Material Handling and Storage
Module 2

Special Warehouse Worker Hazards in Structural Steel Fabricating and Supply Companies
Material Handling and Storage
Module 2

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Program Development

This program was developed by faculty and students in the School of Planning, Design and Construction at Michigan State University in conjunction with the American Institute of Steel Construction - Safety Committee and the University of Puerto Rico

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Learning Outcomes: Participants shall be able to:

- Identify key material handling hazards
- Recognize hazards associated with material handling equipment
- Identify methods to abate, avoid, and prevent accidents when moving material
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Material Handling Equipment Addressed:

- Workers and ergonomics
- Overhead cranes
- Mobile cranes
- Trucks for receiving and shipping
- Powered Industrial Trucks (Forklifts)
- Carts
- Industrial magnetic lifting devices
- Slings, wire ropes, and alloy chains
- Lifting hardware
- Loading docks
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Workers

- Workers are a key part of the material handling chain
- Use of equipment to help make the job easier can lead to certain injuries
- Use proper lifting techniques to avoid injury (Module 5)

Workers working on fabrication
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Workers

- Obtain training on each piece of equipment you use
- Use equipment properly
- Pay attention to what you and others around you are doing
- Use Personal Protective Equipment (PPE) specifically required for the task you are performing
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Personal Protective Equipment

- For loads with sharp or rough edges, wear gloves or other hand and forearm protection
- Steel-toed or composite toed safety shoes to prevent foot injuries if work is dropped
- Wear a hard hat with a good suspension system
- Eye Protection
- Hearing protection
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Equipment Use-Identifying Points of Risk

- Receiving materials
- Additional Operations
- Stored
- Stored in Plant Yard
- Moved at Work Station
- Loaded for Shipping
- Moved into Plant
- Moved to Work Station
- Shipped
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Topics addressed in Modules 2 and 3

- Receiving materials
- Stored in Plant Yard
- Moved into Plant
- Additional Operations
- Moved at Work Station
- Moved to Work Station
- Stored
- Loaded for Shipping
- Shipped
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Receiving and Shipping

- Receiving materials
- Stored in Plant Yard
- Moved into Plant
- Additional Operations
- Moved at Work Station
- Moved to Work Station
- Stored
- Loaded for Shipping
- Shipped
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Receiving and Shipping-Key Topics

- Rail
- Trucks
- Removing strapping
- PPE
- Loading Docks
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Receiving material at the shop

- Material typically delivered by rail or trucks
- Offloaded with overhead cranes or mobile cranes
- Smaller items may be offloaded with Powered Industrial Trucks (Forklifts)
- Smaller items may be off loaded to loading docks
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Receiving material at the shop

Steel arriving from the mill
Material Handling Equipment
Module 2

Trucks for Receiving and Shipping

Receiving material

Fabricated shapes loaded for shipping
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Loaded for shipping

Fabricated shapes loaded and ready for shipping

Loads must be secured
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Potential Hazard: Moving vehicle/equipment accidents
- Struck-by and caught-between accidents

Hazard Avoidance
- Clear surfaces of ice and snow
- Direct traffic movement and drivers with hand signals
- Use trained “spotters”
- Personnel should use personnel doors rather than doors intended for vehicles
- Use backing-up audible warnings, lights and flashers
- Stand clear of moving vehicles
- Do not stand between vehicles and obstructions
- Maintain clearances
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Potential Hazard: Moving vehicle/equipment accidents
- Struck-by and caught-between accidents

Hazard Avoidance
- Set brakes of trucks to prevent trucks from moving during loading and unloading
- Block/chock wheels to prevent movement
- Follow company policy on whether drivers can remain in trucks during loading and off loading
- Maintain guards at dropped loading areas

Other methods to avoid hazards that you use?
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Rail for Receiving and Shipping

- OSHA 1910.178 (k) requires wheel stops or other recognized positive protection to prevent rail cars from moving during loading or unloading.
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Use of Spotters

https://www.osha.gov/doc/topics/backover/spotter.html
Use of Spotters - Backing Safety Solutions

“Spotters are a proven method of protecting employees on foot behind vehicles with an obstructed view, but spotters themselves can be at risk for injury or even death.”

https://www.osha.gov/doc/topics/backover/spotter.html
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- **Use of Spotters - Backing Safety Solutions**
  - Spotters and drivers agree on hand signals before backing
  - Spotters should maintain visual contact with the driver
  - Drivers should stop backing immediately if they lose sight of the spotter
  - Spotters should not have additional duties while they are acting as spotters
  - Spotters should not to use personal mobile phones, personal headphones, or other items which could pose a distraction during spotting activities
  - Spotters should wear high-visibility clothing, especially during night operations

https://www.osha.gov/doc/topics/backover/spotter.html
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Hand Signals

- Use hand signals to direct drivers

https://www.osha.gov/doc/topics/backover/spotter.html
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Hand signals

https://www.osha.gov/doc/topics/backover/spotter.html
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Truck Hand Signals

*In-class activity - Instructor to demonstrate with student proper hand signals*

*Each attendee to demonstrate one hand signal*
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Hazard Potential: Slips, falls and trips from equipment or in storage yard

- Slips, falls and trips may occur from equipment or in the storage yard due to slippery surfaces from inclement weather or obstructed walking paths

Hazard Avoidance:

- Clear surfaces of ice and snow
- Use proper foot-ware with treaded soles
- Keep walkways clear of debris
- Do not work fatigued
- Use protection from falls when working on platforms above 4 feet
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Potential Hazard-Unstable loads due to shifting during transport
- Loads may shift or otherwise become unstable during transport or during unloading

Hazard Avoidance
- Observe and evaluate load upon arrival and during unloading
- Stabilize and re-secure loads
- Stand clear of unstable loads
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Potential Hazard - Cuts, scrapes, bumps, pinches and contact injuries from material sharp edges and being caught between materials

Fabricated material and material from the mill will have sharp edges. Always wear proper clothing and PPE.
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Potential Hazard-Cuts and scrapes from material sharp edges

Hazard Avoidance:
 ✓ Wear appropriate personal protective clothing
 ✓ Handle materials properly
 ✓ Use tools properly
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Potential Hazard-Injuries from removing metal banding

- Cuts and eye injuries

**Hazard Avoidance-removing metal material banding**

- Wear appropriate personal protective clothing:
- Use the right tools such as long handled shears
- Do not use tools like crowbars or claw hammers

Adapted from wyomingworkforce.org/Documents/OSHA/.../SteelStrapping.pdf date visited December 8, 2014
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Hazard Avoidance - removing metal material banding

✓ Plan the job. Cut the band farthest away first.
✓ Other personnel should stand clear
✓ Make cuts squarely
✓ Stay away from the area that straps springs to when cut
✓ Clean up straps after cutting the straps, do not leave them laying around

Adapted from wyomingworkforce.org/Documents/OSHA/.../SteelStrapping.pdf
date visited December 8, 2014,
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Potential Hazard-Loading docks
- Injuries happen when forklifts run off the dock, products fall on employees or equipment strikes a person.

Hazard Avoidance:
- Do not stand between a truck and a fixed surface
- Block/chock wheels of trucks
- Guide trucks with hand signals
- Drive forklifts slowly around docks
- Check if dock plates can safely support loads
- Do not back up forklifts to dock edge
- Avoid dock edges

Source OSHA 3220-10N 2004

Careful use of forklifts in areas of loading docks is needed to prevent fall-offs
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Potential Hazard-Loading docks
❑ Injuries happen when forklifts run off the dock, products fall on employees or equipment strikes a person.

Hazard Avoidance:
✓ “Provide visual warnings near dock edges”
✓ “Prohibit “ dock jumping ” by employees”
✓ Use non-slip surfaces and keep surfaces clean
✓ Paint the edges of the loading dock to improve visibility
✓ Meet OSHA standards for dock ladders, stairs, and guardrails

Source OSHA 3220-10N 2004
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Movement Overhead

- Receiving materials
- Stored in Plant Yard
- Moved into Plant
- Additional Operations
- Moved at Work Station
- Moved to Work Station
- Stored
- Loaded for Shipping
- Shipped
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Movement Overhead - Key Topics

- Overhead Cranes
- Mobile Cranes
- Slings
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Cranes - Moving material in the yard

- Typically by overhead crane or mobile crane

Overhead crane in material yard
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Cranes - Moving material within the shop

- Typically material is moved within the shop with overhead, gantry or jib cranes

Overhead crane for moving material in shop
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Overhead Cranes

- 1910.179 Overhead and gantry cranes

Photo from OSHA 3341-03N 2008
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Potential Hazard: Dropped loads

- Loads carried by overhead cranes can be dropped or workers can be struck or caught between objects

Hazard Avoidance:

- Do not work under loads being moved or suspended overhead
- Maintain safe distances from loads being moved overhead
- Use only trained operators
- Use “Spotters” when operator cannot see the load and a clear path
- Operate cranes within load rating limits
Potential Hazard: Dropped loads

- Loads carried by overhead cranes can be dropped

Hazard Avoidance:

- Maintain crane equipment
- Conduct required safety inspections of lifting equipment
- Use proper rigging hardware, slings, alloy chains and wire ropes free of defects and properly sized
- Inspect slings, chains, wire ropes and hardware for defects, corrosion and degradation. Discard if damaged.
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Safety measures for cranes:

- Know the weight of the material that is being lifted
- Always check the crane's rated capacity to make sure that the crane will not be overloaded
- Plan lifts before starting them to make sure that they are safe.
- Know the “weakest” link in the lift, often rigging. Plan the path of travel, clear landing area, notify others in the area, etc.

https://www.osha.gov/Publications/OSHA2236/osha2236.html
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Safety measures employers should take with cranes:

- Inspected at least quarterly “by persons thoroughly familiar with the crane, the methods of inspecting the crane, and what can make the crane unserviceable. Crane activity, the severity of use, and environmental conditions determine more frequent inspection schedules.”

- “Ensure that the critical parts of a crane—such as crane operating mechanisms, hooks, air, or hydraulic system components and other load-carrying components—are inspected daily for any maladjustment, deterioration, leakage, deformation, or other damage.”

https://www.osha.gov/Publications/OSHA2236/osha2236.html
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Mobile Cranes

1910.180 Crawler, locomotive, and truck cranes

Mobile crane being used in yard to load trucks
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Safety measures with mobile cranes:

- Only thoroughly trained and competent workers should operate cranes.
- Cranes operators must be National Commission of the Certification of Crane Operators (NCCCO) certified if operating cranes on a construction jobsite, although it is not mandated for work in the shop.
- Operators should know what they are lifting and what it weighs. Rated capacity of mobile cranes vary with boom length and radius.

https://www.osha.gov/Publications/OSHA2236/osa236.html
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Safety measures with mobile cranes:

- To minimize the risks of crane use, employers shall take the following precautions:
  - Equip all cranes with boom angle indicators
  - “Provide cranes with telescoping booms with some means to determine boom lengths unless the load rating is independent of the boom length.”
  - “Post load rating charts in the cab of cab-operated cranes. (All cranes do not have uniform capacities for the same boom length and radius in all directions around the chassis of the vehicle.”

https://www.osha.gov/Publications/OSHA2236/osha2236.html
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Safety measures with mobile cranes:

- Know that there are regulations and limitations that operators need to know before working close to power lines
- Outriggers if used must rest on firm ground, timbers, or cribbing to spread the crane weight and load over a large enough area

https://www.osha.gov/Publications/OSHA2236/osha2236.html
Cranes Reminders*

- Check the load chart in the cab
- Frequently inspect
- Lift people only when permitted by OSHA Standards
- Check overhead power lines if outdoors
- Ensure area of travel is clear
Mobile Cranes

- Use hand signals when necessary to guide load placement
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Mobile Cranes

- Hand signals continued

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Crane Hand Signals

**In-class activity - Instructor to demonstrate with student proper crane signals used by spotters**

*Each attendee to demonstrate one hand signal*
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Mobile Cranes

- AISC has a sample daily inspection checklist available on its safety channel

http://www.aisc.org/content.aspx?id=31828
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Mobile Cranes
AISC has two useful crane webinars available for viewing at its safety channel site for additional information

http://www.aisc.org/content.aspx?id=31828
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Industrial Magnetic Lifting Devices

http://www.walkermagnet.com
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Industrial Magnetic Lifting Devices

Permanent magnet

Using magnet to lift plate
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Industrial Magnetic Lifting Devices

1910.179(a)(47) "Magnet" means an electromagnetic device carried on a crane hook to pick up loads magnetically.
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Industrial Magnetic Lifting Devices

The American Society of Mechanical Engineers has developed the **ASME B30.20-20-3 Below-the-Hook Lifting Devices** - Safety Standard for Cableways, Cranes, Derricks, Hoists, Hooks, Jacks, and Slings which addresses permanent and electric-rated lifting magnets and their operation.

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Industrial Magnetic Lifting Devices

ASME B30.20-20-3 addresses safety of magnetic lifting devices including:
- User qualifications
- Training
- Operation practices

http://www.thefabricator.com/article/materialshandling/understanding-lift-magnet-compliance
Three main types of magnets:
- Electromagnets
- Permanent magnets
- Electro-permanent magnets

All three can be used to lift ferrous metals such as plate, structural shapes, coils etc.

http://www.walkermagnet.com/resources-magnetics-101.htm
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Industrial Magnetic Lifting Devices

- Permanent magnets typically will have “on” position and “off” position. The operator engages the magnet using the “on” position.

- Safety pins are engaged to protect against accidental switching to the “off” position and disengaging the magnet.

- May also include safety lifting features that can be used to test the load before a lift.
Potential Hazard Magnets: Dropped loads
- “Caught between” injuries can range from pinching, crushing to amputations (caught between) due to:
  - Dropped loads
  - “Struck by” caused by material being moved
  - Attracting unintended surrounding tools, material etc. due to magnetic force

Hazard Avoidance:
- Never work under the path of the load
- Maintain safe distances from loads being moved overhead
- Never put your fingers under the load when guiding loads
- Use same precautions as crane hazard avoidance discussed previously
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Industrial Magnetic Lifting Devices

- Dropped loads can occur from factors such as
  - Instantaneous loss of power
  - Loss of magnetism of permanent magnets
  - Irregular surfaces which may prevent the magnet from being fully engaged with the material being moved

http://www.thefabricator.com/article/materialshandling/understanding-lift-magnet-compliance
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Industrial Magnetic Lifting Devices

- Follow Manufacturer's instruction for safe operation
- Magnets should have legible labels showing magnet lifting capacity
- Lifting charts can be hard to read on magnets, and hard to keep legible. These charts can be enlarged and posted in the facility (as long as employees know where to find the information)
- Remove from service defective equipment or when missing tags.

http://www.thefabricator.com/article/materialshandling/understanding-lift-magnet-compliance
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Industrial Magnetic Lifting Devices

- “Strong magnet warnings” should be placed in areas when lifting magnets are used

- Strong magnets can attract unwanted materials such as tools, adjacent materials, table etc.

- Remember magnets depending on their design can lift from several hundred lbs to 10,000 lbs

http://www.thefabricator.com/article/materialshandling/understanding-lift-magnet-compliance
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Q and A
Take a Break!