifting
- Possible Solutions to high frequency and long duration lifting:
  - Rotate tasks so employees are not exposed to the same activity for too long.
  - Work in teams; one employee lifts and holds items while the other assembles.
  - Take regular breaks and break tasks into shorter segments. This will give muscles adequate time to rest. Working through breaks increases the risk of musculoskeletal disorders (MSDs), accidents, and reduces the quality of work because employees are over fatigued.

TIP: Many stressors can not be engineered out of a task, short of complete automation. Rotation of assignments can be an effective means of limiting the amount of time employees are exposed to these stressors. This will often reduce the chance of injury, because the risk of injury is proportional to the amount of time one is exposed to a stressor.
Materials Handling - Lifting

• High-Frequency - Long-Duration Lifting
• Possible Solutions to high frequency and long duration lifting:
  – Plan work activities so employees can limit the time they spend holding loads.
  – Pre-assemble work items such as fixtures or boxes to minimize the time employees spend handling them.
Pushing, Pulling, Carrying

• Pushing, Pulling, Carrying

• Construction work involves ...
  – Moving materials around the worksite.
  – Commonly, there is a central staging area from where supplies are distributed to separate work areas.
  – This can involve pushing, pulling, and lifting materials, sometimes with the help of a hand truck or utility cart.
  – The following hazards may exist when employees transport materials around the worksite:
    • Awkward Postures
    • Forceful Exertion
Pushing, Pulling, Carrying

• Awkward Postures

• Potential Hazards:
  – Assuming awkward postures such as reaching behind the body, bending forward and to the side, and twisting when pushing and pulling materials may lead to muscle strain and spinal injuries.
  – Handles that are too high or too low require extra force exertion.

TIP: Use vertical handles instead of horizontal handles to allow employees of different heights to maintain neutral postures.
Pushing, Pulling, Carrying

• Awkward Postures

• Potential solutions:
  – Use transport devices, such as hand trucks and pallet jacks, and know the correct postures to maintain when using these tools.
  – Provide transport devices with appropriate handles. These handles should be in the power zone when pushing and large enough to accommodate the entire hand. There should be no sharp edges or rough spots that could cut or pinch the employee's hands.
Pushing, Pulling, Carrying

• Awkward Postures

• Potential solutions:
  – Do not stack materials on a cart higher than eye level so that you do not have to bend to the side to see around the load. Employees should be able to easily see over the top of the load.
  – Use stair-climbing hand trucks to transport materials up and down stairs.
Pushing, Pulling, Carrying

• Awkward Postures

• Potential solutions:
  – Avoid pulling when possible. Pushing generally takes less effort than pulling because your body weight is used to assist the exertion. Also, pulling a load often causes carts to run into the shins or ankles.
  – Limit the weight of loads so the necessary pushing force is less than 50 pounds. The greater the force that is necessary to push the load, the greater the risk of injury.
Pushing, Pulling, Carrying

- Forceful Exertion
- Potential Hazards:
  - Operating transport devices with improperly functioning wheels makes moving materials more difficult than necessary.
  - Exerting more force to guide a hand cart with under-inflated or unevenly pressurized tires may put stress on an employee's arms, back, and legs.
  - Moving carts or hand trucks over bumpy, rough terrain or up and down stairs may expose employees to abrupt, jarring impacts which can cause shoulder and back strain.
Pushing, Pulling, Carrying

• Forceful Exertion

• Possible solutions to forceful exertion:
  – Replace wheels when they become wobbly or uneven.
  – Select hand trucks or carts with pneumatic wheels for moving things over bumpy, uneven terrain or up and down stairs.
  – Check the air pressure of pneumatic tires and fill them to the recommended pressure.
Pushing, Pulling, Carrying

• Forceful Exertion
• Possible solutions to forceful exertion:
  – Use transport devices, such as hand trucks and pallet jacks, and know the correct postures to maintain when using these tools.
  – Provide employees with access to elevators or ramps so they can avoid stairs and bumpy ground.
  – Use powered hand trucks with stair-climbing and self-leveling abilities when stairs cannot be avoided.
Pushing, Pulling, Carrying

• Forceful Exertion

• Possible solutions to forceful exertion:
  – Develop good housekeeping practices to ensure that floors are clean so there is minimal resistance.
  – Wear shoes with good soles to maintain firm footing.
  – Reduce the size of the load you carry when going up and down stairs to reduce the force required to transport loads.

TIP: An additional potential solution may be, use curb ramps that allow the employee to easily push the transport device over curbs.
Staging & Housekeeping

• Staging & Housekeeping

• Everybody benefits when employers encourage ...
  
  – Proper staging and housekeeping practices; productivity rises, quality improves, profits increase, and the risk of injury is reduced. Employees can spend less time moving materials and more time performing skilled tasks.
• Staging

• Potential Hazards associated with materials hazard staging:
  – Poorly-planned staging may result in employees lifting materials from awkward locations or carrying materials longer than necessary.
Staging & Housekeeping

• Staging

• Possible solutions to materials handling staging:
  – Ensure that materials are off the floor and are placed on stands, racks, or other devices that allow the materials to be in the power zone, minimizing the need to bend or reach to access materials.
  – Ensure that materials are staged within 25 to 50 feet of the point of use. This reduces walking distances, an element that affects risk factors, efficiency, and productivity.
Staging & Housekeeping

• Housekeeping

• Potential hazard.
  – Poor housekeeping creates a disorderly workspace, which increases the risk of ergonomic and other injuries and decreases productivity.
Staging & Housekeeping

• Housekeeping

• Potential solutions:
  – Make housekeeping a priority by performing housekeeping tasks daily or more often if necessary.
  – Plan to create a work space that is easy to maintain.
Vehicular Activities

• Vehicular Activities

• Contractors often use vans or trucks to ...
  – Transport tools and supplies. Employees may have to reach over or climb into the small, awkward areas of these automobiles.
  – Contractors can implement solutions to ease the tasks of transporting and retrieving supplies and tools from automobiles.

• Reaching into a Vehicle

• Loading and Unloading
Vehicular Activities

• Reaching into a Vehicle

• Potential Hazards:
  – Crouching or kneeling to reach into the back of a van or a truck with a shell might put contact stress on the knees and stress on the lower back.
  – Employers often use vans with a narrow, short access space to store materials. Stooping and reaching may be required to access these materials.
Vehicular Activities

• Reaching into a Vehicle
• Potential solutions:
  – Perform lifting tasks from a kneeling position and pushing and pulling tasks from a crouched position when working in cramped areas.
  – Install a roll-out truck bed deck. Materials will be free from the confines of the truck shell and sides, allowing employees to gain easy access to the contents of the truck. These deck platforms also provide a convenient waist-high work space.

TIP: An additional solution may include the placement of the most commonly-used materials closest to doors or in outside truck bins, minimizing the stooping and reaching.
Vehicular Activities

• Loading and Unloading

• Potential hazards:
  – Lifting and lowering materials and equipment from the back of vehicles may place strain on the back.
  – Lifting toolboxes, supplies, or other materials over the sides of the truck stresses the shoulders and back.
Vehicular Activities

• Loading and Unloading

• Possible solutions:
  – Use a vehicle with hydraulic lift equipment.
  – Use reach forklifts that extend the forks over the truck sides and lift materials out of the back.
  – Use truck ramps that allow employees to wheel loads in and out of the back of vehicles.
Vehicular Activities

• Loading and Unloading

• Possible solutions:
  – Do not lift over the sides of a truck or latched tailgate. Reposition materials closer to the tailgate so you can lift in the power zone.
  – Use a multiple-man lift when necessary. The rule of thumb is one person for every 50 pounds.
Employer Responsibilities

• Provide a workplace free from serious recognized hazards and comply with standards, rules and regulations issued under the OSHA Act.
• Examine workplace conditions to make sure they conform to applicable OSHA standards.
• Make sure employees have and use safe tools and equipment and properly maintain this equipment.
• Use color codes, posters, labels or signs to warn employees of potential hazards.
• Establish or update operating procedures and communicate them so that employees follow safety and health requirements.
• Provide medical examinations and training when required by OSHA standards.
• Keep records of work-related injuries and illnesses.

Employer Responsibilities

- When moving materials mechanically
- Ensure that the equipment-rated capacity is displayed on each piece of equipment and is not exceeded except for load testing.
- To prevent creating hazards when storing materials:
  - Keep storage areas free from accumulated materials;
  - Place stored materials inside buildings that are under construction and at least 6 feet from hoist ways, or inside floor openings and at least 10 feet away from exterior walls;
  - Separate non-compatible material; and
  - Equip employees who work on stored grain in silos, hoppers, or tanks, with lifelines and safety belts.

TIP: Employers must train employees in the proper use and limitations of the equipment they operate.
Employer Responsibilities

- With respect to conveyors, employers must:
  - Install an emergency button or pull cord designed to stop the conveyor at the employee’s work station.
  - Install emergency stop cables.
  - Design the emergency stop switch so that it must be reset before the conveyor can be restarted.
  - Ensure that appropriate personnel inspect the conveyor and clear the stoppage before restarting a conveyor.
  - Prohibit employees from riding on a materials-handling conveyor.
  - Provide guards where conveyors pass over work areas or aisles.
  - Cover screw conveyors completely except at loading and discharging points.
Employer Responsibilities

- Operators of fork trucks, platform lift trucks, motorized hand trucks, specialized industrial trucks powered by electrical motors or internal combustion engines:
  - Make these workers aware of the safety requirements pertaining the design, maintenance, and use of these trucks.
  - Develop a training program specific to the type of truck to be driven and the working conditions encountered.
  - Evaluate the operator’s performance in the workplace and certify that each operator has successfully received the training needed.
Summary

• Thank you for your participation in this training class.
• During this section we have discussed:
  – Tips and solutions to prevent injury when performing common materials handling activities on construction sites
  – Reviewed incidents that have caused fatalities during materials handling activities.
  – Crane, light and heavy equipment and conveyor activities can all cause fatality and serious injury and extra precautions must be taken when conducting these activities as well as lighter materials handling tasks.