

Reaching Higher

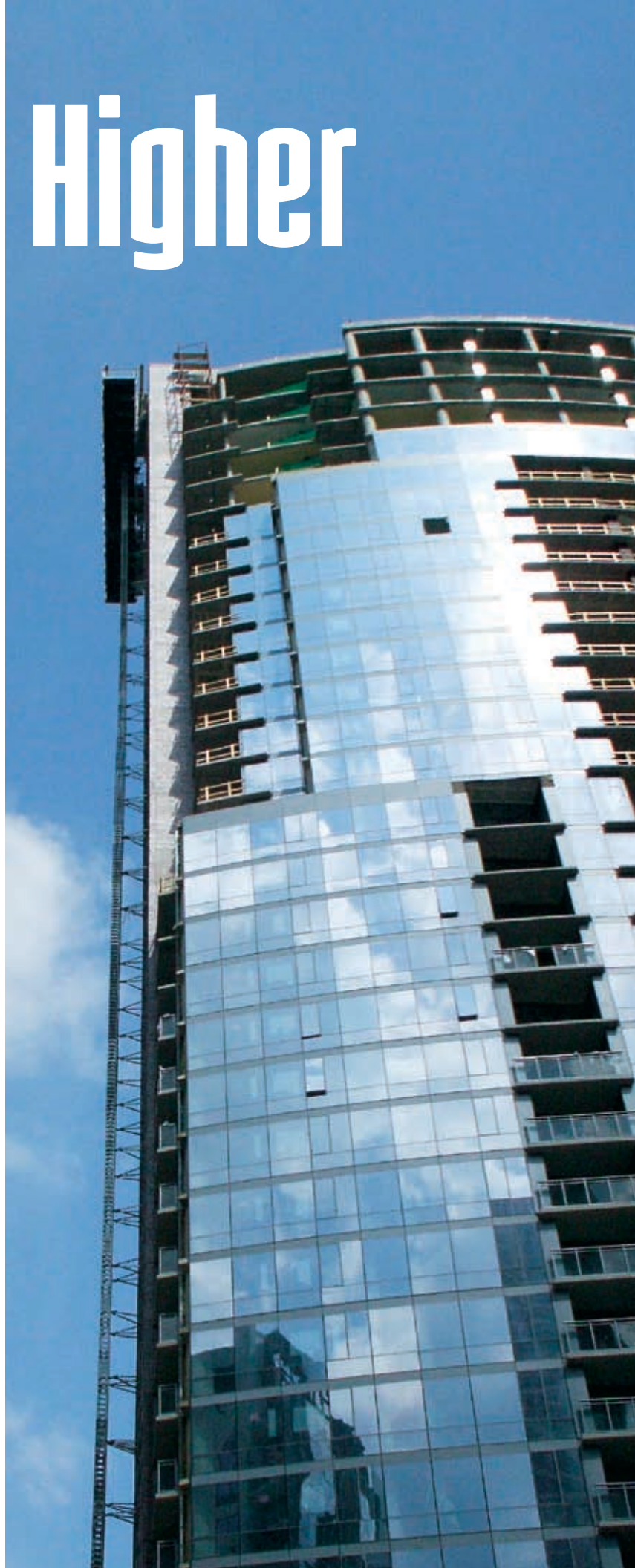
Recommendations for the Safe Use of Mast Climbing Work Platforms

Developed by
the CPWR Work Group
on Mast Climbing
Work Platforms

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December 2010



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Executive Summary

Mast climbing work platforms, also known as mast climbers, are becoming more and more common on U.S. construction sites. Mast climbers have a power-driven work platform that climbs a vertical tower, allowing them to reach much higher and carry greater loads than traditional scaffolds. Although they were available in the U.S. in the 1980s, they became more common in the early 1990s when contractors began using them as an alternative to traditional tube-and-coupler scaffolds. On average, about 16,800 people now work on some 5,600 mast climbers each day. Workers spend an additional 3.3 million work hours erecting and dismantling mast climbers each year (O’Shea, personal communication, 7/20/10).

Mast climbers offer many advantages over other forms of scaffolding. They are quicker to erect and dismantle, and they are potentially much better at reducing the risk of shoulder and lower back injuries to workers, since they can be adjusted to an optimum working height. Yet some of their advantages, such as their ability to reach

When installed and used correctly, mast climbers are as safe as other scaffold types, but when they fail, the results are usually catastrophic.

hundreds of feet in the air, can create new and potentially hazardous conditions. When installed and used correctly, they are as safe as other scaffold types, but when they fail, the results are usually catastrophic, often involving multiple deaths and serious injuries. For instance, the 12 mast climber incidents described in this report cost 18 lives and a number of serious injuries. Yet the true rate of deaths and serious injuries due to mast climber collapses is

not known. OSHA regulations treat mast climbers under the general category of scaffolds, and work site incident reports often do not specify the type of scaffolds involved in fatalities.

In 2006, CPWR – The Center for Construction Research and Training established a work group of representatives from industry, government, and labor to examine problems and discuss solutions to improve the safety of this important new equipment available to contractors. The group’s main goal was to **develop recommendations that could be used by regulators and those responsible for specifying and contracting work that involves mast climbers**. This paper presents a compilation of the work group’s recommendations, which are broken into five sections:

- **Institute new training programs and qualifications for training providers**, including awareness training for anyone using, working on, or operating mast climbers (the appendix contains a detailed outline for awareness training), an erector/dismantler course, and site- and model-specific training, as well as clear instructor qualifications;
- **Adopt engineering and administrative controls** that address involvement of persons qualified in structural engineering where needed, as well as shoring, anchorage systems, load tables, enclosures, wind, inspections, maintenance, vertical climbs, and fall protection;
- **Define roles and responsibilities** of manufacturers, suppliers, distributors, users, and site owners;
- **Determine specific qualifications and roles** of all participants to improve site safety and oversight; and
- **Update OSHA standards and consensus standards** to address the unique design and safe use of mast climbers.

About Mast Climbing Work Platforms

The main goal of this paper is to present recommendations on the safe use of mast climbing work platforms, also known as mast climbers. The recommendations, which start on page 9, are the culmination of a four-year consensus effort by a work group of representatives from industry, government, and labor. In support of these recommendations, the first part of the paper provides some background information on mast climbers—how they work, their advantages, and their hazards. The paper also explains why current scaffold safety regulations are inadequate for mast climbers.

How Mast Climbers Work

The primary components of mast climbers are a vertical tower typically composed of modular stacked units resting on either a mobile chassis or stationary beams, a work platform that travels up and down the tower, and a drive unit that moves the platform up and down. Mast climbers use either a gas-powered hydraulic power system or an electric motor power system. Mast climbers can be further classified by the drive system, using either a ratcheting or rack-and-pinion drive.

Mast climbers are often used on buildings up to 60 feet tall, but some can reach as high as 1,000 feet.

Mast climbers may be designed and used with a single tower or twin towers. Some modules are designed to operate as free-standing units up to a manufacturer-specified height. Most mast climbers are structurally supported by an anchorage system made up of ties and anchor bolts attached to the building being worked on. Design of the anchorage system (which includes a specified spacing schedule) and use of the correct bolts and ties are thus extremely important to ensure the safety and integrity of a mast climber.

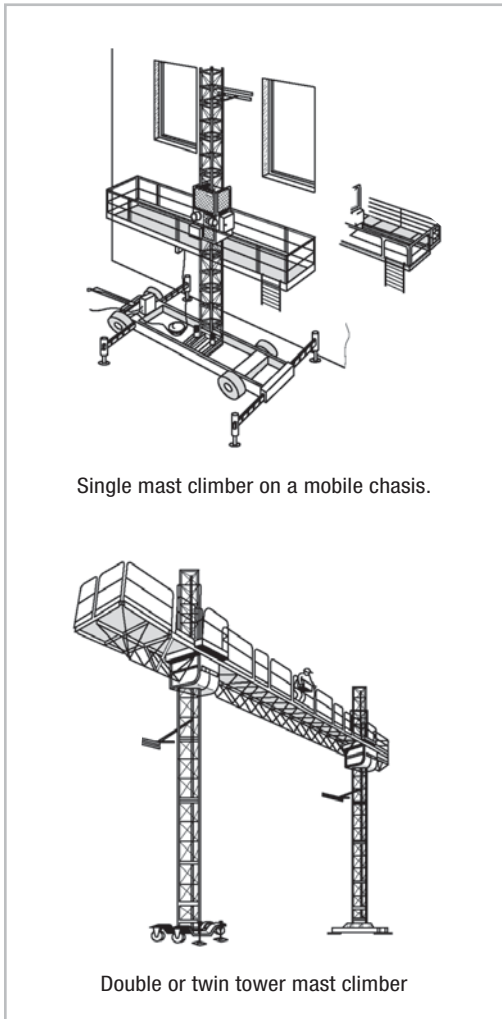
Typical Uses

Mast climbers are typically associated with high-rise construction, but they are used most often on structures up to 60 feet in height (Inglesby 2008). The heights at which mast climbers are used vary according to their specific application and type of system. Hydraulically-powered ratcheting drive systems are commonly used at lower heights, for masonry work. Rack-and-pinion systems, on the other hand, are typically used at elevations of 30 feet and higher and can go as high as 1,000 feet. These systems are commonly used for glazing and drywall applications. In addition to these applications, mast climbers are also used in architectural cladding and mechanical work (for instance, to mobilize and install heavy-duty steel pipe and duct work).

The Advantages

In a recent ergonomic survey of 42 masonry contractors who used mast climbers “sometimes, frequently or always,” nearly 70% cited increased productivity as the greatest advantage of this equipment. More than 60% said the mast climbers save time, and more than 50% viewed them as safer than other types of scaffolding. On the downside, over 70% of survey respondents said the greatest disadvantage was their cost (Hess et al. 2010).

As this survey suggests, mast climbers offer significant gains in productivity and convenience compared with other types of scaffolding. In addition to being quicker to erect and dismantle, they can be adjusted to position workers at the optimum location for performing their work quickly and precisely. This adjustability may yield substantial ergonomic benefits as well, reducing workers’ risk of musculoskeletal disorders, such as sprains, strains, and lower back injuries, which can result from awkward postures during lifting, material handling, and



Single mast climber on a mobile chasis.

Double or twin tower mast climber



Top: Multiple mast towers are often arranged with bridging to create a long, continuous scaffold platform across the face of a building as has been done in the picture above. **Middle Center:** Mast climber designs can be customized to accommodate building profiles. **Middle Right:** A mast climber tie – part of a larger anchorage system – should be designed by someone qualified in structural engineering. **Bottom:** Mast climbers resting on cantilevered platforms extend from this building. The base of support in such designs or when the scaffold is not built directly from the ground must be evaluated by a person qualified in structural engineering giving due consideration to all gravity and lateral loads (see Recommendations 2.1, 2.2, and 4.5).

when working on building faces. Mast climbers also have a very large load capacity, allowing vertical transfer of large loads and workers together on a single platform. The equipment can be customized to suit specific building profiles and project needs, and requires a smaller footprint than other forms of scaffolding. Given their large load capacity, high reach, flexibility, and relatively quick erection times, it is likely that the use of mast climbers will continue to grow well into the future.

The Hazards – and Their Roots

If erected and used correctly, mast climbers represent a powerful technology for the construction industry that is as safe as other forms of scaffolding. However, given the basic mechanics of their design, mast climbers may be less forgiving than other types of scaffolds if not correctly installed or operated. In particular, their ability to carry multiple workers as well as extremely large loads can lead to catastrophic loss

if operating instructions, such as weight-bearing and load distribution requirements, are not followed. According to one estimate, about seven or eight near misses associated with this equipment occur daily¹. However, precise rates of deaths and serious injuries are not available. Mast climber incidents are often categorized under the general heading “scaffolding” in OSHA incident reports, and information on the exact type of equipment involved in the incident is often not available.

In an effort to obtain a clearer understanding of the factors contributing to mast climber-related incidents and resulting injuries, a CPWR researcher and members of the CPWR workgroup reviewed OSHA sources and news reports describing such incidents. The research yielded documentation on 12 mast climber incidents that resulted in 18 deaths over the past 20 years, described in Table 1. The list is not intended to represent a complete compilation of mast climber incidents, but rather to illustrate the pattern of such incidents and the magnitude of the loss of life involved.

The most common contributing factors to the incidents in Table 1 are as follows:

- **Fall hazards** contributed to four incidents (for instance, unguarded ends or removed guards; climbing from the platform to a building opening; inadequate platform material or plank bearing) and four fatalities.
- **Loading issues** (overloaded platforms or use of inadequate bridging) contributed to three incidents and five fatalities.
- **Failure to use the correct mast climber components or faulty configuration** contributed to two incidents and four deaths.
- **Instability of the mast climber during dismantling** contributed to two incidents and four deaths.
- **Equipment failure** contributed to one incident and one death, when two mechanisms failed simultaneously.



A bird's eye view from the platform of a mast climber.

¹Personal communication with Kevin O'Shea, October 15, 2010

Table 1: Serious and Fatal Mast Climbing Work Platform Incidents and Contributing Factors²

Incident Site	Year	Outcome	Incident Details
Binghamton, NY	2010	4 injuries 1 seriously injured	platform fell 60 ft.; eye-witnesses say platform was over-loaded
Columbia, MO	2009	1 death: 53-yr-old Bricklayer	Mast climber equipment failure; two simultaneous failures of different mechanisms within seconds of each other caused platform to drop 2 stories
Austin, TX	2009	3 deaths: 27-, 28-, & 30-yr old workers; employed by framing & stucco contractor	2 workers fell more than 100 ft. (11-13 stories); 3rd worker fell a few stories to roof of 7-floor garage. Mast climber improperly erected; some parts and materials were sub-standard or below required grade for actual loads used
Ann Arbor, MI	2008	1 death: 32-yr-old Journeyman Bricklayer	40-ft. fall; worker stepped back off unguarded end; Michigan OSHA issued 3 willful citations; in 2010, state charged employer with a felony for violating MIOSHA regulations and causing the death of an employee
Boston, MA	2006	3 deaths: foreman and laborer employed by masonry contractor; 3rd victim was a doctor driving by job	14-story job; mast climber collapsed during dismantling; temporary support beams and loads on mast platform subjected to excess load stress and torsion (twisting) when last anchor was removed
Brick, NJ	2003	1 death	40-ft. fall; plank slid out from worker; not enough bearing under plank
Camden, NJ	2003	1 death 1 seriously injured Glaziers	Approximately 40-ft. fall; dismantling failure at level of 1st anchor; platform unstable; unbalanced load; mast climber was not stabilized when removing anchors
Philadelphia, PA	2003	1 death Glazier	85-ft. fall; bad bridging/improper modification and removal of guard rail; worker had no training on mast climbers
Pensacola, FL	1998	1 death 1 injured	60-ft. fall; contractor failed to use mechanism to prevent platform from traveling upward; platform kept rising and fell to the ground
Miami, FL	1995	3 deaths 2 injured	platform overloaded and configured in a manner inconsistent with its design; contractor did not follow manufacturer's load tables or OSHA safety factor; corrosion of components
Alma, MI	1992	2 deaths: Bricklayers	46-ft. fall; plywood bridging used for 4-ft. opening between platform and walls failed from weight of 2 masons and a beam
Virginia	1990	1 death	attempting to climb from platform into window opening (approx. 3-ft. reach); slipped off sill and fell 6 floors

²This table is not a complete list of serious and fatal mast climber incidents; rather it is a list of incidents for which the researchers were able to obtain some documentation. Incident details are based on published information (mostly news clips) and information provided in an unpublished report and in personal communication with Dr. Mohammad Ayub, Director, OSHA Office of Engineering, Directorate of Construction.

According to information from the Bureau of Labor Statistics (BLS) website and communication with OSHA, the trades experiencing the most fatalities involving mast climbers are masons, followed by plasterers and glaziers, with “others” as the fourth category (J. Lincoln, NIOSH, 7/21/10). A mast climber collapse also can pose a threat to public safety, as the 2006 Boston incident proved when a doctor was killed while driving by a collapsing platform. However, the greatest cost to human life and well-being is borne mostly by workers and their families. This point is made painfully clear by the mast climber collapse that killed three workers in Austin, Texas, in 2009. (See textbox below.)

Mast Climber Collapse Kills Three Workers in Austin, Texas

On June 10, 2009, three young men went to work at a high-rise construction project located at 21st and Rio Grande Streets in Austin. It would be the last day of their short lives. They died when the mast climber they were working on collapsed. Two workers fell more than 100 feet (11-13 stories) and the 3rd victim landed on the roof of a garage after falling several stories. Raudel Ramirez Camacho, 27, left



behind his wife and two young children at home in Mexico. Joel Irias Cerritos, 30, and Angel Lopez Perez, 28, both had family in Honduras depending on them for support.

OSHA issued more than 20 citations and nearly \$160,000 in fines to the four firms involved in the incident: the workers' employer, the firm that owned and installed the mast climber, the general contractor, and the exterior stucco sub-contractor. The alleged safety violations included:

- failing to develop and implement a safety and health program;
- not having the scaffolds designed by a qualified person and not constructing and loading according to that design;
- failing to provide a competent person to inspect the scaffold prior to use;
- lack of training on use of scaffolding systems; and
- failing to provide adequate fall protection.

The OSHA area director in Austin, Eric Harbin, said, “If scaffolding parts had been inspected and replaced or repaired as needed, it is possible that this tragic accident and loss of life could have been avoided” (OSHA News Release, 12/7/09).

Lack of training on the installation and use of this complex equipment is a critical factor in many mast climber incidents. The mechanics and methods of erecting, using, operating, and dismantling mast climbers are different from other scaffolding methods and require a great deal of expertise and skill. Moreover, mast climbers are relatively new to the construction industry, thus a large share of the workforce (both management and labor) is untrained and unfamiliar with their correct use and operation. Furthermore, mast climbers differ by model and manufacturer. Getting trained on the operation of one model does not guarantee that an operator will be able to safely run a different mast climber. Thus it is essential that users receive proper training on the specific equipment to be used at the work site.

Another safety concern is the communication gap between the mast climber manufacturer and the equipment's end users. Without effective lines of communication, critical safety warnings and operating updates may never reach the people who most need the information. Distributors, suppliers and lessors of mast climbers must find ways to stay current on equipment updates and ensure that this information is provided to mast climber end users, including workers responsible for equipment operation, maintenance and inspection. Manufacturers must also make sure that this information is relayed to those who buy, lease, or use their equipment.



Mast climbers scale the exterior of a Chicago high-rise. Note that multiple towers are in place with platforms positioned in varying locations depending on the stage of work.

Why Current Regulations are Inadequate

The OSHA regulation, 29 CFR 1926 *Subpart L- Scaffolds*, contains general requirements for mast climbers, including capacity, construction, access, loading, clearance from power lines, fall protection, and training. However, these requirements do not address the unique design and potential safety hazards of mast climbers. The appendix to Subpart L lists specific guidance and tables for 27 types of scaffolds, but does not include guidelines for mast climbers, with the exception of referencing the ANSI A92.9-1993 standard, Mast Climbing Work Platform. However, relying on this 1993 ANSI standard to ensure the safety of mast climbers raises several concerns:

- 1.** The ANSI A92.9-1993 standard is a “non-mandatory guideline” intended to assist employers in complying with the requirements of Subpart L (OSHA Publication 3150, 2002). An OSHA standard is needed that spells out legally enforceable requirements for mast climbers. (See Recommendations, page 9.)
- 2.** The ANSI A92.9-1993 standard is outdated. A new version is expected to be published in early 2011.
- 3.** The ANSI 92 standards are “design” standards, more relevant to those involved in the manufacture and design of scaffold systems with less content for on-site end users.

During an OSHA Advisory Committee on Construction Safety and Health public meeting on May 15, 2008, Dr. Mohammad Ayub, the Director of the Office of Engineering in the OSHA Directorate of Construction, acknowledged that OSHA standards do not adequately address mast climbers. Dr. Ayub also noted that the ANSI A92.9 standard is primarily a design standard, and therefore does not fill the existing regulatory void (ACCSH

Meeting, May 15, 2008). **Nonetheless, the upcoming revision of the ANSI mast climber standard is an important resource for the construction industry and, at a minimum, OSHA should update its scaffold standard to reference the latest version. Publication of the revised ANSI A92.9 standard is scheduled for early 2011.**

Other countries have begun to enact regulations that specifically address the hazards of mast climbers. For instance, in 2002 the United Kingdom (UK) enacted BS 7981:2002, a standard enforced by the Health and Safety Executive, the UK equivalent to OSHA. The standard sets out requirements for training and safe use of mast climbers. Although based on a small sample size, a study by the International Powered Access Federation (IPAF) showed a steep drop in dangerous occurrences associated with mast climbers in the UK following passage of the standard. Dangerous occurrences went down from a peak of four incidents in 2000 to no incidents during the last three years for which data are available (2005-2007). Given the small sample size, the findings are not conclusive, but the results nonetheless suggest that regulations aimed specifically at mast climbers can help prevent serious injuries and deaths resulting from their use.

The Canadian province of Quebec also has regulations governing construction including mast climbers. Before work may begin, employers must send to the labor commission all plans related to installation and disassembly of any mast climber that must be anchored to a building. The plans must be signed and sealed by an engineer.

A poorly trained workforce, lack of relevant regulations, and the growing use of mast climbers sets the stage for more catastrophic – but entirely preventable – incidents.

this equipment sets the stage for more catastrophic – but entirely preventable – mast climber incidents. Recognizing the urgent need to prevent such incidents, CPWR convened the Work Group on Mast Climbing Work Platforms, whose recommendations are provided in the next section.



Use of twin masts on the Saint John Harbor Bridge Pier in Saint John, New Brunswick, Canada, illustrates the flexibility and small footprint of mast climbers. Photo courtesy of Klimer Manufacturing, Inc.

According to the standard, mast climbers must be erected in conformity with the engineer's plans and each hoisting system must be equipped with a plate stating maximum loads. The standard also requires that workers who use this equipment must be trained to identify and prevent hazards associated with erection, dismantling, and use of the scaffolding and to work on the platform safely (<http://www.csst.qc.ca>).

The convergence of a poorly trained workforce, a lack of relevant safety regulations, and the growing use of

Recommendations for the Safe Use of Mast Climbing Work Platforms (Mast Climbers)

Prepared by the CPWR Work Group on Mast Climbing Work Platforms

These recommendations are the result of a four-year process of analysis, discussion, needs assessment, and consensus-generated conclusions drawn from a work group of mast climber manufacturers, contractor and labor representatives, and individuals from OSHA and the National Institute for Occupational Safety and Health (NIOSH). (See listing of work group participants on page i.) All shared the common goal of preventing deaths and injuries associated with the use of mast climbers. CPWR assembled the group and tasked it with examining problems and discussing solutions to improve the safe operation of this important equipment increasingly used by contractors.

These five recommendations and supporting information are intended for use by federal and state agencies, such as OSHA and their affiliated state plans, those responsible for specifying and contracting work that involves mast climbers, as well as training providers. In addition to providing practical guidance, the recommendations are intended to serve as model language for regulations and specifications.

1. Institute New Training Programs and Qualifications for Training Providers

Existing training programs for mast climbing work platforms (mast climbers) fall into one of the following three categories: a) employer/industry sponsored; b) union sponsored; or c) manufacturer programs. However, there is general agreement that training for mast climbers use is sorely lacking in the U.S.

OSHA requires initial and refresher training for scaffold users (29 CFR 1926.454), but the standard does not specify minimum training hours required for various disciplines.

Recommendations:

1.1 An awareness-level user/employee course of a minimum of four (4) hours duration shall be required for anyone using, working on, or operating mast climbers. Such training programs shall include the following:

- OSHA Subpart L: Scaffolds (or have as a prerequisite)
- Role of user and limitations of an awareness-level course
- Mast climber configuration, operation and safe use of mechanical equipment
- Case studies of accidents that have occurred and contributing factors
- What to look for before getting on the scaffold (major hazards, job hazard analysis and hazard control):
 - Corrosion
 - Removal of tie-offs
 - Over-loading
 - Inadequate base support
 - Insufficient anchorage
 - Path of travel obstructions
 - Removal of planking and guard rails
 - Safe access and egress
 - Electrical hazards

-
- Structural components/scaffolding connections
 - Fall hazards (including spacing between platform and wall)
 - Wind and enclosures
 - Trouble-shooting
 - Refer to manufacturer information
 - Whom to contact – employer first, then OSHA if the employer fails to correct safety problems
 - What your employer should be doing: safety programs & resources
 - Written programs
 - Implementation of safety and health programs
 - Manufacturer documentation (where to find)
 - Job hazard analysis
 - Competent person
 - Daily and weekly inspections
 - Fall protection
 - Emergency Procedures

NOTE: Appendix A contains a detailed outline for a model 4-hour awareness/user training program.

1.2 An erector/dismantler course of a minimum of 16 hours duration (or 12 hours with 4 hours user class) shall be required for anyone responsible for erecting or dismantling mast climbing work platforms; the course shall include a combination of hands-on or on-site and classroom training. Topics covered in the user course and Subpart L should be included in the 16 hours of training if not required as pre-requisites.

Topics/modules of the erector/dismantler course shall include:

- Role of erector/dismantler and limitations of the course
- How to build and dismantle mast climbers
- Hands-on training with equipment
- Selection of anchorage and proper anchoring³
- How to tighten and verify tightness of bolts connecting mast tower sections
- Torque testing
- Resisting anchor forces and tying into structures
- An emphasis on removal of ties including procedures for not removing the last tie until you look at the tie schedule and the structural stability of the unit is determined
- Being aware of and understanding risk assessments to be conducted by the employer and routine safety procedures
- Conducting daily and weekly inspections
- Types of job sites that may use powered mast-climbing scaffolds
- Companies that manufacture powered mast-climbing scaffolds in North America
- How each of the scaffold components are used on powered mast-climbing scaffolding

³Course curricula should include written documentation of the types of anchorage that are available, perhaps as an appendix.

-
- Reasons for having a firm foundation for a powered mast-climbing scaffold unit
 - The steps for erecting powered scaffold according to safe guidelines and the manufacturers operating manual
 - How to safely dismantle powered mast-climbing scaffolds

1.3 Site- and model- specific training involving the equipment in use on the job shall be required in addition to the training requirements listed above.

1.4 Refresher training, for both the user and erector/dismantler course, which, at a minimum, meets OSHA standard 29 CFR 1926.454(c), shall be required as follows:

- Every 3 years unless a qualified instructor in the discipline in question certifies refresher training is not required; or
- When the employer has reason to believe that an employee lacks the skill or understanding needed for safe work involving the erection, use or dismantling of scaffolds, the employer shall retrain each such employee so that the requisite proficiency is regained. Retraining is required in at least the following situations:
 - Where changes at the worksite present a hazard about which an employee has not been previously trained; or
 - Where changes in the types of scaffolds, fall protection, falling object protection, or other equipment present a hazard about which an employee has not been previously trained; or
 - Where inadequacies in an affected employee's work involving scaffolds indicate that the employee has not retained the requisite proficiency.

1.5 Instructor Qualifications

- **User Awareness Course.** Instructors shall have completed an OSHA 500 course and have at least one mast climber manufacturer user certification or work experience with mast climbers.
- **Erector Dismantler Course.** Instructors shall have completed an OSHA 500 course, at least one manufacturer certification for erection/dismantling and at least five years, or equivalent, of documented work experience in mast climber erection, dismantling and operation).
- **Training Assessments.** Successful completion of training courses shall be contingent on: a) a written exam with a defined passing score, and b) a performance exam.

2. Adopt Engineering and Administrative Controls

Work group participants described several common factors that have led or could lead to mast climber incidents, including:

- Corrosion of scaffold components
- Removal of the last tie-off resulting in the scaffold tipping over
- Over-loading or unbalanced loading of platform
- Inadequate base support
- Insufficient anchorage
- Path of travel is interrupted by immovable objects
- Removal of planking, guard rails and excessive gaps between the building and work platform

Recommendations:

2.1 If the scaffold is supported on a cantilevered base or on frames not furnished by the manufacturer, or when the support conditions of the scaffold differ substantially from the manufacturer's recommendations, the base support shall be evaluated and approved by a person qualified in structural engineering with due considerations of all gravity and lateral loads. Special considerations should be made when the scaffold is enclosed by tarps.

2.2 Where floor slabs are being shored, floors should be treated as having no load bearing capacity, and shoring shall be sufficient to hold the load, taking into account the ability of the slab to resist the compression forces applied. If the scaffold is placed on suspended floors (not slab on grade) or roofs requiring additional structural supports underneath, a person qualified in structural engineering shall determine the extent and type of support needed considering all loads including live, impact, and lateral loads, and prepare drawings showing the additional supports needed. Such drawings shall be provided to the superintendent and the installation supervisor.

2.3 Anchorage systems (including anchors, ties, connectors, fasteners and the structural substrate to which anchors are connected), shall be designed to support all gravity and lateral loads required for each scaffold under individual conditions of the site. The anchorage system shall be designed by a person qualified in structural engineering with due consideration given to the capacity, embedment length, minimum edge distance, spacing between the anchors and factor of safety. The qualified person shall provide details of the anchor in written instructions including required torque or any tests, as specified by the manufacturer.

2.4 The practice of tying into brick or timber is prohibited unless approved on a case-by-case basis by a structural engineer or designed in conjunction with a representative of the mast climber manufacturer, who is qualified to give such engineering design opinions.

2.5 Load tables (specific to each machine configuration) provided by the manufacturer (or the equipment provider) must be available on site and understood by everyone operating or using mast climbers. Tables shall be presented in a measurement system and communicated to users in a language they understand.

2.6 Tarps, wind screens or signage use shall be designed to withstand wind loads and shall be authorized by the manufacturer for each configuration. Weather enclosures (e.g. as used in colder climates) shall be designed by the manufacturer.

2.7 Wind speeds shall be monitored and work stopped at speeds that meet or exceed those recommended by the manufacturer during erection, dismantling and use of mast climbers. Where wind speeds are not designated by the manufacturer, work shall be stopped when wind speeds exceed 30 miles per hour. Under high winds, exceeding the recommended conditions, machine platforms shall be lowered and secured at the lowest possible point, following the manufacturer's procedures.

2.8 Scaffold and scaffold components must be inspected for visible defects (including corrosion) before the start of every shift and after any occurrence which could affect a scaffold's structural integrity.

2.9 A written preventive maintenance program shall be provided by the mast climber manufacturer; the owner/leasee of a mast climber shall ensure that the maintenance program is implemented following the manufacturer's guidelines and based on the conditions and use of the mast climber. Regular maintenance shall be carried out by a qualified person. Any malfunctions or deficiencies noted during inspections or maintenance shall be documented and corrected before the mast climber is put back into service.⁴

⁴Consult the latest version of ANSI A92.9 for additional maintenance requirements.

2.10 Spaces between the edge of the scaffold plank and the wall or working surface of the building shall not exceed 7 inches unless necessary for specific operations such as plastering. Where spacing exceeds 7 inches, a job hazard analysis to prevent falls, over-exertion and pinch hazards shall be conducted by an employer representative;

2.11 Access and egress to the mast climber from a building opening will be permitted only if the following conditions are met:

- Employees are not exposed to fall hazards from unguarded openings;
- Adequate fall protection for scaffold users is determined by a competent person for gaps over 8 inches;
- A reasonable effort is made to achieve level access and egress when stepping into or out of building openings (e.g., windows) onto the platform. Where level access and egress is not feasible, any vertical distance greater than 15 inches has a safe method of access and egress; and
- Non-slippery access and egress working surfaces are maintained before and during scaffold use.

2.12 Vertical climbs of any height shall be assessed using a Job Hazard Analysis (JHA)⁵. A lock-out/tag-out procedure to be followed whenever anyone is climbing the tower shall be included in the JHA. In addition, mast platforms must be lowered or safe access/egress provided to work platforms to prevent vertical climbs greater than 20 feet. In cases where mast scaffold towers are considered acceptable access structures as defined by OSHA⁶ and equipment and/or site conditions make lowering the platform infeasible, a written method for safely accessing mast climbers shall be in place before climbing is permitted. Where climbing is permitted above 20 feet, rest platforms shall be provided every 20 feet.

2.13 Fall protection, including self-retracting life-lines and body harnesses, shall be provided for climbing heights over 10 feet.

3. Define Responsibilities of Manufacturers, Suppliers, Distributors, Users and Owners

3.1 Manufacturers' operating instructions and required training on the proper use and operation of the mast climber shall be provided upon each delivery by sale, lease or rental.

3.2 Owners and users of mast climbers must stay current on manufacturer **equipment updates** and maintain copies of such updates for review by personnel responsible for maintenance and inspection. **Manufacturers** shall have such information readily available through websites and customer service.

3.3 Suppliers and distributors must make mast climber users aware of any necessary updates.

3.4 Operators and users of mast climbers shall be aware of and have access to operating and safety manuals in a language that they can understand. Written safe operating procedures shall be communicated to all users of mast climbers and readily available at all times.

⁵A job hazard analysis is a technique that focuses on job tasks as a way to identify hazards before they occur. It focuses on the relationship between the worker, the task, the tools, and the work environment. Ideally, after you identify uncontrolled hazards, you will take steps to eliminate or reduce them to an acceptable risk level. ([www.OSHA.GOV/publications/OSHA 3071.HTML](http://www.OSHA.GOV/publications/OSHA%203071.HTML), 2002 (revised)).

⁶See 29 CFR 1926.451(e) and letter of interpretation to Mr. Justin Breithaupt from Russell B. Swanson on March 14, 2002; http://www.osha.gov/pls/oshaweb/owa-disp.show_document?p_table=INTERPRETATIONS&p_id=24466 (accessed October 18, 2010).

4. Determine Specific Qualifications and Roles of All Involved Parties to Improve Site Safety and Oversight

4.1 Site owners or designees (project managers or general contractors) shall be responsible for the structural integrity of mast climbers in use on their job sites.

4.2 Site safety personnel designated by the employer to supervise access and operation of a mast climber and conduct inspections of mast climbers shall be qualified by experience and training or education to carry out assigned duties; shall have authority to stop work and take corrective action if necessary and shall be present at the point of use.

4.3 A Job Hazard Analysis of each mast climber shall be prepared prior to erection.

4.4 There must be at least 2 people per mast climber platform present at all times.

4.5 A person qualified in structural engineering must approve the mast climber design in the following circumstances:

- When the scaffold is cantilevered or lacks a substantial base or has not been designed by the manufacturer; or
- When the scaffold is not built directly from the ground (e.g. supported by a suspended floor, platform or roof system), to ensure the support structure can support the intended load and that it meets OSHA's required safety factor; or
- When imbedded anchorage systems are used. A written standard operating procedure detailing how to secure anchorage shall be prepared by the qualified person and followed by the scaffold erectors. (See 2.3)

4.6 One person, to be designated by the user/contractor, shall have overall control of each mast climber set-up in use.

4.7 A jobsite inspection and maintenance schedule shall be established and followed throughout the course of mast climber erection, use and dismantling. This schedule shall include removal criteria for all worn or damaged scaffold components.

4.8 The operator or users of mast climber shall immediately report any potential hazards to the individual able to recognize mast climber hazards and with the authority to correct identified hazards.

4.9 Compliance with safety procedures and manufacturers' recommendations in place to prevent hazards associated with mast climbers shall supersede concerns related to productivity by top-line site supervision down, where concerns about safety and productivity conflict.

5. Act on Regulatory and Consensus Standards

5.1 OSHA standards are inadequate in addressing mast climbers and should be strengthened in accordance with the above recommendations.

5.2 ANSI standard A92.9-1993 should be modified to include any of the above recommendations that are not currently contained in the standard. Specifically, ANSI should adopt the above recommendations that relate to:

- Training
- Access to mast climbers, including fall protection for climbs over 10 feet
- Site safety personnel and over-sight
- Engineering controls

Definitions

ANSI – American National Standards Institute

Competent person – One who is capable through training and experience of identifying existing and predictable hazards in the surroundings or working conditions that are unsanitary, hazardous or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them. (OSHA, 29 CFR 1926.450 (b))

Erector/Dismantler. Person(s) responsible for installation, including erection, modification and dismantling of mast climbers.

Job Hazard Analysis – An analysis of the hazards within a particular job which focuses on methods used, through the use of various techniques and hazard abatement tools such as engineering controls, to prevent any aspect of a task that could result in injury or illness to an individual.

Operator – A person or entity qualified to control movement of the mast climbing work platform

Qualified person – One who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training, and experience, has successfully demonstrated his ability to solve or resolve problems relating to the subject matter, the work or the project. (OSHA, 29 CFR 1926.450 (b))

Shall – Mandatory

Should – Recommended

User – A person(s) or entity that is on, utilizes or works from a mast climbing work platform.

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Appendix A

Suggested Training Content for Four (4) hour Awareness Level Training

A. Teaching and Testing Methods

Instructors should use a combination of teaching methods including lecture and presentations with audio visual material, hands-on demonstrations, group discussions, and small group activities when teaching this course. Students must complete both a written exam and a hands-on practical exam. The hands-on practical exam should be scored using a check-list method with the following ratings:

- 1) Understands the material
- 2) Needs further supervision to understand the material
- 3) Cannot demonstrate an understanding – needs further training

The written exam should include questions covering all of the course topics. The practical exam should include activities representative of the skills and knowledge presented for Topics 6, 8, 9, 11, 16, 17 and 18.

B. Training Topics, Need to Know Information, and Suggested Time Frames

1) Scope and Limitations of Course

Suggested Time Frame: 15 minutes

NEED TO KNOW:

- This course does not train you to operate a mast scaffold.
- It is your employer's responsibility to train you on use of the specific mast scaffold you are asked to work on.
- This course is not intended to replace site and equipment specific (manufacturer and model) training which should be provided to you on the job whenever using a new make or model of mast scaffold or when beginning work on a new site.
- This course is not intended to replace OSHA 10-hour training.
- This course does not teach you how to erect or dismantle a mast scaffold.
- This course is intended to teach you the general principles of safe use of mast climbing work platforms.
- All machine types/models have different capacities and being trained in one model does not make you qualified to operate or use another model.

2) Training Disciplines, Frequencies and Durations

Suggested Time Frame: 15 minutes

NEED TO KNOW:

- OSHA requires that your employer provide you with training from a person qualified in the appropriate subject matter to be able to recognize and prevent hazards associated with any scaffold system you are asked to use.
- OSHA doesn't specify the duration of that training.

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- CPWR-The Center for Construction Research and Training, a non-profit organization affiliated with the Building and Construction Trades Department, AFL-CIO, recommends the following minimum training for use, erection and dismantling of mast climbing work platforms (MCWPs):
 - An **awareness level user/worker course** of a minimum of 4 hours duration for anyone using or operating MCWPs (which is this course);
 - An **erector/dismantler course** of a minimum of 16 hours duration (or 12 hours with a 4 hours user/awareness class) for anyone responsible for erecting or dismantling MCWPs; the course should include a combination of hands-on, or on-site, and classroom training;
 - **Site- and model- specific training** involving the equipment in use on the job *in addition* to the training requirements listed above. (This training should be offered by your employer);
 - **Refresher training, for both the user and erector/dismantler**
 - Every 3 years unless a qualified instructor in the discipline in question certifies refresher training is not required; or
 - When the employer has reason to believe that an employee lacks the skill or understanding needed for safe work involving the erection, use or dismantling of scaffolds; and
 - In the following situations: Where changes at the worksite present a hazard about which an employee has not been previously trained; Where changes in the types of scaffolds, fall protection, falling object protection or other equipment present a hazard about which an employee has not been previously trained.

3) Regulations and Recommendations

Suggested Time Frame: 5 minutes

NEED TO KNOW:

- OSHA has scaffold standards that your employer is required to follow by law.
- OSHA regulations may be enforced by the Federal government or by the state if you are in an OSHA “State Plan” state.
- CPWR has published recommendations for safe use of mast scaffolds.
- ANSI, the American National Standards Institute, is a national organization that publishes voluntary consensus standards. ANSI also has a standard which defines responsibilities of users, manufacturers and contractors. This standard – A92.9 is specific to mast scaffolds.
- The OSHA General Duty Clause requires employers to provide a “place of employment ...free from recognized hazards that are likely to cause death or serious physical harm to his employees”. OSHA may sometimes cite an employer for not using an ANSI standard in conjunction with the General Duty Clause if compliance with the ANSI standard could have prevented or lessened the the severity of an injury.
- MCWP users and trainers should be aware of any state or local regulations that may exceed OSHA requirements.

4) MCWP History & Development of Equipment

Suggested Time Frame: 10 minutes

NEED TO KNOW:

- MCWPs were introduced in Europe as early as the late 1950s, but did not receive much use there until the late 1970s.

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- MCWPS began to be used in the US in the 1980s with use increasing from the 1990s to the present.
 - MCWPs are relatively new to the US, and although beneficial in many respects, several accidents resulting in multiple fatalities have occurred.

5) Manufacturers, Uses & Applications

Suggested Time Frame: 10 minutes

NEED TO KNOW:

- Manufacturers of most common MCWPs and manufacturers of equipment they are asked to use.
- There are different models made by the same manufacturer and this will affect correct and safe use.
- Manufacturer contact information should be on site and readily available.
- Manufacturers are available and should be consulted whenever needed or a question arises.
- The employer should be in communication with the dealer, supplier and/or manufacturer.
- If questions arise, consult the manufacturer's manual, utilize the employer chain of communication, or contact the manufacturer directly if necessary.
- MCWPs are used by a number of trades including bricklayers, glaziers, plasterers, sheet metal workers, and carpenters.
- Other trades, such as laborers, are involved in erection and dismantling, particularly in masonry applications.

6) Types and Components of MCWPs

Suggested Time Frame: 10 minutes

NEED TO KNOW:

- Main types of MCWPs used
 - rack and pinion
 - hydraulic
- About enclosed platforms
 - when it is enclosed
 - when it is not enclosed
- That MCWPs are designed to position personnel, their tools and materials to a desired elevation necessary to perform work; they are not intended for use as hoists
- About extension slides and planking
 - extending/retracting
 - load information
 - assembly
 - condition of planking
- Weather canopies/roofs/signs
 - how stability is affected
 - visibility issues

-
- How to identify and describe components including the ground frame, wheels or casters, buffers, leveling jacks, mast sections, platform modules, platform extensions, the drive unit, mast guard, control panel, tie assembly, handrails/guardrails, access gate, access steps, and top mast.
 - Types of Configurations
 - single mast
 - twin mast
 - multiple mast
 - two drives on one mast

7) Common Contributors to Accidents/Case Study⁷

Suggested Time Frame: 20 minutes

NEED TO KNOW:

The following may contribute to or may cause accidents involving MCWPs:

- Removal of tie-ins
- Overloading or unbalanced loading
- Inadequate base support or cribbing
- Insufficient anchorage
- Path of travel obstructions
- Removal of planking and/or guardrails
- Access and egress problems
- Electrical hazards
- Corrosion or failure of structural components/scaffolding connections
- Not utilizing qualified engineering services
- Fall hazard spacing between the building structure and the MCWP
- Wind/enclosures
- Improper erection
- Improper dismantling procedures
- No operators instructional manual
- Maintenance deficiencies
- No competent person at site/on machine
- Falling objects
- No guardrails
- No personal fall arrest system (PFAS) utilized
- Lack of lateral anchorage at regular intervals to provide stability
- Not adhering to load table requirements
- Pinch points (e.g. between building structure and MCWP)
- Planking/decking deficiencies (improper spacing, failure to secure)

⁷ See Case Study at the end of this document

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- Improper load and force calculations
 - Modifications to MCWP design or in place set-up
 - Failure to secure the work area surrounding the MCWP
 - Special configurations/applications (such as incline or asymmetric)
 - Fire hazards
 - Power cord entanglement
 - Misuse (e.g. using the MCWP as a crane or personnel hoist)
 - Equipment failure
 - Incorrect installation of MCWP components
 - Environmental conditions
 - Inadequate training
 - Failure to regularly inspect equipment
 - Poor or lack of communication

8) Fall Hazards

Suggested Time Frame: 15 minutes

NEED TO KNOW:

- The safe and proper access and egress from a building to the work platform⁸
- Guardrails should not be removed
- Safe distances between buildings and platforms based on both OSHA regulations and recommended practice
- Distance between planking should be no greater than 1"
- How to identify improperly constructed outrigger/work platforms
- CPWR recommends the following with regard to vertical climbs:
 - Vertical climbs should be assessed using a Job Hazard Analysis.
 - MCWPs should be lowered or safe access provided to prevent vertical climbs of greater than 20'.
 - Fall protection should be provided for climbs over 10'.

9) Fire Safety

Suggested Time Frame: 5 minutes

NEED TO KNOW:

- There are flammable, combustible and electrical fire hazards.
- OSHA 29 CFR 1926.150 thru .155 address fire protection and prevention
 - 1926.150 – Fire protection

⁸ CPWR recommends access and egress to the MCWPs from a building opening should only be permitted if the following conditions are met:

- Employees are not exposed to fall hazards from unguarded openings.
- Space between the scaffold and building is not more than 7 inches unless necessary for specific operations such as plastering. Where spacing exceeds 7 inches, a job hazard analysis to prevent falls, over-exertion and pinch hazards shall be conducted by the employer representative.
- Adequate fall protection for scaffold users is determined by a competent person for gaps over 8 inches.
- A reasonable effort is made to achieve level access and egress when stepping into or out of building openings (e.g windows) onto the platform. Where level access and egress is not feasible, any vertical distance greater than 15 inches has a safe method of access and egress.
- Non-slippery access and egress working surfaces are maintained before and during scaffold use.

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- 1926.151 – Fire prevention
 - 1926.152 – Flammable and combustible liquids
 - 1926.153 – LP Gas
 - 1926.154 – Temporary heating devices
 - 1926.155 – Definitions
- Employers should have a fire protection program in place which includes use of an all-purpose fire extinguisher at all times.
 - How to use a fire extinguisher

10) System Lock-Out and Caught Between

Suggested Time Frame: 5 minutes

NEED TO KNOW:

- OSHA requires that all nip/pinch points and moving parts be guarded from contact.
- Access to the area below the footprint of platform should be prohibited.
- Users should be familiar with manufacturer specifications for system lock-out.

11) Electrical Hazards

Suggested Time Frame: 5 minutes

NEED TO KNOW:

- It should be assumed that all overhead wires are energized at lethal voltages. Never assume that a wire is safe to touch even if it is down or appears to be insulated.
- A safe minimum distances from power lines is 10 feet for 50 volts or less and an additional 4/10 of an inch in addition to 10 feet for every 1 kilovolt over 50.
- Non-conductive wood or fiberglass ladders should be used when working near power lines.
- Never repair electrical cords or equipment unless qualified and authorized.
- Inspect electric cords and equipment to ensure that they are in good condition and free of defects, and use a ground-fault circuit interrupter (GFCI).
- Extension cords shall be kept in a manner as not to create a hazard to employees.
- No employer shall permit an employee to work in such proximity to any part of an electric power circuit that the employee could contact the electric power circuit in the course of work, unless the employee is protected against electric shock by de-energizing the circuit and grounding it or by guarding it effectively by insulation or other means.
- The contractor should ensure that only qualified persons shall change or charge batteries.
- Safety precautions should be known and used when arc welding.

SAMPLE CASE STUDY: Scaffold Too Close To Power Line

Seven employees of a masonry company were erecting a brick wall from a tubular, welded-frame scaffold approximately 24 feet high. The scaffold had been constructed only 21 horizontal inches across from a 7,620-volt power line. A laborer carried a piece of wire reinforcement (10 feet long by 8 inches wide) along the top section of the scaffold and contacted the power line with it. The laborer, who was wearing leather gloves, received an electric shock and dropped the wire reinforcement, which fell across the power line and

simultaneously contacted the metal rail of the scaffold, energizing the entire scaffold. A 20-year-old bricklayer standing on the work platform in contact with the main scaffold was electrocuted.

12) Role of Engineer, Contractor, Manufacturers and Distributors

Suggested Time Frame: 15 minutes

NEED TO KNOW:

Engineers

- An engineer should be involved in plans that govern the following:
 - the layout and design of MCWPs (e.g. where it is seated/orientation);
 - how the MCWP should be supported (footings and anchorage); and
 - the load carrying capacity of each end of the platform for both uniform loads (distributed equally on each side of the platform) or loads concentrated in a single area.

It is common for manufacturers of MCWP systems to have in their employ engineers who have established detailed design plans of the more typical configurations for the above items. As such, the manufacturer or installer may have previous engineering specifications available regarding those portions of the MCWP design plan. If in doubt of a configuration, or such design specifications are not available through consultation with the MCWP manufacturer, additional engineering to ensure safe design and use of the MCWP system is required.

If the scaffold is supported on a cantilevered base or on frames not furnished by the manufacturer, or when the support conditions of the scaffold differ substantially from the manufacture's recommendations, the base support should be evaluated and approved by a person qualified in structural engineering with due consideration of all gravity and lateral loads. Special considerations should be made when the scaffold is enclosed by tarps.

Employers/Contractors

- Employers have a general duty to provide employees with a safe worksite.
- The employer must erect, secure and load MCWPs in a method that conforms to design plans provided by the manufacturer and/or engineer.
- The employer is responsible for assigning a competent person who has the knowledge and authority to recognize and abate hazards associated with mast scaffold use.
- The employer is responsible for providing site specific training on the specific make and model of the MCWP in use on the job.
- The employer is responsible for ensuring that persons erecting and dismantling MCWPs are qualified and approved for that task.
- The employer should coordinate with the manufacturer representative and site safety personnel to conduct initial and regular inspections of the MCWP.
- The employer is responsible for ongoing safety training.
- The employer is responsible for having the MCWP operating manual on site where personnel responsible for safe use of MCWP can easily and readily locate and access.
- The employer is responsible for maintenance of records.
- The employer should make sure users don't place materials on outriggers, which are not designed to carry loads, and that they don't extend an outrigger too far.

13) Job Hazard Analysis

Suggested Time Frame: 15 minutes

NEED TO KNOW:

- A Job Hazard Analysis (JHA) is a technique used to identify potential hazards associated with specific tasks.
- OSHA has materials that walk you through how to do a JHA and provides sample forms to use when doing a JHA. (Instructors should be provided with a copy of OSHA Publication 3071, 2002 revised.)
- JHA's should be manufacturer and model specific.
- The main questions to consider when doing a JHA are:
 1. What can go wrong?
 2. What are the consequences?
 3. How could it happen?
 4. What are other contributing factors?
 5. How likely is it that the hazard will occur?
 6. How can the hazard be prevented or abated?
- For a JHA to be effective, the employer must follow up on any identified hazards by taking measures to prevent or correct them.
- A good JHA includes employee involvement.
- Someone qualified to identify mast climber hazards should be involved in a JHA.

14) Ground Conditions

Suggested Time Frame: 5 minutes

NEED TO KNOW:

- What affects stability
- Recording results
- When/how to inspect
- The employer is responsible for designating a person to check adequacy of cribbing each day.

15) Environmental/Weather Conditions

Suggested Time Frame: 20 minutes

NEED TO KNOW:

- Environmental conditions need to be considered when designing, erecting and using a MCWP.
- Tarps, wind screens, signage, and weather enclosures should be designed to withstand wind loads.
- Wind speeds should be monitored and work stopped when winds get too strong.
- Your employers should monitor wind speeds under windy conditions and establish a designated wind speed at which to stop work with MCWPs and lower and secure the platform at the lowest possible point.
- The employer should refer to the manufacture's recommendations in setting designated wind speeds for lowering the MCWP and stopping work when erecting, dismantling or using them.

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- CPWR recommends that when wind speeds are not designated by the MCWP manufacturer, work should be stopped and platforms lowered when wind speeds exceed 30 miles per hour (mph).
 - Rain and ice can create slippery conditions on platforms and equipment used to access platforms.
 - Your employers or the individual responsible for control of the MCWP should ensure that working surfaces and access and egress surfaces (ladders, etc) are treated to prevent slip and fall hazards.

16) Anchoring & Anchorage Methods

Suggested Time Frame: 20 minutes

NEED TO KNOW:

- About anchoring
 - How to assess the anchor type required
 - Anchor installation
 - Anchor inspection/testing
 - That each MCWP make/model has a different tie-off schedule
 - Before anyone uses, accesses or operates a MCWP, the employer's competent person must verify that tie-offs are consistent with that schedule.
- Anchor Installation
 - Embedment depth
 - Clean-out
 - Where to put them
 - Torque
- Methods for anchorage and tie-ins
 - The definition of a mast tie according to ANSI
 - The importance of MCWP stability
 - Component recognition
- Tying to the structure
 - Impact of shallow holes
 - Impact of spacing
 - Impact of being close to the slab edge
 - Impact of high/low torque
 - Impact of anchor selection
 - Assessing platform loads
 - Ties may be removed by other trades and not replaced correctly
 - Ties can become loose

Additional Instructor Notes:

Objectives:

- Realization that improper anchorage (systems) has led to catastrophic failures and fatalities
- Importance of utilizing an engineer for anchoring criteria

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- That anchorage systems can be complex, and sound engineering principles are required
 - Discuss/demonstrate the loads forces that MCWPs may be subject to: structural, horizontal, manual, power tool usage, dynamic, wind load, erection and dismantling loads
 - Show a few “unusual” or “unique” slides to depict the importance of correct anchorages (multi or twin deck, large spans, base support such as parking garage, etc.)

Power Point presentation may incorporate slides depicting:

- A captive and attached tie frame
- Several systems that are not acceptable
- Different tie frame positions
- Edge distance
- Minimum embedment
- Tie-in terminology
- Spacing requirements
- Manufacturer’s tie schedule
- Manufacturer’s “professional” anchorage drawing/detail
- Torque considerations

Instructor should also:

- Hand out a structural calculation – to depict that users are not engineers and what goes into design of an anchorage system
- Display/hand out fasteners that are not rated for tie-in purposes
- Discuss type of structural attachment: steel, concrete, scaffold
- Discuss the possible consequences of tying into brick, block, and timber
- Display/demonstrate methods of attachment: welding, screwed, bolted, clamped, etc

17) Limitations/Loading

Suggested Time Frame: 20 minutes

NEED TO KNOW:

- About Calculation of Load/Distribution/ Installation Method
 - Impact of shallow holes
 - Impact of distance between
 - Impact of high/low torque
 - Impact of anchor selection
 - Assessing platform loads
- Load distribution
- Where to load materials
- Bridging between towers is model/equipment specific and should be determined in consultation with the manufacturer

18) Maintenance, Inspection & Storage

Suggested Time Frame: 15 minutes

NEED TO KNOW:

- Inspections
 - When and how to inspect MCWPs
 - Necessity of recording inspection results
- Maintenance
 - What is required
 - What parts fail most often
 - Lubrication chart
 - How to record results
- Daily Inspections
 - What to inspect
 - What to look for
 - How to record
 - What to do if something is found
- Storage
 - All maintenance and inspection records for each MCWP should be safely stored.
 - Operating and safety instructions should be stored on the machine.
 - Users need to know where and how to access the operating and safety instructions as well as the last thorough inspection record.

19) OSHA 1926.454, Scaffold Training Standards

Suggested Time Frame: 15 minutes

NEED TO KNOW:

1926.454 (a) - Users

- Requires that employers have **each employee who performs work while on a scaffold trained by a person qualified** in the subject matter to recognize the hazards associated with the type of scaffold being used and to understand the procedures to control or minimize those hazards;
- Requires that affected employees be trained in the nature of any electrical hazards, fall hazards and falling object hazards in the work area;
- General hazards to include access/egress, distance between the MCWP and the building, use of ladders, stair towers and planks;
- Requires that affected employees be trained in the correct procedures for protection from electrical hazards and for erecting, maintaining, and disassembling the required fall protection systems and falling object protection systems;
- Employees who are on scaffolds while working need to know how protective systems function, so that they know how to install, maintain or remove these systems, as necessary;
- Fall protection systems include consideration of tie-off points, guard rails, harness/PFAS, overhead power lines/wires, power cords, electrical storms, trailing cords, battery/battery cables, limited access zones;

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- Requires that employees be trained in the proper use of the scaffold and in the proper handling of materials on the scaffold;
 - Requires that employees be made aware of weight distribution, location of labels/charts indicating weight capacity and audible alarms; and
 - Requires that employees be trained in the pertinent requirements of Subpart L for example: scaffold-parts/sections, load charts, operating manuals, and weather conditions.

1926.454 (b) – Erectors, Dismantlers, Movers, Operators, Repair, Maintenance, and Inspection

- Requires that the employer shall have **each employee who is involved in erecting, disassembling, moving, operating, repairing, maintaining, or inspecting a scaffold trained by a competent person** to recognize any hazards associated with the work in question;
- Requires that affected employees be trained in the nature of scaffold hazards, including access/egress, distance to the building, use of ladders, stair towers, planks, electrical, etc;
- Requires that affected employees be trained in the correct procedures for erecting, disassembling, moving, operating, repairing, inspecting, and maintaining the type of scaffold in question;
- Training provided to an employee to construct, repair or dismantle one type of scaffold will not necessarily enable that employee to repair another type;
- Training must include how to correctly put the scaffold into operation, hazard identification (electrical, fall hazards etc), and use of a daily check list;
- Requires that affected employees be trained in the design criteria, maximum load-carrying capacity, intended use of the scaffold, as well as configuration load charts/capacity and manufacturer's instructions; and
- Requires that affected employees be trained in the pertinent requirements of subpart L.

1926.454 (c)

- Requires the employer to retrain any employee when the employer has reason to believe that the employee does not have the understanding and skill required by paragraph (a) or (b) of this section;
- Requires that employees be retrained, as necessary, to restore the requisite scaffold-related proficiency; and
- Circumstances where the provision requires retraining include, but are not limited to, the following situations: first, whenever there is a change at the worksite that presents a hazard about which the employee has not been trained (paragraph (c)(1)); second, where changes in the types of scaffolds, fall protection, falling object protection, or other equipment present a hazard about which the employee has not been trained (paragraph (c)(2)); and, third, where inadequacies in an affected employee's work practices involving scaffolds indicate that the employee has not retained the requisite proficiency (paragraph (c)(3)).

20) OSHA Definitions

Suggested Time Frame: 5 minutes

NEED TO KNOW:

Need to know OSHA's definition for competent and qualified persons are as follows:

Competent person means one *who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees and who has authorization to take prompt corrective measures to eliminate them.* (29 CFR 1926.450 (b))

Qualified means one who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training and experience, has successfully demonstrated his/her ability to solve or resolve problems related to the subject matter, the work, or the project. (29 CFR 1926.450 (b))

21) OSHA Subpart L – Scaffolds

Suggested Time Frame: 10 minutes

NEED TO KNOW:

- This is the standard to use when questions arise regarding OSHA's scaffold standards.
- Which of the subpart L standards apply

22) OSHA Subpart M – Fall Protection

Suggested Time Frame: 10 minutes

NEED TO KNOW:

- This standard requires workers be trained
 - to recognize fall hazards
 - to be familiar with fall protection, PPE and its proper fit and application
 - to understand how to properly access work areas
- This is the standard to use when questions arise regarding fall hazards and fall protection requirements.

23) OSHA Subpart X – Stairs & Ladders

Suggested Time Frame: 10 minutes

NEED TO KNOW:

- This standard addresses safe access (stairways, ladders, etc.).

Appendix B

CASE STUDY: Description of a Fatality Involving Mast Climbers

Two Mast Climbing Work Platforms were positioned on the inside corner of a university dormitory. The physical layout formed an “L” shape. The machines were set at an elevation of around 110 feet (above the ground). The scope of the work necessitated that both machines be utilized and moved up or down in tandem. Workers treated the walking/working surface of both machines as one. Six tradespersons performed work on both of the machines. One machine was “field modified” (outrigger platform added – size 62 inches by 37 inches) to allow the workers to move more easily from machine to machine. The spacing between the two MCWP’s was approximately 3 inches. Guardrails were incorporated on the left side of the platform, the right side of the platform, and along the back side. There were no guardrails on the front portion. No personal fall arrest equipment was utilized.

According to the safety narrative/accident data furnished by the local OSHA office: “An employee fell approximately 85 feet from a mast scaffold that was on the eighth floor to another mast scaffold that was on the first floor. The employee was installing rubber around a window when he walked off the unprotected edge. The two scaffolds were bridged earlier in the day. The planking was removed from the bridged area and one scaffold was lowered to the first floor. This created one unprotected edge on the outrigger section of the mast scaffold. At the time of the accident, the deceased was working his way toward an unprotected edge when he fell.”

Critical Factors that May Have Led to The Fatality:

- Misuse: The bridging of the two scaffolds was not approved by the installer;
- Lack of communication: One worker authorized the movement of one platform to the ground, thereby removing the guardrail system;
- Job schedules, pressures and deadlines;
- The lead person/jobsite supervisor failed to inform the workers on the platform that conditions were changing;
- The MCWPs were utilized by different subcontractors;
- Ignorance of industry standards regarding fall protection;
- A trained and qualified competent person was not present on the site;
- Training deficiencies; or
- Apprentice/ journeyman ratio was not balanced.

System or Process Failures:

No pre-task planning or Job Hazard Analysis was conducted. All affected workers should have been informed that one of the mast scaffolds needed to be lowered. Prior to the movement of the mast scaffold, the guardrail system should have been reconfigured and a personal fall arrest system should have been put in place.

Associated Organizations and Websites

CPWR - The Center for Construction Research and Training (CPWR)

8484 Georgia Avenue, Silver Spring, MD 20745, USA, Tel: 301-578-8500,
E-mail: cpwrwebsite@cpwr.com, Website: www.cpwr.com

Building and Construction Trades Department, AFL-CIO (BCTD)

815 16th Street, Suite 600, Washington, DC 20006, USA, Tel: 202-347-1461,
Website: www.bctd.org

National Institute for Occupational Safety & Health (NIOSH)

1600 Clifton Rd., Atlanta, GA 30333, USA, Tel: 800-CDC-INFO/800-232-4636,
Email: cdcinfo@cdc.gov, Website: www.cdc.gov/niosh

Occupational Safety & Health Administration (OSHA)

200 Constitution Ave., NW, Washington, DC 20210; Tel: 800-321-OSHA
(6742) | TTY: 877-889-5627, Website: www.OSHA.gov

Scaffold Industry Association, Inc. (SIA)

400 Admiral Blvd, Kansas City, MO 64106, USA, Tel : 816-595-4860,
Website: www.scaffold.org

American Work Platform Training, Inc. (AWPT)

225 Placid Drive, Schenectady, NY 12303, USA, Tel: 518-280-2486,
E-mail: mail@awpt.org, Website: www.awpt.org

The electronic Library of Construction Occupational Safety and Health (eLCOSH)

Developed by CPWR with funding by NIOSH, Website: www.elcosh.org



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