

The background of the cover is a photograph of a construction site, heavily tinted with a green color. It shows a multi-level structure under construction with extensive scaffolding and wooden formwork. The overall scene is industrial and focused on infrastructure work.

mita

Fall **P**rotection
Handbook

This handbook was designed by the
Michigan Infrastructure & Transportation Association

TABLE OF CONTENTS

Introduction.....	4
Before You Start.....	5
Crane Operations.....	6
Electrical Line Clearance Table.....	7
Crane Hand Signals.....	8
Scaffolding.....	10
Scaffold Planking Requirements.....	11
Portable Ladders.....	12
Welding and Cutting.....	13
Signals, Signs and Barricades.....	15
Personal Protective Equipment.....	16
Eye Protection Guide and Applications.....	18
Aerial Work Platforms.....	20
Safety Nets.....	21
Fall Protection and Guarding.....	22
Electrical.....	24
Fire Protection.....	25
Controlled Access Zones.....	26
Glossary.....	27
Disclaimer.....	28
Employee Sign-off Sheet.....	29

INTRODUCTION

Employees in the heavy construction industry can be exposed to even the most common workplace hazards. This Fall Protection Handbook provides a quick reference to help you avoid the potential dangers associated with your job.

This handbook was designed by the Michigan Infrastructure and Transportation Association (MITA) to help you comply with Michigan Occupational Safety and Health Administration (MIOSHA) standards. This handbook is not intended to be a substitute for these standards, and it is your responsibility to familiarize yourself with the specifics that influence heavy construction.

Approximately 4 percent of Michigan's workforce is employed in the heavy construction industry. Heavy construction fatalities, however, account for more than 40 percent of all fatal workplace accidents.

The numbers say it all: the seriousness of injury in your workplace is real. Adhering to the safety principles in this handbook will help keep you and your fellow workers safe and healthy. It will also help keep injury levels closer to where they should be—zero.

BEFORE YOU START

When performing heavy construction operations, MIOSHA requires that you have a qualified person on hand to perform certain procedures.

A qualified person does not have to be an engineer or have a degree. Any person who—by extensive knowledge, training or experience—can solve or resolve problems that occur on the job site is considered to be a qualified person. This person could be the superintendent, foreman, or anyone else on the project designated by the company owner.

As you read this handbook, you will notice various tasks that are the responsibility of the qualified person. Make certain that you designate an individual for this job and make certain the crew knows who it is.

Crane Operations

A variety of cranes are used in heavy construction. The following information applies to all crane operations. Most of the referenced material can be found in Part 10 of the MIOSHA Construction Safety Standards.

- Always complete a daily visual inspection of a crane before operations.
- A current annual written inspection should be maintained at each job site where a crane is used.
- A rated capacity chart should be in the cab of each crane.
- Always barricade the swing radius of the crane.
- Operators should never leave a load unattended.
- Discard or repair wire ropes that:
 - are worn through one-third or more of original diameter;
 - exhibit kinking, crushing, birdcaging or waving;
 - have six random broken wires in one lay or three broken in one strand in the lay.
- Maintain a 10-foot minimum clearance from energized lines; use a spotter in difficult areas (see Electrical Line Clearance Table on next page)

Electrical Line Clearance Table		
	Voltage	Clearance With Boom Raised
To	50 kV	10'
	69 kV	10'-7.6"
	120 kV	12'-4.0"
	138 kV	12'-11.2"
	345 kV	19'-10.4"
	765 kV	33'-10.0"

- Discard nylon slings with any wear or cord exposure.
- Only use tagged chains of appropriate size for items being lifted.
- Use hand signals when materials are being lowered or raised unless a voice communication system is in place.
- When using hand signals, remain in a position in which the operator can clearly see all hand signals.

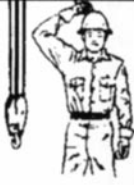
Crane Hand Signals



HOIST: With forearm vertical, forefinger pointing up, move hand in small horizontal circle.



LOWER: With arm extended downward, forefinger pointing down, move hand in small horizontal circle.



USE MAIN HOIST: Tap fist on head; then use regular signals.



USE WHIPLINE: (Auxiliary Hoist). Tap elbow with one hand; then use regular signals.



RAISE BOOM: Arm extended, fingers closed, thumb pointing upward.



LOWER BOOM: Arm extended, fingers closed, thumb pointing downward.



MOVE SLOWLY: Use one hand to give any motion signal and place other hand motionless in front of hand giving the motion signal. (Hoist slowly shown as example.)



RAISE THE BOOM AND LOWER THE LOAD: With arm extended, thumb pointing up, flex fingers in and out as long as load movement is desired.



LOWER THE BOOM AND RAISE THE LOAD: With arm extended, thumb pointing down, flex fingers in and out as long as load movement is desired.

Crane Hand Signals



SWING: Arm extended, point with finger in direction of swing of boom.



STOP: Arm extended, palm down, move arm back and forth horizontally.



EMERGENCY STOP: Both arms extended, palms down, move arms back and forth horizontally.



TRAVEL: Arm extended forward, hand open and slightly raised, making pushing motion in direction of travel.



DOG EVERYTHING: Clasp hands in front of body.



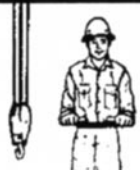
TRAVEL (Both Tracks): Use both fists in front of body, making a circular motion about each other, indicating direction of travel, forward and backward. (For land cranes only.)



TRAVEL (One Track): Lock the track on the side indicated by raised fist. Travel opposite track in direction indicated by circular motion of other fist, rotated vertically in front of body. (For land cranes only.)



EXTENDED BOOM (Telescoping Booms): Both fists in front of body with thumbs pointing outward.



RETRACT BOOM (Telescoping Booms): Both fists in front of body with thumbs pointing toward each other.

Scaffolding

Scaffolding is often used in heavy construction. The following should assist you in the erection of scaffolding. Consult Part 12 of the Construction Safety Standards for further requirements.

- Scaffolding should only be erected under the direction of a qualified employee.
- Do not load scaffolding beyond the designated working load.
- Keep scaffolding free from excess tools, materials and debris.
- All scaffolding 10 feet or higher must have a guardrail system installed on any open side or end.
- Remove from service any wood or laminated planks in poor condition, along with any bent scaffolding members.
- Use ties, guys, bracing and/or outriggers when needed.
- Wear hard hats when erecting or dismantling scaffold.
- Maintain a 10-foot clearance from energized lines.
- A fall arrest device must be worn when working on a scaffold without railings at or above 10 feet.
- Employees working from scaffolding exposed to overhead hazards or falling material must be protected with something sufficient enough to prevent injury.
- Do not work on scaffolds during storms or when wind speeds exceed 25 mph.
- Keep scaffolding free from slippery conditions caused by snow, ice, oil, grease or other substances.

Scaffold Planking Requirements

- Planking must overlap support a minimum of 6 inches or be cleated. Where planks are lapped, each plank shall lap its bearer not less than 6 inches, which will provide a minimum overlap of 12 inches.
- Planks should not extend beyond the support more than 18 inches. Such overhangs must be separated from work platforms by a guard or railing so they cannot be walked upon.
- Planking on continuous runs must extend over supports and overlap each other by at least 12 inches.
- 2-inch by 10-inch scaffold planks should never exceed 10 feet.
- No more than one person should stand on an individual plank at one time.
- Never place materials on a cantilevered platform unless assembly is designed to support materials.
- Use tie-downs when wind conditions pose a threat.

Portable Ladders

Portable ladders, when used during heavy construction, should meet the following requirements:

- Only use Type 1 or Type 1A ladders.
- Always extend ladders 3 feet above the landing surface that the ladder is gaining access to.
- Never use a stepladder as a straight ladder by leaning it against a wall or support.
- All ladders used in conjunction with platforms must be secured at the top and bottom.
- The recommended safe degree for ladder use is between 90 degrees and 75 degrees.
- Never stand on the top two rungs or within 3 feet of the top of the ladder.
- When working in the presence of energized electrical lines, a minimum clearance of 10 feet must be maintained. This includes the ladder, employee and any materials.
- A ladder must have safety feet unless tied or blocked off. Slip-resistant boots do not fulfill this requirement.

Welding and Cutting

Welding operations are common to heavy construction work. When performing these operations, the following should be considered:

- When welding above ground, work from a guarded platform and use a safety harness.
- Always wear the appropriate personal protective equipment when welding or cutting (i.e., aprons, leggings, safety shoes, hard hats, proper goggles, shields or safety glasses).
- When finished welding or cutting, warn others of hot metal.
- Store full and empty cylinders valve-end up and secured with a chain or bracket. Never store oxygen and acetone together.
- When hoisting cylinders with a crane, use cradles or enclosed platforms.
- Store cylinders at least 20 feet from combustibles.
- Always use backflow devices on gas and oxygen hoses.
- Never weld or cut in a confined space without taking the proper precautions.
- Only use welding and cutting equipment if you have been trained and authorized to do so.

- Welding operations should never be performed within 50 feet of explosives, stored cylinders or stored fuel.
- Remove or cover (with fire resistant material) any combustibles located within 35 feet of a welding operation.
- If a smoldering fire could result from welding operations, a person must remain on the job for at least 30 minutes after the welding has ceased.
- A fire extinguisher with a minimum rating of 2A-10BC must be available for use during welding operations.
- Clean all drums, barrels and tanks of toxic, flammable or combustible material before performing welding or cutting operations.

Signals, Signs and Barricades

In most cases, heavy construction is often performed in and around traffic. The following safety precautions are taken from Part 22 of the Construction Safety Standards:

- While flagging or directing traffic, a warning vest shall be worn at all times. Hard hats are also recommended.
- A hand-held, two-sided paddle sign (on a six-foot staff) with “STOP” on one side and “SLOW” on the other shall be used to control traffic.
- Do not ride on equipment unless it has been designed for occupancy and safety precautions are in place.
- Traffic control devices shall be installed and maintained as prescribed by Part 6 of the Michigan Manual on Uniform Traffic Control Devices (MUTCD).
- When working in or adjacent to vehicular traffic, always face the flow of traffic or use a spotter.
- MDOT projects require a traffic regulator certification and training (materials are available at the MITA office).

Personal Protective Equipment

In heavy construction, as in many types of construction, there are various types of personal protective equipment that must be used. This equipment is supplied by your employer to protect you from hazards and injury. The following are requirements of Part 6 of the Construction Safety Standards:

- A hard hat shall be worn on the job site when the risk of injury from overhead and falling objects exists (MITA recommends that hard hats be worn at all times on job sites).
- Proper face and eye protection shall be worn at all times when the job creates a hazard or possible injury (see eye protection guide on page 18).
- Employees, including traffic regulators, are required to wear steel-toed boots on construction sites.
- When working more than 6 feet above the ground or water on an unguarded surface, employees shall wear a safety harness and lanyard 10 feet on scaffolding.

- When working over or adjacent to water (and the possibility of drowning exists), employees shall wear a life jacket or buoyant work vest that is Coast Guard approved and roles the potential victim face-up in the event of an accident.
- A ring buoy with not less than 90 feet of line and one lifesaving boat shall be available every 50 feet when employees are working near water.

Eye Protection Guide and Applications

Operation	Hazards	Recommended Protectors
Acetylene–burning Acetylene–cutting Acetylene–welding	Hazards	7,8,9
Chipping	Sparks, harmful rays, molten metal, flying particles	1,3,4,5,6,7A,8A
Electric (arc) welding	Flying particles	9,11 (11 in combination with 4, 5 and 6 in tinted lenses is advised)
Grinding–light	Sparks, intense rays, molten metal	1,3,4,5,8,10
Grinding–heavy	Flying particles Flying particles	1,3,7A,8A (for severe exposure add 10)
Spot welding	Flying particles, sparks	1,3,4,5,8,10

Eye Protection Guide and Applications

1. Goggles: flexible fitting, regular ventilation
2. Goggles: flexible fitting, hooded ventilation
3. Goggles: cushioned fitting, rigid body
4. Spectacles: metal frame, with side shields
5. Spectacles: plastic frame, with side shields
6. Spectacles: metal-plastic frame, with side shields
7. Welding goggles: eyecup type, tinted lenses
- 7A. Chipping goggles: eyecup type, clear safety lenses
8. Welding goggles: cover spec type, tinted lenses
- 8A. Chipping goggles: cover spec type, clear safety lenses
9. Welding goggles: cover spec type, tinted plate lens
10. Face shield: available with plastic or mesh window
11. Welding helmets

Aerial Work Platforms

Part 32 of the Construction Safety Standards addresses aerial work platforms. These work platforms—which must be supported by scissors, mast or boom—are intended to raise personnel into position for the completion of work tasks. The following rules apply to the use of this equipment:

- Aerial work platforms should only be operated by employees who have been trained and issued a permit to use this equipment.
- The permit may only be used when performing work for the employer who issued the permit.
- All occupants of aerial work platforms must use a safety harness with a lanyard attached to the appropriate points of the platform.
- Never tie off to an adjacent structure when working from an aerial platform.
- Never stand on rails or planks to achieve additional working height.
- Always maintain a minimum 10-foot clearance from energized electrical lines.

Safety Nets

Safety nets should adhere to the following requirements:

- Be installed as close as possible under the surface that employees are working on.
- Safety nets must extend outward from the outmost edge as follows:

Vertical distance from the working level to the horizontal plane of the net	Minimum required horizontal distance of outer edge of net from the edge of the working surface
Up to 5 feet	8 feet
5 feet to 10 feet	10 feet
Greater than 10 feet	13 feet

- Drop test must be performed unless the employer can prove it is unreasonable.

Fall Protection and Guarding

During steel and precast erection, fall hazards are often present. The following options may be used to address fall hazards:

- Safety nets should be used in workplaces that are 30 feet above the ground or water and when other means of protection cannot be provided.
- Perimeter cables constructed of 3/8-inch cable with danger signs or yellow caution tape midway between the cable supports may be used as a fall protection device.
- Perimeter cables should be not less than 34 inches above the floor, including sag.

When guarding work areas, adhere to the following guidelines:

- Never use resteel for guardrail construction.
- Guardrail support posts should be spaced not more than 8 feet apart.
- Guardrail height should be 42 inches plus or minus 3 inches.

- The intermediate rail should be halfway between the floor and top rail.
- Open-sided floors and work platforms 6 feet or higher should be guarded unless a safety harness is used.
- Use a safety belt or harness when installing guardrails.

Electrical

- Always use ground fault circuit interrupters (GFCIs) with portable hand tools when working outside.
- Be sure all GFCIs are in working order.
- Inspect extension cords, plugs, electrical tools and equipment. Repair or replace any defective or broken equipment.
- Portable lights must be equipped with bulb guards.
- Only three-prong plugs should be used with electrical equipment.

Fire Protection

- Be sure emergency phone numbers are posted.
- Always use a safety can when transporting gas in quantities greater than 1 gallon.
- Do not smoke or use an open flame within 25 feet of combustibles.
- Portable tanks stored outside must be at least 20 feet from any building.
- A maximum of 60 gallons per container and 1,100 gallons per storage site must be maintained for outside storage facilities.
- Aboveground tanks must be no closer than 25 feet from energized power lines and must never be stored directly under power lines.
- A 40-pound fire extinguisher must be available at tar kettle operations at a distance of not less than 10 feet and not more than 25 feet.
- Fuel storage areas should be marked “no smoking” with an appropriate fire extinguisher available.
- Perform annual inspections on extinguishers to ensure they are functioning.

Controlled Access Zones

Employees may implement the use of controlled access zones when working on bridges in designated and clearly marked areas. The type of work performed in this area is usually leading edge. A controlled access zone should only be used in areas where the employer can prove that conventional fall protection methods are not feasible or create a greater hazard.

Controlled access zones are used to keep out workers who are not authorized to enter work areas. The controlled access zone must encompass all points of entry.

The use of a safety monitor is required at all controlled access zones. This person should remain in constant visual contact of leading edge workers and be able to vocally alert workers of hazards.

Only implement the use of a controlled access zone under the direction of a qualified employee.

Glossary

Anchorage: A secure point of attachment for lifelines, lanyards or deceleration devices.

Connector: A device that is used to couple (connect) parts for a personal fall arrest system.

Body Harness: Straps that may be secured around a person in a manner that distributes fall arrest forces.

Controlled Access Zone: A designated and clearly marked work area in which certain types of work (such as leading edge) may take place without the use of conventional fall protection systems.

Leading Edge: The edge of a floor, roof or formwork for a floor or other walking/working surface (such as the deck), which changes location as additional sections are placed or constructed.

Safety Monitor System: A safety system in which a qualified person is responsible for recognizing and warning employees of fall hazards.

Disclaimer

MITA has provided this handbook as an overview of important MIOSHA Construction Safety Standards that affect heavy construction. It is intended to provide general information, not advice, regarding any particular situation. This handbook is not intended to set forth all the requirements of the applicable MIOSHA standards and should never be used as a substitute for the standards. Contractors and employees should always be familiar with the current and complete MIOSHA Construction Safety Standards before starting construction. MITA cannot be held responsible in any manner for any damage or loss, or any action whatsoever, resulting from inaccuracies or omissions in this handbook, nor can the MITA's officers, employees, directors, members or its publisher.

Employee Sign-off Sheet

I, _____, an employee of this company, have read this Fall Protection Handbook and I understand it. I also understand that if I have any questions concerning the handbook or safety in general, I may contact the company's Safety Officer for clarification. Furthermore, I understand that safety is everyone's responsibility, including my own.

Notes

Fall Protection

MITA
P.O. Box 1640
Okemos, MI 48805 -1640
www.mi-ita.com