Safe and Innovative Work Best Practices for Mechanical Crafts Field Reference Guide

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Safe and Innovative Work Best Practices for Mechanical Crafts Field Reference Guide

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DEDICATION

The research efforts and outcomes of this project are dedicated to those employees who continue to strive to improve safety and health in the workplace, and who have been injured or lost their lives on construction jobsites. Our work is dedicated to their lives and to preventing additional worker injuries and fatalities in the future.

ACKNOWLEDGMENTS

The *Safe and Innovative Work Best Practices for Mechanical Crafts Field Reference Guide* is an abbreviated version of the *Safe and Innovative Work Best Practices for Mechanical Crafts Booklet* written to help construction crafts to obtain information quickly in the field. Funding and support for this project have been provided by the State of Washington, Department of Labor and Industries, Safety and Health Investment Projects (SHIP) Grant Program (Grant No. 2016ZH00312). The project team would like to thank the construction safety subject matter experts for serving as best practice/innovation peer reviewers. We acknowledge the input of the booklet development committee members for their valuable input and guidance. The project team wish to acknowledge the support we received from the employees, contractors, manufacturers, and vendors who shared their innovations and best practices. For the complete list of contributors, please refer to the full version of this document titled "Safe and Innovative Work Best Practices for Mechanical Crafts Booklet" available on the SHIP Grant Program website www.lni.wa.gov/safety/GrantsPartnerships/SHIP/Grants.asp.

INTRODUCTION

Construction employee safety and health continues to be a concern for mechanical contractors, firms involved in heating, air conditioning, refrigeration, plumbing, piping, and mechanical service. To prevent injuries, illnesses, and fatalities, many mechanical contractors have implemented successful, safe work practices/ procedures ("innovative best practices"), unique to their discipline, which has helped them improve worker safety and health performance. In addition, many mechanical employees/employers have developed and implemented innovative work practices, and also developed innovative tools that improve worker safety and work efficiency. However, most of the time these innovative, safe methods and tools originate and end on a single project or in a fabrication shop, or remain within a separate crew. Disseminating information about the innovative practices and tools developed by employees to other mechanical contractors will aid in enhancing safety performance throughout the industry.

PURPOSE

The purpose of the Safe and Innovative Work Best Practices for Mechanical Crafts Field Reference Guide is to provide a quick reference of the 72 innovations and best practices (IBPs), which have improved or have the potential to improve worker safety performance. The guide offers various mechanical construction or closely related processes, procedures, and products that have been implemented by mechanical contractors,

employees, product manufacturers, and general contractors. These IBPs can be easily replicated and/or implemented by contractors and employees in any company and on any work site to improve safety performance.

FIELD GUIDE ORGANIZATION

The 72 IBPs are organized by the type of innovation – product, process, and procedure – in that order. The authors have provided an "Innovative Best Practices Summary" of the IBPs organized by hazard types to assist crafts interested in referencing controls for certain types of hazards. The project team wanted to describe the individual IBPs in the guide in a way that provides the most relevant information. Hence, the team decided to include only the following information for each IBP in the field guide. Readers interested in additional information (i.e., innovation type, hazard control, impacted trades) including the complete list of benefits crafts have experienced can refer to the full version of the guide on the SHIP grants program website.

- Activity Name – The major activity name in question (e.g., bend pipe, install ductwork, run conduit).
- Task – The sub-activity (task) within the major activity (e.g., lifting ductwork into the ceiling space).
- Problem – A statement(s) describing the safety

issue addressed by the IBP.

- Solution – The IBP solution to mitigate (solve) or control the risk factors.
- Additional Items to Remember – Additional items to remember if another employee/ employer were to use this process, procedure, or product. List of special safety precautions to remember when implementing the process, procedure, or product. Additional resources such as specification sheets, video trainings, etc.
- Acknowledgements – Information to credit the contractor/manufacturer/vendor who shared the IBP.

REGULATORY JURISDICTION

Regulatory requirements (if any) referenced in this booklet are based on Washington Division of Occupational Safety and Health (DOSH) regulations. These IBPs are only included as an example, and the readers should be aware that the contractors identified may reference safety regulations based on their regulatory jurisdictions. It is the reader's responsibility to ensure that they adapt the best practices provided in this booklet for their jurisdiction and comply with all applicable local, state, and federal regulations affecting their workplace. In addition, please note the materials available in this booklet are intended to provide general information about the subject matter covered. The

materials are not meant to provide legal advice. Readers should contact their legal counsel to obtain advice with respect to any particular issue or problem.

DISCLAIMER

While every attempt has been made to ensure that the information contained in this guide has been obtained from reliable sources, the project team is not responsible for any errors or omissions, or for the results obtained from the reliance on or use of this information. All information in this guide is provided “as is”, with no guarantee of completeness, accuracy, timeliness or of the results obtained from the use of this information, and without warranty of any kind, express or implied, including, but not limited to warranties of performance, merchantability and fitness for a particular purpose. In no event will the project team, its related companies, partnerships, or corporations, or the owners, partners, employees, or agents thereof be liable for any decision made or action taken in reliance on the information in this guide or for any damages resulting therefrom including consequential, special or similar damages, even if advised of the possibility of such damages.

Innovative Best Practices Summary

In order to help the readers navigate the field reference guide quickly, the IBPs are arranged by the primary hazard addressed by the IBP. This page is organized by the IBP #, title, and page number.

Chemicals / Personal Protective Equipment (PPE)

Poor Communication and Planning

Cuts and Impalement

Electrical, Explosion and Fire Related

Ergonomic Risk Factors

Motor Vehicle Crashes (Fleet Safety)

Slips, Trips, and Falls

Struck-bys and Equipment

Work Area – Poor Access and Housekeeping

1. Raised Welders

Activity Name
All activities that involve welding in a fabrication shop.

Task

Using a welder in the fabrication shop.

Problem

Employees moving heavy welders around the fabrication shop exposes them to an ergonomic hazard and may lead to injuries such as strains and sprains. This task also impacts productivity due to additional time needed to move the welder from one work area to another.

Solution

McKinstry Co. installed the welders on a jib that swings over the work area, which requires welding. By attaching the welder leads on a swing arm (the welding machine itself is located securely on the ground), the welder can be quickly moved around from one workstation to another, eliminating manual handling of the welder and employee exposure to ergonomic risk factors. McKinstry Co. also found that this setup helps to keep the work area organized and free of trip hazards caused by welding leads on the ground.

Additional Items to Remember

The maximum lifting capacity must be easily visible on the jib. Instructions for using the jib must be made available with the crane, and training provided to ensure those who will be operating the crane are familiar with its operation, lifting capacity, and safe operating procedures. Contractors must ensure that the welder lead is properly secured to the jib, never exceed the weight capacity of the jib, and the structure can support the load. All equipment should be inspected before use.

Acknowledgements

The information provided in this section was used with permission from McKinstry Co.

Raised welder leads
(Picture Courtesy of McKinstry Co.)

2. Automated Material/PPE Dispensing Machine

Activity Name

All activities that require the use of consumable supplies.

Task

All tasks that require the use of consumable supplies.

Problem

Safe and efficient construction benefits from ready-access to tools, equipment, and supplies. When material supplies run out and are not available, the work is interrupted. In some cases, when materials are unavailable, employees may try to improvise or cut corners in order to maintain production. Doing so can lead to safety issues. In addition, when it is recognized that material supplies are needed, it may take a long time to order the supplies and have them delivered to the site. Such inefficiencies in the process can similarly cause improvisation and shortcuts, and potential safety concerns. Employee job satisfaction and morale may suffer.

Solution

McKinstry Co. utilizes a supply “dispensing machine”

for small materials that employees use regularly and are consumed as part of the regular work activities. The dispensing machine consists of a set of cabinets in which material supplies are stored. The machine is centrally located where everyone has access. The machine can be stocked with small materials and/or safety supplies (e.g., earplugs). Everyone has access to the dispensing machine and can take materials from it.

When an employee runs out of a material for the task that they are working on, the employee can get more supplies from the machine. When the employee takes supplies from the machine, the machine automatically notifies the company management staff (e.g., purchasing department) that supplies have been taken. Then, when the supplies in the machine are low, the company can order more supplies before they run out. This process eliminates the problem of forgetting to restock the supplies and ensures that there will always be supplies available for conducting the work. An organized supply area also helps to improve housekeeping and eliminate safety hazards associated with a messy work area.

Additional Items to Remember

The supply dispensing machine requires a reliable system that connects the availability of supplies to the purchasing department in a company. There must be an electronic communication system set up to promptly notify the purchasing department that supplies are

needed, and the purchasing department needs to take prompt action. If the communication with the purchasing department fails, there will be frustration amongst the employees with the system. Also, once the new supplies arrive, the dispensing machine needs to be restocked promptly to avoid delays in the work.

Some dispensing machine suppliers may also permit or promote using locker-type machines for non- dispensing purposes. For example, contractors may be able to use these machines to control access to restricted equipment, keys, expensive and complex tools, specialized testing equipment, or other sensitive tools. Housing tools and equipment in this manner enables employers to track and restrict access to individual tools and equipment.

When the dispensing machine is used to supply PPE, it will be provided for free by the employer to employees to protect employees from hazards they are exposed to.

Acknowledgements

The information provided in this section was used with permission from McKinstry Co.

Material Supply dispensing Machine
(Picture Courtesy of McKinstry Co.)

3. Spreader Bars for Overhead Crane

Activity Name

All activities that require the use of a crane or hoist to move materials.

Task

All tasks that require employees to attach materials to a crane or hoist.

Problem

Some of the safety concerns associated with using a crane or hoist to move materials in a fabrication shop include poor load control, lifting points too far apart, and potential for damaging material when being lifted.

Solution

A spreader bar is a below the hook lifting device used to distribute the load of a lift across more than one point, which increases stability, decreases the loads applied during hoisting, helps with load control and reduces the potential for damage caused by rigging.

Spreader bars are typically used to lift objects that are too large to balance from a single point, are not designed

to handle adverse loading conditions, and require better load control. These include items such as duct work, and HVAC equipment, among others. Spreader bars come in two configurations fixed and adjustable length.

Additional Items to Remember

Contractors should take the following precautions when using spreader bars:

- Equipment must be inspected prior to use
- Verify the spreader bar capacity
- Post spreader bar capacity on the equipment according to the marking guidelines found in ASME B30.20

Acknowledgements

The information provided in this section was used with permission from McKinstry Co.

Sample Spreader Bar
(Picture Courtesy of McKinstry Co.)

4. Retractable Cords and Hoses

Activity Name

All fabrication activities.

Task

Use of extension cords and hoses.

Problem

Extension cords and air hoses cause tripping hazards around the work place and make the work place look disorganized. Cords and hoses are exposed to being damaged by other equipment.

Solution

Use of retractable cords/hoses to help prevent tripping hazards and to keep the workplace more organized. The retractable cords/hoses are not always laying on the floor surface and are only out when needed. When not needed they easily retract which keeps the tripping hazards of cords/hoses laying around to a minimum.

Additional Items to Remember

After use, retract the cable or hose so that it keeps the

workplace clean and free of tripping hazards. Make sure that the retractors are mounted securely. Inspect hoses, cords, and retractors for damage before use.

Acknowledgements

The information provided in this section was used with permission from McKinstry Co.

Retractable cords and hoses
(Picture Courtesy of McKinstry Co.)

5. Leather Cable Cover

Activity Name

All welding activities in a fabrication shop.

Task

All welding activities in a fabrication shop.

Problem

Over time, the welding cable leads are damaged from prolonged and repeated exposure to sparks. This damage decreases the life of the equipment and, if not fixed, will create electrical/fire hazards from exposed wires.

Solution

Covering the welding cables with a leather cable cover is a solution. There are several leather cable covers available commercially. The leather protects the cables from sparks and protects the insulation from breaks which increases the life of the equipment. The leather stops the sparks from gradually melting through the cable insulation. Use of FM Global approved or listed welding pad/blanket/curtain to protect torch and cord/hose ends would be consistent with the intent of NFPA 51B Standard for Fire Prevention during Welding, Cutting, and Other Hot Work.

Additional Items to Remember

- Inspect welding cable leads for damage or wear before use every day
- Situational awareness regarding the location of cables and generated sparks

Acknowledgements

The information provided in this section was used with permission from McKinstry Co.

Sample Leather covers for welding cords

(Picture Courtesy of McKinstry Co.)

6. Jib Cranes

Activity Name

All activities that require lifting of heavy objects and repetitive lifting.

Task

All tasks that require lifting of heavy objects and repetitive lifting.

Problem

Mechanical construction work often requires lifting heavy objects or lifting objects repetitively. Many parts and pieces of mechanical construction, such as piping, ductwork, pumps, and support framework are heavy and require more than one person to lift the components. Without support equipment to lift and move heavy components, employees are at risk of injury associated with heavy lifting. In addition, work tasks that require repetitive lifting during the course of a work shift can lead to injury if consideration is not given to using appropriate ergonomic positioning and movements during the lifting. A lack of support systems and equipment can result in employees trying to lift too much weight or overexerting themselves during highly repetitive lifting.

Solution

The use of lifting equipment such as stationary and mobile cranes can significantly lesson the physical impacts associated with lifting in the workplace. A jib crane is one example of a stationary lifting system that is used in the mechanical construction industry to benefit safety. A stationary jib crane is typically composed of a lifting arm (boom) supported by a diagonal tie rod or cable (jib). The jib crane may be attached to a structural wall or column that has enough strength to support the design loading plus the weight of the crane and load. The system may be connected to the wall or column through rotating brackets (hinges) so that the crane can rotate to move loads from one location to another. The crane may also be outfitted with an electronic hoist system with rigging to raise and lower the load. The crane may be rotated by hand, or possibly contain an additional system to rotate the crane, in order to set the load in a different location. Pre-engineered systems are available that can be bolted directly to a support structure. When attached to a wall or column, the crane requires no floor space or special foundation, freeing up more space to conduct the work and eliminating tripping hazards. Jib cranes also help prevent employees dropping objects, which could then injure employees or damage equipment or products.

Additional Items to Remember

The maximum lifting capacity of the crane must be easily visible on the crane. Instructions for using the

crane must also be made available with the crane, and training provided to ensure those who will be operating the crane are familiar with its operation, lifting capacity, and safe operating procedures. When using the crane to lift heavy objects, rigging of the load must be performed by a competent employee. Appropriate types of slings must be made available, and only those with adequate strength are to be used. Each day before being used, you must ensure that the sling and all fastenings and attachments are inspected for damage or defects by a competent person designated by the employer. Additional inspections must be performed during sling use, where service conditions warrant. You must immediately remove damaged or defective slings from service. Make sure that this solution meets the requirements of all applicable WAC requirements.

Acknowledgements

The information provided in this section was used with permission from McKinstry Co.

Jib Crane (Picture Courtesy of McKinstry Co.)

7. Sheetmetal Roll Custom Cradle

Activity Name

Ductwork fabrication in shops.

Task

Moving Sheetmetal rolls around the shop.

Problem

Moving materials such as Sheetmetal rolls around the shop poses ergonomic and crushing hazards.

Solution

McKinstry Co. uses a custom cradle to secure materials such as Sheetmetal rolls. Having the material on the cradle helps reduce the chance of the material accidentally rolling away and creating struck-by hazards during storage or moving the material.

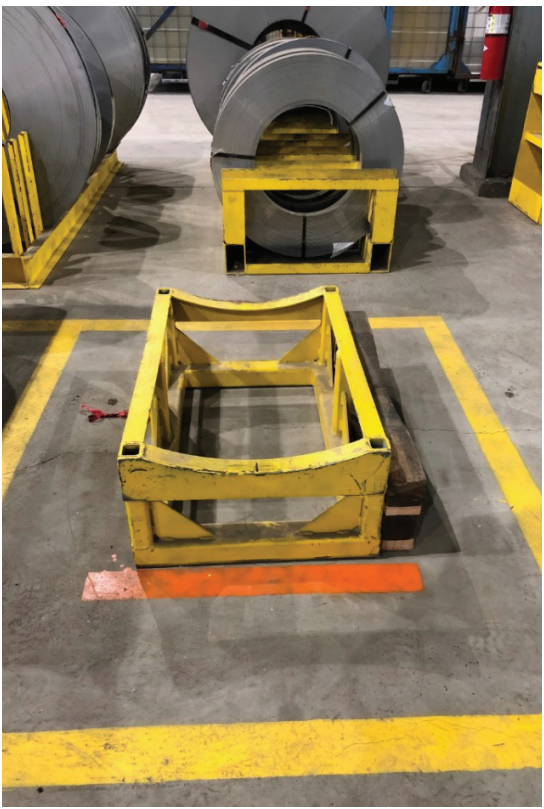
Additional Items to Remember

Contractors may improve on this idea by welding wheels on the cradle or putting the cradles on top of carts. Make sure material is stable and secured to the cradles. Be sure to check and post specs on the cradle for the maximum weight capacity.

Acknowledgements

The information provided in this section was used with permission from McKinstry Co.

Custom Cradle (Picture Courtesy of McKinstry Co.)



Custom Cradle (Picture Courtesy of McKinstry Co.)

8. Overhead Exhaust Vents (Fume Extractor Arm)

Activity Name

Piping fabrication.

Task

Cutting, welding, and painting.

Problem

Prolonged exposure to fumes and particulates created during cutting, grinding, and welding activities in the fabrication shops exposes employees to various health hazards.

Solution

General or local exhaust ventilation systems can be used to remove fumes and gases from the welder's breathing zone to outside of the work environment. McKinstry Co. installed overhead exhaust vents at each of their workstations to capture fumes/gases and particulates while performing cutting and welding activities to remove fumes out of work environment.

Additional Items to Remember

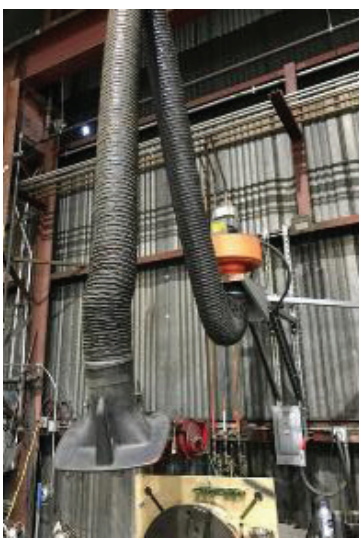
OSHA recommends keeping fume hoods close to the plume source to remove the maximum amount of fumes and gases. Portable or flexible exhaust systems can be positioned so that fumes and gases are drawn

away from the welder. Keep exhaust ports away from other employees. Consider substituting a lower fume-generating or less toxic weld type or consumable (OSHA Fact Sheet 3647). “Use of mechanical ventilation in construction during welding must comply with “WAC 296-155-415 Ventilation and protection in welding, cutting, and heating” requirements.”

Acknowledgements

The information provided in this section was used with permission from McKinstry Co.

Overhead exhaust vent
(Picture Courtesy of McKinstry Co.)



9. Forklift Scale

Activity Name

All construction activities that utilize forklifts.

Task

All construction tasks that utilize forklifts.

Problem

Overloading a forklift may cause a tip over or falling loads. Employees should know the stated capacity of their forklift and should never exceed it. Only by keeping within the weight limit can an employee operate the forklift safely. However, due to some challenges employees may not be aware of the loads they are handling.

Solution

A solution could be a forklift scale system that provides increased weighing accuracy. By being aware of their loads, employees minimize the risk of exceeding the forklift capacity and prevent tip-over incidents. A forklift scale also allows employees to select the appropriate rigging to handle the load.

Additional Items to Remember

While there are benefits to this solution, employees

should follow all requirements of the scale manufacturer. Also, all loads being transported using the forklift should be secured properly. Any modifications to a powered industrial truck must be performed consistent with WAC 296-863-20010.

Acknowledgements

The information provided in this section was shared by McKinstry Co.

Scale in Forklift Cab
(Picture Courtesy of McKinstry Co.)

10. Cylinder Storage Cage

Activity Name

Supply Gas to the work stations

Task

Blocking off and securing gas tanks.

Problem

Individual compressed gas cylinders are usually exposed in the work place to different hazards such as trucks, forklifts, and cranes that move materials around.

Solution

Building a wall/cage for compressed gas cylinder storage. The wall/cage keeps the cylinders organized and safe from other work place hazards. The gas is supplied to each work station via hard lines.

Additional Items to Remember

Contractors must inspect the cylinders regularly and according to manufacturer guidelines. Access and maintenance related issues must be a primary factor when organizing the cages. Prevent sparks and flames

from contacting cylinders. Monitor the atmosphere in areas where gases may vent and collect. Fuels and oxidizers must not be stored together without a firewall. Ensure storage of gas cylinders stored in a cage are firmly secured and upright, not able to fall or tip over, and not able to become energized or part of an electrical circuit. Ensure oxygen and fuel cylinders are stored separately with either a minimum distance of 20 feet or a wall that is at least five foot feet high with a 1/2 hour fire-rating. Make sure that this solution meets the requirements of WAC 296-24 and CGA Pamphlet G-1 and P-1.

Acknowledgements

The information provided in this section was used with permission from McKinstry Co.

11. Portable Electric Scissor Lift Table

Activity Name

Pipe fabrication process.

Task

Material (pipe) handling as part of the fabrication processes.

Problem

Fabrication shop employees perform many tasks at a workstation. Fixed workstations force employees to adopt awkward postures that include excessive twists or turns and uncomfortable reaches. Over the long run, these awkward positions may result in soft tissue injuries and lower worker productivity. Also smaller (area) workstations with less than adequate space to store tools and materials can cause safety issues.

Solution

A mobile and adjustable height workstations that allow shop employees to complete tasks with minimal awkward postures. This solution will allow the employee to move the table without the need for excessive force and adjust the height for achieving the best ergonomic posture while working. The height

adjustable feature reduces the ergonomic hazard exposure transferring material to/from the table. The mobile feature allows the station to be moved around in the shop allowing additional flexibility.

Additional Items to Remember

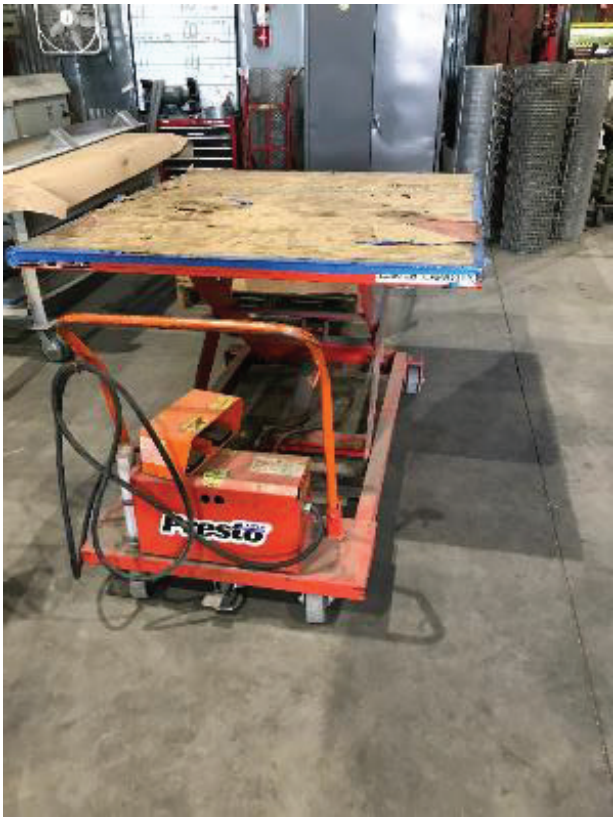
The system may introduce other hazards into the work process. Hence, shop managers must thoroughly assess the risks associated with the system and control them. Equipment shall be maintained and used in accordance with the manufacturer's recommendations and the following actions must be taken:

- Check the lift capacity of the equipment
- Inspect the equipment
- Keep on the flat ground
- Do not work under the table. All personnel must stand clear of the lift when the lift is in motion, and not put their hands or feet under the lift table

Acknowledgements

The information provided in this section was used with permission from McKinstry Co.

Portable Hydraulic Table
(Picture Courtesy of McKinstry Co.)



12. Individual Chemical Cabinets

Activity Name

Welding activities

Task

Clear coating welds/ painting welds

Problem

Employees have to walk to and take chemicals from central chemical cabinets, exposing them to other activities along the way and increasing the time to conduct tasks.

Solution

Create individual chemical cabinets at each work station. By utilizing this solution, employees do not have to walk across the shop to get the chemicals for each task they have to do. Having individual chemical cabinets reduces time to get supplies and keeps employees at their own work station. Only chemicals that are needed in that work station are stored in the cabinet.

Additional Items to Remember

Contractors should ensure all environmental/chemical regulations and safe work practices are followed when using this solution such as:

- Ensure cabinets are compliant with NFPA 30 Flammable Liquids Code with respect to construction, appropriate location (away from electrical outlets/potential ignition sources), and permissible quantities
- Making all safety data sheet available
- Labeling all chemicals
- Posting spill procedures
- Ensure all storage for flammables meets WAC 296-155-270 Flammable liquids

Acknowledgements

The information provided in this section was used with permission from McKinstry Co.

Individual Chemical Cabinets
(Picture Courtesy of McKinstry Co.)

13. Pipe Scissor Clamp

Activity Name

Material handling in the fabrication shops.

Task

Lifting pipes in the fabrication shops.

Problem

Securing pipes and moving them around the shop manually can create ergonomics hazards due to the weight and shape of the material. Also, while handling the pipes manually, the pipe can roll and fall from the work station or cart. Safely moving the pipe around requires two employees.

Solution

Use of a pipe scissor clamp to handle pipes in the fabrication shop. Using this clamp to lift/move piping reduces the potential for strains, pinch points, and fall hazards. The clamp locks on the pipe and with the use of an overhead crane can transport the pipe to other areas. After setting the pipe down in a secured position, the clamp will open.

Additional Items to Remember

The maximum lifting capacity must be easily visible on the crane. Instructions for using the crane must be made available with the crane, and training provided to ensure those who will be operating the crane are familiar with its operation, lifting capacity, and safe operating procedures. When using the crane to lift heavy objects, rigging of the load must be performed by a competent employee. Appropriate types of slings must be made available, and only those with adequate strength should be used. Each day before being used, you must ensure that the sling and all fastenings and attachments are inspected for damage or defects by a competent person designated by the employer. Additional inspections must be performed during sling use, where service conditions warrant. You must immediately remove damaged or defective slings from service. Make sure that this solution meets the requirements of all applicable WAC requirements. Use of taglines removes employees from being adjacent/beneath suspended load. Also, egress routes around load should be free of tripping hazards and restrictions.

Acknowledgements

The information provided in this section was used with permission from McKinstry Co.

Pipe Scissor Clamps
(Picture Courtesy of McKinstry Co.)

14. Shipping Containers

Activity Name

Transportation of materials.

Task

Transportation of materials.

Problem

With the increasing popularity of pre-fabrication, mechanical trades have seen an increase in the amount of materials (e.g., pipes) companies transport from shops to jobsites and vice versa. This process may create safety hazards for the employees handling these materials. For example, sometimes employees manually carry awkward loads from floor to floor. An excellent system to transport materials is needed to eliminate or mitigate safety hazards during this process.

Solution

McKinstry Co. employs shipping containers to move materials from their shops to the jobsites safely and securely. Contractors can safely hoist the container using a crane to different parts of the job site. Employees' exposure to ergonomic risk factors is now significantly reduced. McKinstry's shop employees modified the

shipping container to move material and lift material to any floor as needed.

Additional Items to Remember

Contractors have to be sure not to overload the shipping containers when used as described above. Employees involved with the crane pick should identify and control all hazards associated with hoisting a load overhead using a crane including proper pick points, etc. Follow the requirements according to the marking guidelines found in ASME B30.20.

Acknowledgements

The information provided in this section was used with permission of McKinstry Co.

Shipping Containers
(Picture Courtesy of McKinstry Co.)

15. 90-Holder Racks

Activity Name

Equipment Storage.

Task

Accessing equipment.

Problem

Lack of organized equipment storage for 90-holders (see pictures) creates housekeeping issues. The lack of storage also impacts productivity when trying to find the right size tool.

Solution

Utilizing organized racks sorted by size for 90-holders to be stored. The racks are organized by size which allows employees to access them quickly. The racks keep the equipment off the ground which eliminates tripping hazards. Having an organized system to store the 90-holders reduce the time for employees to locate and grab these tools for use, increasing productivity.

Additional Items to Remember

- Keep rack clean and organized
- Store the 90-holders in the rack and secure

them after use
- Inspect before use
- Employees must use PPE based on a proper PPE hazard assessment when handling the holders

Acknowledgements

The information provided in this section was used with permission from McKinstry Co.

90 holder racks (Picture Courtesy of McKinstry Co.)

16. Color-coordinated Tool Shelf (Tool Shadow Board)

Activity Name

All activities that require the use of hand tools.

Task

All tasks that require the use of hand tools.

Problem

Safe and efficient construction benefits from ready-access to tools, equipment, and supplies. When hand tools are not within easy reach, misplaced, or difficult to efficiently obtain, the work is interrupted. In some cases, when tools are unavailable, employees may try to improvise by using an inappropriate tool in an unsafe manner in order to maintain production. Doing so can lead to safety issues.

Solution

A highly organized tool shelf also called a "tool shadow board" for hand tools, like that used by McKinstry Co. shown in the figure below, can help overcome this potential problem. A unique feature that provides additional benefit is color-coding the tools and shelf. For example, all cutting tools might be painted green.

Similarly, all tools associated with drilling might be colored yellow. The color coding allows employees to quickly spot the appropriate type of tool. In addition, the location on the tool shelf where the tool is stored can also be colored to match the color of the tool. For example, if the cutting tools are a green color, the specific location on the tool shelf where the cutting tools are to be stored can also be painted green. This color coordination helps to efficiently locate the needed tool, identify when a tool is missing, and make it easy for employees to know where to place the tools after they have been used.

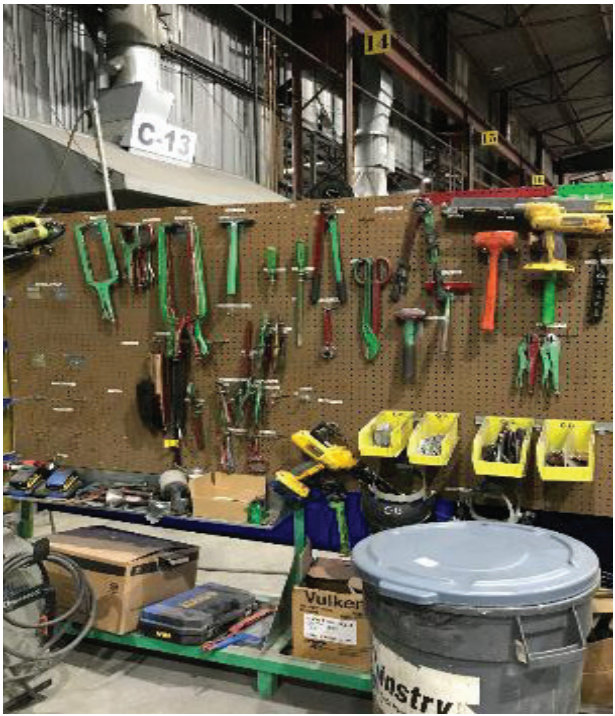
Additional Items to Remember

The color coating on the tools should not create a hazard for the employees when using the tools. Coatings that create a slippery surface may create a hazard for employees when using the tool. If the coating creates a slippery surface, it should only be applied on areas of the tool where the employee does not hold the tool when using it.

Acknowledgements

The information provided in this section was used with permission from McKinstry Co.

Color-coordinated Tool Shelf
(Picture Courtesy of McKinstry Co.)



17. Crane Baskets

Activity Name

All activities on upper floor levels that require equipment and materials.

Task

Transporting equipment and materials to upper floor levels in a building.

Problem

On projects that involve the construction of multi-story buildings, mechanical construction work requires transporting materials and equipment to the upper floor levels. This task is often performed many times during the course of a project by employees carrying the materials and equipment. Transporting the materials and equipment to upper floors using stairways presents hazards when the materials are heavy, numerous, and awkwardly shaped, and when unprotected tripping and fall hazards exist on the jobsite. Strain and sprain injuries may occur when employees have to repetitively carry materials and equipment up many floor levels. Moving the equipment and unused materials back down to ground level also poses safety hazards in the same manner.

Solution

A large, enclosed crane basket allows for lifting large quantities of materials and equipment to any floor level.

The crane basket can be constructed of any materials, including a shipping container as shown in the photos below. If a shipping container is used, the materials and equipment can be placed on movable carts and bins for easy offloading onto the floor deck. As a result, the crane basket eliminates the need for employees to make many trips up and down the building to transport materials and equipment, and helps to prevent strains due to lifting of heavy materials when offloading the materials and equipment onto the floor deck.

The crane basket must be designed such that it meets the governing regulations for personnel platforms. The requirements for personnel platforms can be found in WAC 296-155-547 through WAC 296-155-55305. Personnel platforms and/or their suspension systems must be designed, constructed, and tested according to ASME B30.23-2005, Personnel Lifting Systems. The design and manufacturer's specifications must be made by a registered professional engineer. Personnel platforms manufactured prior to the effective date of ASME B30.23-2005, must comply with ASME B30.23-1998.

It is important to remember that a personnel platform is supposed to be a last resort. Other, more reliable types of lifting and personnel systems should be considered first.

In addition, there are test lift requirements and de-rating requirements associated with personnel platforms. Documentation of the personnel platform meeting these requirements must be provided as well.

Additional Items to Remember

The structural capacity of the crane basket must be determined so that it is not overloaded. Also, special rigging and/or spreader frames must be used to stabilize and safely lift the crane basket into place. For offloading the basket, a ramp or other means must be available for employees to safely access the crane basket while adjacent to the floor edge. Fall protection must be used at all times when entering the basket to remove materials. Special consideration must also be given to providing guardrail protection on each side of the crane basket to prevent employees and objects from falling through the openings on each side of the basket. DOSH directive 22.25 “Lifting & Offloading Intermodal Containers at Construction Sites” has more information on this subject. We recommend that users obtain a copy of the policy and review it.

Acknowledgements

The information provided in this section was used with permission from McKinstry Co.

Crane basket lifted to floor level
(Picture Courtesy of McKinstry Co.)

18. Wearable Communication Device

Activity Name

All activities where wireless communication can help to improve safety.

Task

All tasks where wireless communication can help to improve safety.

Problem

Construction sites can be crowded environments with many obstructions, moving equipment, and blind spots. Sometimes increased communication with employees can make a difference in being able to recognize and avoid a hazard. Communicating the presence of a hazard from one employee to another enable working together to improve safety for everyone on a project – a trait of high achieving companies with excellent safety cultures. Additionally, in emergency situations, fast and clear communication with employees who are spread out throughout a project can greatly enhance evacuation of the work site. Difficulty in communicating the presence of hazards and emergency situations to employees can inhibit working safely and getting employees out of harm's way. For the employees, communication devices that are hands-free enhances communication without sacrificing productivity.

Solution

One innovative product, shared by McKinstry Co. that can facilitate safety through faster and higher quality communication is the Heads Up wearable communication device (https://www.headsupsafe.com/). The Heads Up device is small, lightweight, and attaches easily to protective eyewear. The device provides alerts within the employee's peripheral vision, and enables instant communication between employees, equipment operators, safety crews, and management personnel. The alerts are provided via colored lights. Different color lights come one depending on the type of issue of concern such as an emergency situation, private messages, and environmental alerts. The alerts are activated using Bluetooth, sensors, and networks.

The device allows employees to receive personal safety and time critical updates while maintaining focus on their work activities and surroundings. A sound meter is present in the device to alert employees of exposure to a high level of noise. The device can also track hazardous situations and collect the data for access and analysis later.

Additional Items to Remember

The Heads Up device is especially useful when employees are separated by a long distance or are located in hard-to-reach spaces.

More information about the product is available at: https://www.headsupsafe.com/.

Acknowledgements

The information provided in this section was shared by McKinstry Co. and is used with permission from Heads Up Display, Inc. The opinions and guidance expressed in this handbook are those of the authors and not necessarily those of McKinstry and Heads Up Display.

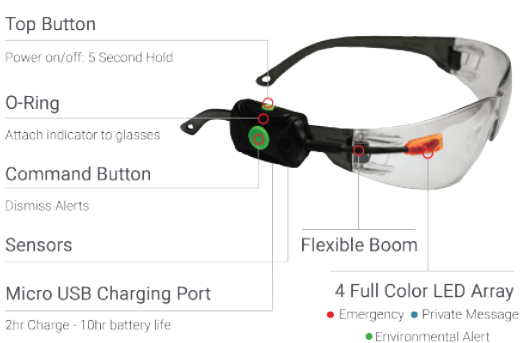
Heads Up Capabilities
(Courtesy of https://www.headsupsafe.com/)

Sensor Indication

Two-Way Communication

Emergency Notifications

Heads Up Wearable Communication Device
(Courtesy of https://www.headsupsafe.com/)



19. Mobile Eyewash Station

Activity Name

All mechanical construction activities involving chemicals and small particulate matter

Task

Cleaning, cutting, sanding, and other similar tasks that use chemicals and/or create dust particles

Problem

Mechanical construction work may involve the use of hazardous chemicals for cleaning, applying coatings, gluing, welding, and other types of work tasks. In some cases the chemicals are toxic and can be damaging and unhealthy when they come in contact with an employee's skin. Getting the chemicals into one's eyes can be a serious safety issues. Jobsites can be very large, require access via stairs and/or manlift, or require employees to work in confined spaces. When an employee gets a chemical or dust in his/her eyes, it may be difficult or take a long time to get to an eyewash station that is not nearby or readily accessible. Having an eyewash station nearby can greatly reduce the amount of time needed to walk to an eyewash station, a task that may also be difficult when an employee has trouble seeing.

Solution

Bringing the eyewash station closer to the work area is one solution to this problem. A mobile eyewash station provides this ability. It makes response time for flushing eyes faster since the unit can be moved easily to the work area. Many of the mobile eyewash stations have wheels which enable the stations to be moved easily around jobsites and shops. The stations typically have a storage tank with water so that there is no need to have access to running water. McKinstry Co. shared one example of a mobile eyewash station manufactured by Uline (http://www.uline.com/). The unit is self-contained; no plumbing is needed. The entire unit includes the eyewash station, an emergency sign, a stainless steel wall bracket, and an inspection tag. An optional waste cart is also available. A water preservative is added periodically to prevent bacteria and algae for up to six months.

Additional Items to Remember

An eyewash station does not prevent hazardous chemicals or small particulate matter from entering into one's eyes. Employees should wear appropriate eye protection while performing their work to prevent exposure of their eyes to hazardous chemicals and dust. Regular maintenance and cleaning of all eyewash stations are necessary to ensure that they work properly when needed and do not further infect employees flushing their eyes. Employers must make sure emergency washing facilities:

- Are located so that they takes no more than ten seconds to reach.
- Are kept free of obstacles blocking their use
- Locate the eyewash close enough to an activity that needs an eyewash
- Ensure that no one else moves the eyewash away during the work activity.

Acknowledgements

The information provided in this section was shared by McKinstry Co. and is used with permission from Uline, Inc.

Mobile Eyewash Station (Courtesy of www.uline.com/BL_1793/Mobile-Eyewash-Stations)

20. Dust-proof Safety Glasses

Activity Name

Using an angle grinder for cutting or grinding metal, also known as a side grinder or disc grinder.

Task

Using an angle grinder to cut metal, clean up welds, remove rust or paint from metal, and other various tasks.

Problem

Construction experiences one of the highest rates of eye injuries compared to other industries. Preventing flying particles from entering employees' eyes is a challenge to construction contractors.

Solution

SNC Lavalin created a safety policy on a pilot project to require all employees to wear dust-proof safety glasses when operating an angle grinder. Dust-proof safety glasses are a form of safety glasses that come equipped with a foam liner to reduce the chance of foreign eye debris coming into contact with an employee's eyes. The foam lining creates a tight fit around the employee's face, which reduces the chance of flying particles getting behind the employee's safety glasses and into the employee's eyes. It is an affordable solution that can drastically reduce the amount of eye injuries for employees who are using angle grinders.

Additional Items to Remember

- Other employees who are working in the vicinity of flying particles from angle grinders should also wear dust-proof safety glasses as needed.
- A face shield should also be utilized when using a grinder to provide sufficient face protection.
- Training should be given with the reminder to be cautious when removing the safety glasses and wiping your brow to prevent rubbing metal shavings into your eyes that were on your face or gloves.
- Awareness of proper donning of PPE needs to increase especially in the monitoring by Supervisors and Health & Safety Staff.
- Doffing of PPE, specifically face shields, needs to be part of the Job Safety Analysis.
- Proper protocol for what to do if a foreign object enters your eye needs to be covered periodically throughout the duration of the project.
- Supplies for preventing safety goggles from fogging, such as anti-fog wipes or “cat crap”, should be readily available on the jobsite

Acknowledgements

The information provided in this section was used with permission of SNC Lavalin.

Sample Dust-proof safety glasses
(Picture Courtesy SNC Lavalin)

21. EksoWorks – ZeroG™ Arm

Activity Name

The use of power tools from aerial lifts.

Task

The use of heavy power tools from aerial lifts for the installation of hangers, pipe, ductwork, etc.

Problem

Power tools are heavy, bulky, and awkward, and involve vibration, all of which expose employees to a variety of ergonomic risk factors. Construction crafts are also prone to using these tools in a static, extended positions for long periods of time when working from an aerial lift. Due to the force required to use these tools, stamina and accuracy are reduced, affecting productivity and quality.

Solution

The Ekso Bionics® Aerial system is designed to increase safety and productivity while working on an elevated work platform. The system includes a special mounting bracket which allows the ZeroG Ergonomic Tool Arm to be mounted to most scissor or boom lift models and scaffolds. The system takes the weight of the tool off the user, thus allowing employees to focus

on accuracy and safety while also reducing fatigue. According to the manufacturer, the product is built for construction and is designed to reduce stress and strain of lifting heavy tools. EksoZeroG helps ease the physical burden on industrial employees. This product is new to the construction industry and greatly reduces the stress put on employees.

Additional Items to Remember

- Employers must perform a thorough hazard/risk assessment before using this device. Proper control measures should be implemented prior to use.
- Equipment shall be maintained and used in accordance with the manufacturer's recommendations.
- The key tools used include rivet busters, chipping hammers, rotary hammers, demo hammers, impact wrenches, and grinders.
- Ekso Works Aerial: https://eksobionics.com/wp-content/uploads/2016/04/Aerial_ff-2.pdf
- EksoZeroG Documentation – Brochures and Sell Sheets: http://eksobionics.com/eksoworks/

Acknowledgements

The product was shared by JE Dunn Construction.

EksoWorks – ZeroG™ Arm
Picture Courtesy EksoWorks)

22. Ladder Levelers

Activity Name

All construction activities that involves the use of ladders.

Task

All construction tasks that uses ladders on uneven surfaces.

Problem

Leveling of non-self-supporting ladders (extension ladder) is not always done in compliance with ANSI A14.8-2013, putting companies and users at risk. When working in commercial construction and industrial environments, compliance with ANSI and national or local OSHA standards is imperative. For ladders currently in-service, determining how to safely retrofit a leveler to the ladder can be challenging.

Solution

Andersen Construction recommended this solution. Werner Ladder offers the PK70 series of LeveLok leveling devices, providing up to 8-1/2" of leg leveling. Levelers can be installed on existing ladders by following instructions included with the leveler kit.

Levelers can be ordered from Werner with levelers factory installed. Keylok Base Unit mounting brackets are permanently attached to each side of the ladder with the LeveLok leveler attaching to the Base Units as needed. Levelers are compatible with D7100, D6200, 7100, D1300, D1800-EQ, D1500, 7800 series Werner ladders

Additional Items to Remember

Where this ladder is being used on projects (Andersen Construction), the employees are required to be in fall arrest as the work is being placed near a leading edge. Always inspect your work area before proceeding. Always inspect your ladder. Ensure these leveling feet are installed correctly and up to manufacturer's standards. Never use aluminum components when there is potential for electrical hazards. Special training should be required to ensure the employees know how to use this product and install them correctly. The employees should also be trained on how to set the ladder up correctly with these attachments. For more details about the product visit www.wernerco.com.

Acknowledgements

Werner Co. and Andersen Construction recommended this solution. The information provided in this section was used with permission of Werner Co.

PK70-3 LeveLok Leveler
(Picture Courtesy of Werner Company)

23. Impalement Protection

Activity Name

All construction activities taking place in the vicinity of concrete reinforcement bars.

Task

All construction tasks taking place in the vicinity of concrete reinforcement bars.

Problem

Reinforcing bars that are not protected pose an impalement hazard to all trades who could be potentially exposed to the unprotected ends of the bars. Traditionally rebar caps have been used to protect rebar. Recently Carnie Cap™ was introduced as the most effective way to cap exposed rebar and reduce the danger of worker impalement. However, sometimes these two caps slide off the rebar.

Solution

Attaching a longer PVC tube to the existing rebar/carnie cap to make it easier to slide onto the exposed rebar. The tube makes it sturdier and less likely to slide or be bumped off. The solution makes it easier and quicker for the employees to cover exposed rebar pieces without compromising safety. The best way to go about creating the solution would be to manufacture it in a way where it is one piece, which would be more time and cost

effective if it is something to be made more common in the future.

Additional Items to Remember

It is pretty simple to use. Make sure that the apparatus is in working order (not cracked or compromised in any way). Make sure that the product is not compromised in any way. If using the caps that use 2x4s to span the length of the rebar, make sure the 2x4 is not damaged as well. Make sure that the apparatus is secure and working correctly, or the product will not be effective and in turn, leave a possible impalement hazard behind.

Acknowledgements

The information provided in this section was used with permission of Hensel Phelps.

PVC Attachments to Carnie Cap™ and Rebar Caps (Picture Courtesy of Hensel Phelps)

24. Pipe Hanger Cart

Activity Name

Installation of overhead plumbing.

Task

Transportation of pre-fabricated pipe hangers and seismic braces.

Problem

When transporting pipe hangers and seismic braces, it can be hazardous moving the cart around. Typically, the carts are tall and narrow to allow a significant amount of material to be transported, while still maintaining maneuverability and stability. When the carts are full, they are very heavy and have a potential to tip over.

Solution

To mitigate/control the risk factor, the contractor re-designed their carts to include the following:

1. A wider base. The original base was 19” wide, and the contractor had it rebuilt to have a 24” base.
2. Adjustable 6” outriggers were fabricated to extend the minimum base width of the cart to

36” from 24”. These were included on all four corners of the cart.

3. Specific instructions on what the best practices are to use/move the carts. The best practices include, but are not limited to:

    a) Moving with a minimum of two people,

    b) Ensuring the cart is not overloaded on one side,

    c) Checking for blind spots in your travel path (around corners),

    d) Staying perpendicular to any ramp/change in elevation (not at an angle), and

    e) Always using the outriggers while the cart is in motion.

These best practices were posted on each cart. The wider base gave the cart more stability and mitigated the potential of the cart tipping over. The adjustable outriggers are designed to stop the cart from completely tipping over should the cart lose balance while in transport. The instructions on use/best practices helped train employees on how to properly use the cart. Additionally, they spread awareness amongst the crew on the dangers of what they are working with.

This solution is innovative because it addressed an issue the company had internally. The carts that this contractor were using were not manufactured by another

company. They were designed and fabricated internally by the contractor. There was a flaw in their design, and the contractor decided to fix the flaw to account for any potential accidents in the future. Once completed, the new and improved design was put into use company-wide.

Additional Items to Remember

Additionally, employers should remember that sequencing of material on the carts is very important as well. Ensure you use caution with how material is taken off the cart and installed. If too much material that is going to be installed at once is all on one side of the cart, it will get overloaded to one side based on the flow of production. Therefore, ensure the process of removing material from the cart is a balanced one. Consider the following list of safety precautions when implementing the procedure or tool:

- Moving the cart with a minimum of two people.
- Ensure the cart is not overloaded to one side.
- Check for blind spots in your travel path (e.g., around corners)
- Stay perpendicular to any ramp/change in elevation. Do NOT take at an angle.
- Always use the outriggers while the cart is in motion.

The key point to making this solution successful is the training/communication with the employees. Ensure that

the procedures are posted on the cart and are noted in the Activity Hazard Analysis (AHA) or Job Hazard Analysis (JHA).

Acknowledgements

The information provided in this section was used with permission of Hensel Phelps.

25. Pipe Stands and Vises

Activity Name

Pipe fabrication process.

Task

Cutting and welding of pipes as part of the fabrication processes.

Problem

Pipe stands and chain vises are standard in a mechanical fabrication shop, which are used to support/secure pipes while cutting or welding. Traditionally these pieces of equipment consist of a three-leg support (tripod). Tripod mounts come with a trip hazard, and they also take up too much space in a shop causing congestion and associated safety issues.

Solution

Employees at an Apollo Mechanical fabrication shop came up with a solution - a single leg pipe stand and vises secured to the floor (see pictures). The innovation eliminates the trip hazard and provides additional space for the fabrication process. They also designed multi-V-heads to hold multiple copper pipes on the stands.

Additional Items to Remember

- Shop managers should ensure the pipe stands can adequately (capacity) support the loads (pipes) imposed on them. They also have to ensure the stands are sufficiently secured to the floor to avoid tipping over.

Acknowledgements

The information provided in this section was used with permission of Apollo Mechanical.

Single Leg Pipe Stand with single and multiple heads (Picture Courtesy of Apollo Mechanical)

26. Pipe Handling Conveyors

Activity Name

Pipe fabrication process.

Task

Material (pipe) handling as part of fabrication processes.

Problem

Pipe fabrication commonly deals with daily moving pipes of various shapes and sizes either manually or with equipment. Improper manual handling of materials is one of the leading causes of injury (e.g., lower back injuries) in mechanical industry fabrication shops according to the Mechanical Contractors Association of American (MCAA).

Solution

A pipe handling conveyor can handle pipes of various sizes and shapes quickly and safely eliminating or reducing manual material handling. Apollo Mechanical uses a conveyor system to minimize manual handling of pipes by shop employees. Forklift operators load pipes onto the staging next to the conveyor. Employees roll the pipes onto the conveyor from the staging point (see picture). The pipes then move through the fabrication process, such as cutting, etc., from there on.

Additional Items to Remember

- Proper care must be taken to procure the best conveyor system that suits the needs of the fabrication shop.
- The shop manager should properly assess the risks involved with the conveyor system beforehand and install safety features as applicable.
- Employees should be sufficiently training in the conveyor system operation.

Acknowledgements

The information provided in this section was used with permission of Apollo Mechanical.

Pipe Conveyor System
(Picture Courtesy of Apollo Mechanical)

27. Modified Workstation

Activity Name

Pipe fabrication process.

Task

Supplementary workstations and toolkits as part of the fabrication processes.

Problem

Fabrication shop employees perform many tasks at a workstation and other duties away from workstations. The primary workstation sometimes does not provide adequate space to accommodate all tools, materials, and drawings, which forces employees to adopt awkward postures that include excessive twists or turns and uncomfortable reaches. Over the long run, these awkward positions may result in soft tissue injuries. Also, while performing work away from primary workstations such as cutting/welding on pipe stands, often there is no place to store tools/materials or hold fab drawings.

Solution

An Apollo Mechanical fabrication shop worker came up with an innovative ad-hoc mobile workstation

to supplement the primary workstation. The worker retrofitted a material cart with a music notes holder and other accessories to make it a stand-alone supplemental workstation mitigating some of the problems discussed above.

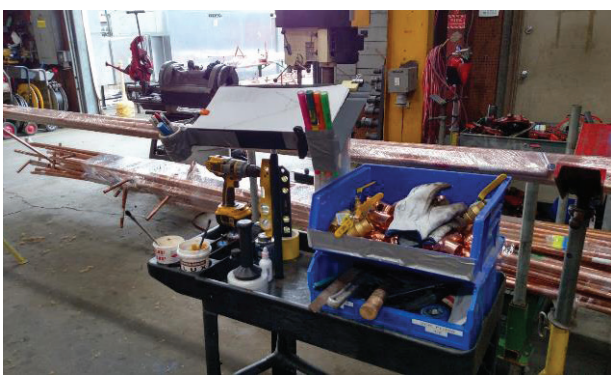
Additional Items to Remember

- None

Acknowledgements

The information provided in this section was used with permission of Apollo Mechanical.

Modified Workstations
(Picture Courtesy of Apollo Mechanical)



28. Mechanical Height Adjustable Workstations

Activity Name

Pipe fabrication process.

Task

Material (pipe) handling as part of fabrication processes.

Problem

Fabrication shop employees perform many tasks at a workstation. Fixed workstations force employees to adopt awkward postures that may include excessive twists or turns and uncomfortable reaches. Over the long run, these awkward positions may result in soft tissue injuries and lower worker productivity. Also smaller (area) workstations with less than adequate space to store tools and materials can cause safety issues.

Solution

Apollo Mechanical has provided adjustable height workstations that allow shop employees to complete tasks with minimal awkward postures. The workstation also has sufficient work area for the employees to stage tools and supplies to complete the tasks safely and productively. Also, Apollo has a crane jib positioned right above the workstation to move materials to the

work area quickly, which minimizes manual handling of materials.

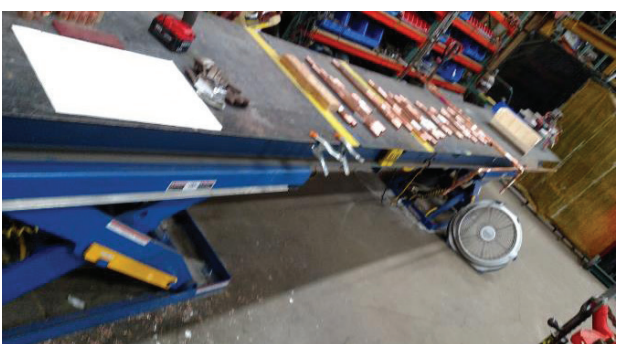
Additional Items to Remember

The system may introduce other hazards into the work process. Hence, shop managers should thoroughly assess the risks associated with the system and control them.

Acknowledgements

The information provided in this section was used with permission of Apollo Mechanical.

Mechanical Height Adjustable Workstations (Picture Courtesy of Apollo Mechanical)



29. Motorized Work Platform (Scaffold)

Activity Name

All activities that traditionally require the use of ladders or elevated work platforms.

Task

All tasks that traditionally require the use of ladders or elevated work platforms.

Problem

Construction crafts are exposed to fall hazards and are at high risk of falls while performing work on ladders, which is evident from a high number of incidents involving falls from ladders. Scaffolds provide a good alternative compared to ladders. However, using traditional elevated mobile work platforms requires employees to climb to the floor to move the equipment, as well as lead to fatigue from climbing up and down multiple times each shift.

Solution

The Power Snappy (see pictures) is a “Motorized Work Platform” with variable platform heights from 24” to 108” (approximately a 15’ working height). Guardrails enclose the entire platform and open at both ends for

easy access. The guardrails eliminate the fall potential making this a much better choice over conventional ladders. Since the Power Snappy is motorized it minimizes the need for climbing to the floor to move the equipment as well as fatigue from climbing up and down multiple times each shift. A more rested worker makes for a more safe and productive worker.

Additional Items to Remember

- Sample Power Snappy Case Study: www.graniteind.com/PDFs/PowerSnappyReview.pdf
- Product information and availability: www.graniteind.com/powersnappy/.
- The scaffold is made in the USA and supported in the USA
- The need to dismount the scaffold to move it is dependent on surface condition. The scaffolding shall be used in accordance with WAC 296-874-40012, specifically section 874-40012(6).

Acknowledgements

The information provided in this section was used with permission of Granite Industries.

Power Snappy Motorized Work Platform
(Picture Courtesy of Granite Industries)

30. Electrical/Flexible Cord Protectors for Construction Sites

Activity Name

All construction activities that utilize extension/flexible cords.

Task

All construction tasks that utilize extension/flexible cords.

Problem

Every trade on a construction site and fabrication shop uses extension/flexible cords including mechanical employees. Improper use of extension/flexible cords has the potential to create a shock hazard or cause a fire. It is typically recommended that extension/flexible cords be kept overhead over walkways and work areas to avoid trips, vehicular traffic, and general housekeeping. Also, to prevent damage to the extension/flexible cord insulation, they cannot be attached to walls or ceilings using metal nails or staples. How to run cords overhead in a supported fashion without causing damage to the outer jacket?

Solution

Many construction companies and vendors have come up with innovative extension/flexible cord protectors to run the cords overhead without causing damage to

the insulation. The pictures below show different ways to run these cords overhead without causing damage. For example, the S hooks in the last picture, are very versatile and give contractors the ability to utilize many forms of existing items in the ceiling or walls as a source to hang extension cords from. These hooks are also large and open so that other trades can run their cords through them as well.

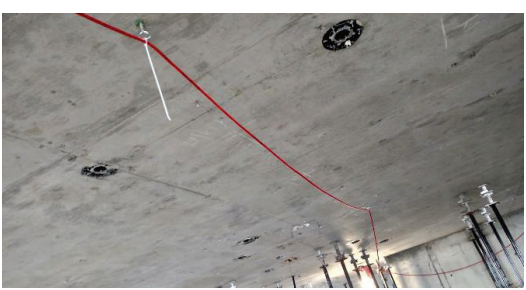
Additional Items to Remember

- Please visit https://www.sheepindustryllc.com/products/ for more information about the safety cord management bracket.

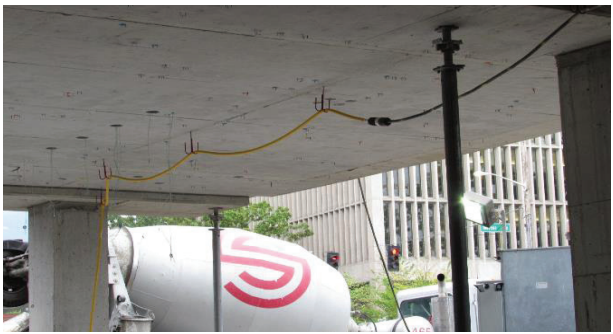
Acknowledgements

The information provided in this section was obtained from multiple sources (GLY Construction and Cochran Inc.) and historic pictures database.

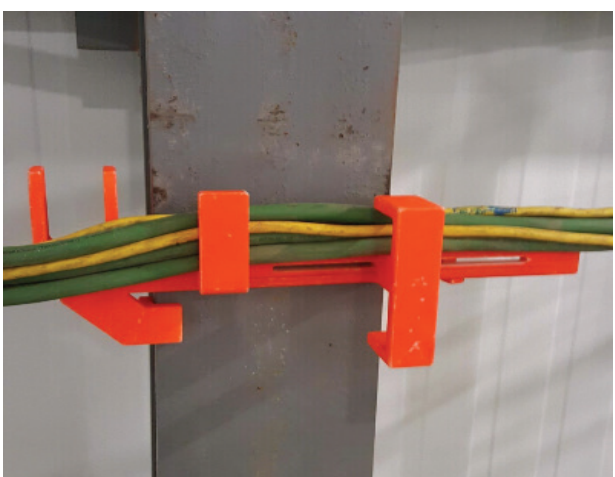
Temporary Extension Cord Protectors
(Picture Courtesy of GLY Construction)



Temporary Extension Cord Protectors
(Picture Courtesy of GLY Construction)

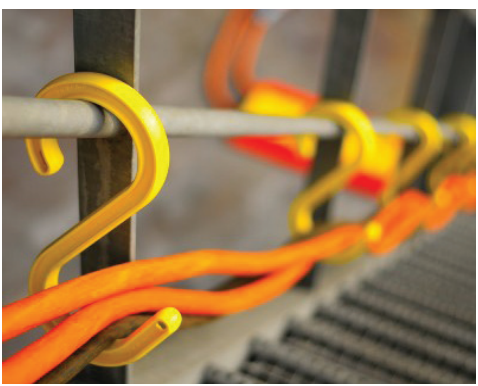


Safety Cord Management Bracket
(Sheep Industry, LLC)



Temporary Extension Cord Protectors
(Source: Cochran Inc.)

Temporary Extension Cord Protectors “S” Hook
(Source: vdb-international.com)



31. Ceramic Blades

Activity Name

All activities involving material cutting.

Task

Cutting materials using a knife or similar object.

Problem

Cutting materials such as paper, cardboard, insulation, and other similar building materials requires a cutting tool. Knives are commonly used for cutting as well as opening containers such as cardboard boxes. Improper cutting practices can lead to severe puncture, laceration, and amputation injuries. In some cases, the cutting tool does not need to be very sharp, and can be made of a softer material, in order to do the job. Tools that are less sharp and made of softer materials can help to eliminate injuries that occur due to poor cutting practices. In addition, tools that are not as sharp present less of a hazard when carrying and storing the tools.

Solution

Blades that are made out of ceramic material provide useful cutting tools that are safer than metal knives in some ways yet just as effective in many situations. Advanced ceramic materials all share some characteristics that benefit safety (e.g., chemically inert, non-sparking, non-magnetic, does not rust, and high wear resistance, all of which leads to a longer lasting

knife and less handling). The challenge is to create a tool that effectively cuts most materials but has difficulty penetrating skin. McKinstry Co. shared information about ceramic blades. Ceramic blades are designed to be effective for cutting many materials yet safer to use. However, ceramics can be, and frequently are, sharpened to unsafe levels. If so, ceramic blades are just as sharp as steel and all retain their edge longer. The ability to penetrate skin differs for each manufacturer of ceramic blades.

The sharpness of the blade is of concern, including how fast a blade loses its sharpness. Metal blades are most dangerous when they are too sharp or too dull, and can go dull quickly. When new, blades are often so sharp that they can penetrate skin very easily. With continued use of a blade, the blade dulls. Metal blades can dull very quickly and soon be too dull to cut materials easily. When dull, users commonly try to exert more force to cut materials, which increases the risk of an injury. Also, injuries frequently occur when changing blades.

Ceramic blades, however, typically dull more slowly and therefore are not as sharp when new. The sharpness depends solely on how the manufacturer grinds the blade. Unfortunately, most ceramic blade manufacturers grind the blade at the same angle as they would for steel, which does not make them safer for preventing lacerations. The number of uses between sharpenings is greater for ceramic blades, and therefore making them safer to use. Given that they do not need to be changed as often, injuries during blade changes are

less. Another benefit of ceramic blades is that they are non-conductive; the blades can be used when there are concerns regarding electrical shock.

A wide variety of different types of tools with ceramic blades are available. Slice, Inc. (https://www.sliceproducts.com/en-ca) is one manufacturer of cutting tools containing ceramic blades that are safer to use in terms of preventing lacerations. What makes Slice's ceramic blades unique is the sharpened edge. Slice's edge, a proprietary design, consists of a double-angle grind, which shortens the initial cutting zone. This type of edge creates a duller, but safer blade, i.e., a "finger-friendly" edge.

Additional Items to Remember

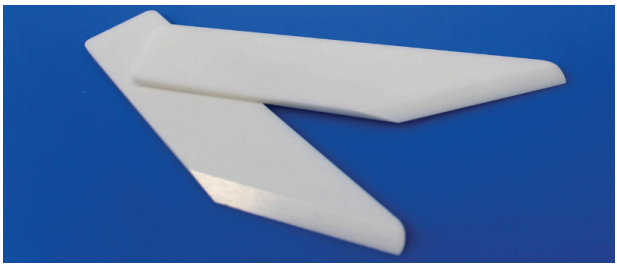
As with any hand tool used for cutting materials, safe cutting practices need to be followed when using a ceramic blade.

Advanced ceramic materials have very high hardness, and much harder than metals. As a result, sharpening ceramic blades requires a grinder with a diamond wheel. Without access to a grinder with a diamond wheel, a ceramic blade should not be sharpened.

Acknowledgements

The information provided in this section was shared by McKinstry Co. and is used with permission from Slice, Inc.

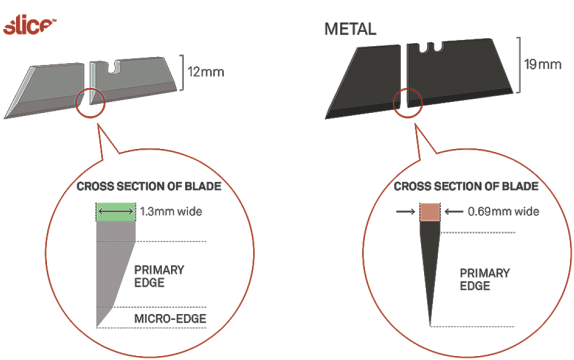
Ceramic Blades for Material Cutting
(Picture Courtesy of Slice, Inc.)



Blade Edge Design for Slice, Inc. Ceramic Blade (left) and Other Metal and Ceramic Blades (right)

http://www.sliceproducts.com/faq/why-are-slice-ceramic-blades-safer-than-metal-blades

(Picture Courtesy of Slice, Inc.)



32. Ladder-Guard™ System

Activity Name

All activities requiring elevated work.

Task

Climbing up and standing on a ladder to perform and access elevated work.

Problem

Falls from ladders is one of the top causes of injuries. Standing on the top cap or top step of a step ladder, for example, often results in collapse of the ladder and injury to the employee. On average, 136,000 people are treated in an emergency room each year as a result of a fall from a ladder (Epha, Inc. 2018). Given the prevalence of falls from ladders in construction, some companies have a "no ladder" policy on projects.

When a ladder is used, however, safe practices need to be followed. Employees are often not mindful of ladder use. When using a stepladder, employees may choose to stand on the top step or top cap of a stepladder in order to reach higher. Doing so greatly increases the chance of falling. Measures are needed to prevent employees from unknowingly, or intentionally, standing on the top step or top cap of a stepladder.

Solution

Comfort Systems USA shared a product, the Ladder-Guard™, that can help prevent unsafe use of ladders. The Ladder-Guard™ System from Epha, Inc. (http://www.epha.com/ladderguard/) is designed to prevent standing on the top step or top cap of a stepladder. The system consists of a lightweight, plastic barrier that is attached to the side rails of the ladder between the top step and top cap. The ladder prevents employees from stepping on the top step. In addition, because they cannot step on the top step, it is very difficult to step all the way up to the top cap.

Additional Items to Remember

The manufacturer of the ladder should be consulted to ensure that the Ladder-Guard™ System does not interfere with the ladder's performance. Approval from the ladder manufacturer may be needed to verify that the system will not compromise or restrict ladder use in a way that makes use of the ladder unsafe.

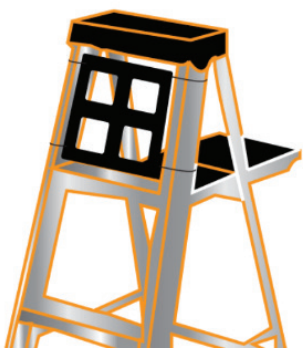
As with any ladder used on a construction site, safe practices for use of the ladder need to be followed. This includes how high to stand on the ladder, maintaining at least 3 points of contact at all times, placing the ladder on a stable surface and away from electrical lines, ensuring proper maintenance of the ladder, plus other safety measures. Subpart X of the OSHA Safety and Health Regulations for Construction (CFR 1926.1053)

provides regulations that must be followed when using a ladder.

Acknowledgements

The information provided in this section was shared by Comfort Systems USA and is used with permission from Epha, Inc.

Ladder-Guard™ System
(Picture Courtesy of Epha, Inc.)



33. Plate Vise™

Activity Name

All activities involving materials that may unintentionally roll or move.

Task

Holding the materials secure while working on the materials.

Problem

Some materials such as pipe can be difficult to work with because they can easily roll or be displaced. The shape of the materials and lack of a handhold can make them hard to work on. In some cases the materials need to be secured temporarily for cutting, welding, or other preparation tasks. Materials that move suddenly while being worked on can lead to injuries associated with the materials falling, impact of the materials, and contact with the equipment used to work on the materials (e.g., saw). A stable, secure means is needed to prevent the materials from moving and allow for work on the materials.

Unsafe Cutting Practice

Solution

To help address this concern, McKinstry Co. suggested the Plate Vise™ from Tri-Vise Industries (http://tri-vise.com/), which is designed to stabilize and secure materials such as pipe to allow for working on the materials. A pipe, for example, is inserted through the Plate Vise™, which elevates the pipe and enables it to be easily cut. In addition to plastic and metal pipe/conduit, other materials that can be secured include rebar, lumber, dowels, and other similar long, slender objects. The Plate Vise™ is lightweight and easy to carry.

Additional Items to Remember

The Plate Vise™ is designed to support many different

types and sizes of materials. However, it should not be used with very heavy materials that may bend or break the Plate Vise™ during use. Consideration needs to be given to the amount of weight that it can support. In addition, when cutting the materials, the Plate Vise™ needs to be located so that the cutting tool does not impact or cut the Plate Vise™. The Plate Vise™ should be situated away from the location of the cut, yet at a location where it can adequately support the material.

Acknowledgements

The information provided in this section was shared by McKinstry Co. and is used with permission from Tri-Vise Industries.

Cutting Steel Pipe Supported by Plate Vise™ (Courtesy of Tri-vise)

34. Auto-Retracting Utility Knife

Activity Name

All activities involving material cutting.

Task

Cutting materials using a knife or similar object, and opening packaging materials.

Problem

Mechanical construction often requires cutting materials and opening supply packaging using knives or similar cutting tools. Knives are commonly used for cutting as well as opening containers such as cardboard boxes. Improper cutting practices can lead to severe puncture, laceration, and amputation injuries. In some cases, the injury occurs before or after the cutting operation while the blade is exposed. Exposed blades present active hazards when carried by employees and also when placed in an open work area.

Solution

Typical utility knives require the blade to be manually retracted when not in use. The challenge is to create a tool that can be used efficiently to cut materials yet not expose employees to the sharp blade when the tool is not being used. One example of a solution to this issue,

shared by Comfort Systems USA, is the Wiss Auto-Retracting Safety Utility Knife manufactured by the Apex Tool Group (http://www.wisstool.com/knives/wiss-wkar2-wiss-auto-retracting-safety-utility-knife.html). This utility knife retracts the blade automatically the moment it loses contact with the material being cut. The blade retracts into the enclosed knife handle even if the user is still holding the lever in the open position. When inside the handle, the blade cannot accidently lead to lacerations while being carried by the employee or placed in an open work area. This safety innovation can be effective in preventing injuries related to material cutting. Additional examples of similar tools with retracting blades are also available.

Additional Items to Remember

As with any hand tool used for cutting materials, safe cutting practices need to be followed when using a utility knife. Employees should always wear protective gloves while using a utility knife, and push the knife in a direction away from all parts of the employee's body. In addition to a retractable blade, a utility knife with a comfortable, non-slip handle is another asset. There are many different designs and types available from a variety of manufacturers. One example is the Klever X-Change Cutter manufactured by Klever Innovations (http://www.kleverinnovations.net/our-products/safety-cutters/klever-xchange/).

Acknowledgements

The information provided in this section was shared by Comfort Systems USA and is used with permission from Apex Tool Group.

Auto-Retracting Utility Knife for Material Cutting (Courtesy of Apex Tool Group)

Utility knife with comfortable, ergonomically-shaped, non-slip grip (Klever Innovations)

35. Kneeling/Sitting Creeper

Activity Name

All construction activities that require frequent kneeling, squatting, or stooping.

Task

All construction tasks that require frequent kneeling, squatting, or stooping.

Problem

Many mechanical construction tasks involve working close to or on the floor such as in fabrication shops or central utility plant construction. When performing these tasks employees are constantly kneeling, squatting, or stooping; all of these awkward postures increase the risk of musculoskeletal disorders.

Solution

The Kneeling/Sitting Creeper from Racactac comes with an adjustable seat, kneepads, and casters. Instead of sitting back on your heels, the fully adjustable seat provides the upper body support, leaving the worker's feet free to control movement. Comfortable attached floating-like kneepads allow the worker's knees to rest and move freely. They eliminate direct knee to floor pressure, circulation problems. The casters allow employees to roll to move, instead of crawling

and bouncing on their knees, elevate their body, and eliminate the normal pressure on toes, ankles, and knees. These devices also can reduce stooping since they make kneeling at floor level more comfortable

Additional Items to Remember

- Product Information: Racatac Products Inc.; To obtain information, visit http://www.racatac.com or contact 337-886-1222; racatac@bellsouth.net
- CPWR Construction Solutions: http://www.cpwrconstructionsolutions.org/masonry/solution/137/kneeling-creepers.html

Acknowledgements

The information provided in this section was used with permission of Racactac Products Inc.

Kneeling Creeper
(Picture Courtesy of Racactac Products Inc.)

Kneeling Creeper
(Picture Courtesy of Racactac Products Inc.)

36. Casters for Stepladders

Activity Name

All activities requiring elevated work and the use of a stepladder

Task

Moving a stepladder to the work location.

Problem

When a stepladder is used repetitively in multiple locations, the employee needs to pick up and carry the ladder to each location. Heavy ladders can expose employees to strains and sprains when lifting the ladders. Additionally, lifting stepladders of any weight many times may result in repetitive motion injuries. The frequency of these types of injuries can be magnified if the stepladders are large and/or tall and need to be moved within a crowded work area. Assistance with moving the ladders can reduce the exposure to injuries associated with ladder use. When working alone, assistance with moving the ladder from another employee may not be available.

Solution

Casters that are attached to the feet or bottom rung of a

stepladder can assist employees with moving the ladder. One example, shared by Comfort Systems USA, is the set of casters manufactured by Werner Co. (http://www.wernerco.com/us/view/Products/Climbing-Equipment/Accessories/40/40-2HD). The casters are design to be attached to the bottom rung of the stepladder. When adjusted to an appropriate height, the casters enable rolling the ladder rather than carrying it. The system consists of lightweight wheels and attachment brackets. When the stepladder is opened up for use, the casters do not touch the support surface and therefore do not allow the ladder to roll when being used.

Additional Items to Remember

The manufacturer of the ladder should be consulted to ensure that the casters do not interfere with the ladder's performance. Approval from the ladder manufacturer may be needed to verify that the casters will not compromise or restrict ladder use in a way that makes use of the ladder unsafe.

As with any ladder used on a construction site, safe practices for use of the ladder need to be followed. This includes how high to stand on the ladder, maintaining at least 3 points of contact at all times, placing the ladder on a stable surface and away from electrical lines, ensuring proper maintenance of the ladder, plus other safety measures. Chapter 296-876 WAC provides regulations that must be followed when using a ladder.

In addition, moving heavy objects, such as ladders, can lead to back injuries if proper lifting practices are not used. Employees need to follow safe lifting practices when moving ladders to the work location.

Acknowledgements

The information provided in this section was shared by Comfort Systems USA and is used with permission from Werner Co.

Casters for Stepladders (Courtesy of Werner Co.)

37. StrongArm Tech. FLx ErgoSkelton

Activity Name

All trades where employees engage in regular lifting, twisting, and dynamic body motion tasks.

Task

All tasks where employees engage in regular lifting, twisting, and dynamic body motion tasks.

Problem

Industrial employees in manual materials handling (MMH) settings often overlook proper lifting techniques and posture due to time pressures, or are simply unaware or their importance. As a result, many employees lift using improper and dangerous ergonomics posture. Over time, moving improperly leads to significant incidences of musculoskeletal injuries (MSI) for individuals working these tasks. MSIs account for a significant amount of lost workdays, and expensive, recordable injuries in the workplace costing the economy billions of dollars each year.

Solution

The FLx Ergoskeleton works as a completely non-powered posture conformance device – gently

reminding employees when they are using improper lifting techniques such as excessive bending or twisting, by applying light pressure via a "posture conformance pad" on the worker's back. The FLx is a lightweight mechanical device that uses cutting edge design to ensure that the posture pad applies pressure only when needed. This pressure prompts the worker to change their posture and reminds them to conform to proper OSHA lifting standards throughout the workday.

Additional Items to Remember

- Intelex/StrongArm tech White Paper: SAT-Intelex-Ergo-Skeleton.pdf
- Further product information: https://www.strongarmtech.com/products#flx

Acknowledgements

The information provided in this section was used with permission of StrongArm Technologies.

FLx ErgoSkelton
(Picture Courtesy of StrongArm Technologies)

38. StrongArm Tech. V22 ErgoSkelton

Activity Name

All activities where employees consistently engage in long term lifting and carrying of heavy loads (>20lbs).

Task

All tasks where employees consistently engage in long term lifting and carrying of heavy loads (>20lbs).

Problem

Industrial employees are often tasked with quickly and repetitively lifting or carrying heavy loads over long distances. The repeated stress of this type of movement rapidly deteriorates the strength of a worker's upper body muscles. This, in turn, leads to improper lifting techniques and a high risk of injury. When lifting heavy loads improperly, the risk of musculoskeletal injuries (MSI) increases dramatically. MSIs account for a significant amount of lost workdays, and expensive, recordable injuries in the workplace costing the economy billions of dollars each year.

Solution

The V22 Ergoskeleton works as a completely non-powered lift-assist device. It functions by transferring a load from a worker's arms and shoulders into the core and leg muscles through a mechanical cable system,

creating a safer and more stable lift. This transfer of load relieves stress and fatigue in the weaker muscle groups and allows a worker to lift both more effectively and more safely using proper ergonomics methods.

Additional Items to Remember

- Intelex/StrongArm tech White Paper: SAT-Intelex-Ergo-Skeleton.pdf
- Further product information: https://www.strongarmtech.com/products#flx

Acknowledgements

The information provided in this section was used with permission of StrongArm Technologies.

V22 ErgoSkelton
(Picture Courtesy of StrongArm Technologies)

39. Ceiling Wire Safety Caps

Activity Name

General work activities by trades in areas where ceiling wires have been installed.

Task

An inspection of ceiling space, installation of mechanical and electrical products, continuous tenant improvement projects.

Problem

During the inspection of ceiling space and when performing related construction tasks inside ceiling space, the sharp end of tile hanger wires poses an impalement and cut hazard to the employees.

Solution

Use of ceiling wire safety caps will help guard the sharp end of the ceiling wires. While the current practice is to bend the wires, it does not eliminate the hazards.

Additional Items to Remember

- The construction environment is busy and

hazardous. When working in above grid conditions, lighting is often poor and ceiling wires are nearly invisible especially when employees are focused on a task. Installation of ceiling wire safety caps during ceiling installation is preferred; there is always time available to make a work area safe.

Acknowledgements

The information provided in this section was used with permission from David Rightmire of JELD.

Ceiling Wire Safety Cap
(Picture Courtesy of JELD)

40. Moveable Guardrail

Activity Name

All activities that are conducted at elevation and adjacent edges protected by temporary guardrails.

Task

All tasks that require use of a ladder immediately adjacent to the temporary guardrail.

Problem

Working at elevation poses the risk of falls for employees. Temporary guardrails are commonly used along exposed edges to keep employees from falling over the edge. Mechanical work is commonly performed adjacent elevator, stair, and mechanical shaft openings. These openings may be protected by guardrails. In some cases, the work activities adjacent the openings require employees to use ladders. When an employee is on a ladder next to the opening, the employee is elevated relative to the temporary guardrail. As a result, the guardrail is too low to protect the employee. In this case, additional protection is needed to keep the employee from falling over the guardrail. In addition, the additional protection may need to be easily moved from one location to another as the work progresses to different locations.

Solution

Charter Mechanical Contractors shared a unique product that can help address this safety concern. A moveable guardrail can provide the necessary additional protection when working on a ladder adjacent a temporary guardrail. Moveable guardrails consist of metal frames that can be attached to a temporary guardrail using brackets. The moveable guardrail is long enough to adequately cover the length of the work area, and tall enough to provide additional protection while the employee is elevated on the ladder. Such a moveable guardrail can be relocated easily from one work location to another. It is especially useful in locations where overhead anchorage of a safety lifeline is not available or use of a lifeline will be obstructive to the work operation or is infeasible.

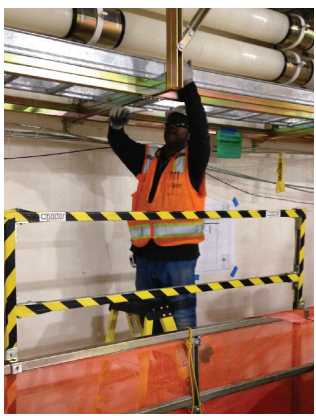
Additional Items to Remember

The moveable guardrail is attached to the temporary guardrail using metal brackets. To be effective, the brackets and moveable guardrail must be designed to keep an employee from falling. In addition, the temporary guardrail to which the moveable guardrail is attached may need to be strengthened in order to resist the force higher than the top rail of the temporary guardrail. Subpart M of the OSHA Safety and Health Regulations for Construction (WAC 296-155-24615(2)) provides regulations that must be followed when designing and using a guardrail for fall protection.

Acknowledgements

Charter Mechanical Contractors in Portland, OR (http://www.chartermechanical.com/) provided this example of a safety innovation for fall protection. The information provided in this section was shared by Charter Mechanical and is used with permission from Charter.

Moveable Guardrail
(Courtesy of Charter Mechanical)



41. Pipe Cart

Activity Name

All activities that involve the use and/or installation of heavy and awkwardly-shaped materials.

Task

Transporting the materials to the work location.

Problem

On projects that involve the construction of multi-story buildings, mechanical construction work requires transporting materials to the upper floor levels. On other types of projects, materials may need to be moved long distances. This task is often performed many times during the course of a project by employees carrying the materials. Transporting the materials across a project and to upper floors using stairways presents hazards when the materials are heavy, numerous, and awkwardly-shaped, and when unprotected tripping and fall hazards exist on the jobsite. Strain and sprain injuries may also occur when employees have to repetitively carry materials up many floor levels. Moving the unused materials back down to ground level also poses safety hazards in the same manner. This safety hazard is especially present when transporting pipe through a crowded building.

Solution

Charter Mechanical Contractors described how a rolling cart can help alleviate this safety concern. A rolling cart allows for easy and safe movement of materials throughout a project. “Pipe carts” have been used successfully to move pipe to the work location. The carts consist of a support frame, raised handle for pushing and steering the cart, side rails (optional), and support wheels. For movement of pipe within a multi-story building, it is helpful if the cart size allows it to fit within an elevator while still being large enough to move full pipe spools. In addition, the frame and wheels need to have sufficient strength to support the desired loads. Control of the cart while it is moving is important; the handle should facilitate easily steering the cart. An adjustable-height handle further prevents strains/sprains due to awkward postures when using the cart. Importantly as well, the brakes should be included on the wheels to prevent the cart from moving during loading and offloading.

Additional Items to Remember

The structural capacity of the cart should be determined and posted on the cart. The car should never be overloaded. Also, special side rails and/or straps should be used to stabilize the pipe on the cart when being moved. The cart should not be loaded too high such that the materials easily topple over. For offloading the cart, the wheel brakes should always be used. In addition, the cart should not be overloaded such that it presents a

hazard when trying to push it up sloped surfaces.

Acknowledgements

Charter Mechanical Contractors in Portland, OR (http://www.chartermechanical.com/) provided this example of a safety innovation for moving pipe throughout a project. The information provided in this section was shared by Charter Mechanical and is used with permission from Charter.

Pipe Cart (Courtesy of Charter Mechanical)

42. Hose Press for Barbed Fitting Connections

Activity Name

All activities that involve flexible hose.

Task

Connecting hoses to barbed fittings.

Problem

Barbed fittings are commonly used to for hose connections to create lasting and tight connections. Using barbed fittings requires the hoses to be pushed over the barbs, a task that often requires extra force to get the hose end past the barbs. When excessive force is required, employees can be injured while trying to insert the fitting into the pipe. In addition, an employee's hands may slip from the hose during the connection process if the hoses are slippery, further creating the possibility of hand and arm injuries.

Solution

A hose press, shared by Charter Mechanical Contractors for this booklet, can be used to eliminate this hazard and reduce hand/arm injuries. The hose press uses leverage to increase the force being applied to the hose while pressing it onto the fitting. As shown in the figure below,

the hose press consists of two long steel arms that are connected to each other at their ends by a hinge. The hinge allows the arms to be moved closer or farther apart from each other. The barbed fitting is attached to one of the arms using a clamp. The hose is secured to the other arm. The arm with the hose is then pushed towards the other arm containing the fitting in order to press the hose over the fitting. Using the steel arms keeps the employee's hands away from the connection, and increases the amount of leverage, and therefore force applied. The hose press is an easy-to-use tool that enables safely pressing flexible hose onto barbed fittings when a large amount of force is required.

Additional Items to Remember

Care should be taken to not damage the hose when making the connection. The hose should be sized such that it fits securely around the fitting without being too loose, or being damaged during the connection process. In addition, the fitting and the hose need to be kept secure to the steel arms so that they do not slip during the process.

Acknowledgements

Charter Mechanical Contractors in Portland, OR (http://www.chartermechanical.com/) provided this example of a safety innovation for connecting flexible hoses to barbed fittings. The information provided in this section was shared by Charter Mechanical and is used with permission from Charter.

Hose Press/Clamp for Barbed Fittings
(Courtesy of Charter Mechanical)

43. Personal Active Safety Systems – HALO Light

Activity Name

All construction activities that require artificial illumination.

Task

All construction tasks that require artificial illumination.

Problem

Mechanical trade employees are often working in low-light environments, including buildings without electricity, confined spaces with limited illumination, and ceiling or HVAC spaces. Insufficient illumination can lead to injury when hazards are not seen. It may also reduce work quality and necessitate costly re-work.

Current task lighting solutions include bulky task lights that take time to move manually, cast shadows in the work area, and leave dark spaces between lights, and headlamps, which only illuminate in a narrow beam.

Solution

The Halo Light is a personal safety and task light that attaches to any standard hard hat and illuminates in 360

degrees. It's portable and personal, traveling with the worker as they move through the worksite to eliminate shadows. The Halo fully illuminates the work area, reducing hazards and increasing quality. It is currently used by 29 of the 50 state DOTs and more than 150 of the ENR top 400 contractors.

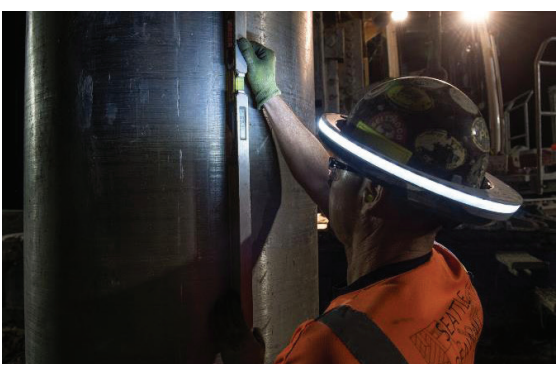
Additional Items to Remember

- Product Information: https://www.illumagear.com/store/halos/halo

Acknowledgements

The information provided in this section was used with permission of Illumagear.

An Employee using HALO Light in the Field (Picture Courtesy of ILLUMAGEAR)



44. Incident Reporting Hotline

Activity Name

Incident Management.

Task

Incident Reporting.

Problem

Timely reporting of incidents and taking action to address them is a challenging task. There are obstacles such as employees not knowing who to call, email, and speak to when they witness or are involved in an incident. Sometimes, their direct manager is not available, and there is always a possibility of communication breaks between field employees and management staff with respect to what actions to take correct.

Solution

Create a single incident reporting hotline number. The incident hotline receives all the calls from incident reports, records them, and notifies the employees that who should get the report to take action on them. This process keeps the company aware of the incident in a timely manner to help the employee and create fast corrective actions to avoid other incidents. In order to

properly analyze the data and capture the information, this process ensures that the incidents are documented. Additionally, if field employees have access to tablets or smartphones, an incident reporting app could be used in conjunction with the hotline.

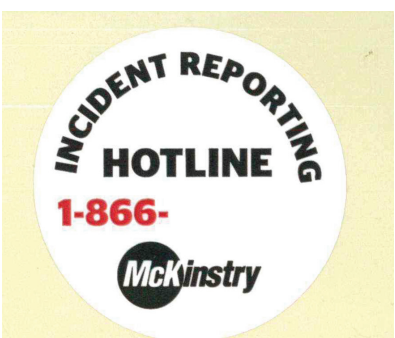
Additional Items to Remember

Contractors should develop and implement a standardized questionnaire for the call center to assist in gathering information from the callers.

Acknowledgements'

The information provided in this section was used with permission from McKinstry Co.

Incident Reporting Hotline Sticker (Picture Courtesy of McKinstry Co.)



45. Incident Report Summaries

Activity Name

Incident Management system.

Task

Incident summaries and lessons learned communication to field project management and employees.

Problem

Incident summaries are usually communicated to, handled by, and managed at the corporate/regional/office levels. Individual projects rarely hear about the incidents that happened in other locations. Craft employees have limited or no access to the incident information to discuss and learn from them.

Solution

Create incident report summaries that are available to all employees and that can be accessed from anywhere. These summaries include all reported incidents such as near misses, first aid injuries, and OSHA recordable injuries. Some distribution methods include, but are not limited to, a weekly summary of the incidents emailed to craft employees, making the summary available in the company intranet accessible to all employees, and

use of Business Intelligence tools such as PowerBI or Tableau to make them available in a live report in mobile devices. The availability of incident report summaries to employees helps them stay aware of how others are getting hurt and how they themselves could possibly get injured. The reports are good tools for supervisors to go over the issues that are relevant to them and the jobsite and how to prevent similar injuries in the future. Enabling employees to review incident reports keeps them aware of similar situations and able to correct them.

Additional Items to Remember

- Reports should have consistent format for better usability.
- Consistent distribution method.
- Encourage field employees to utilize the reports as discussion points with their crews.

Acknowledgements

The information provided in this section was used with permission from McKinstry Co.

Summary of Incident Report
(Picture Courtesy of McKinstry Co.)

Summary Incident Report

Date of Incident	Incident Class	Department	Project Name	Description	On-Time Report
8/11/2017	First Aid Only	[redacted]	[redacted]	Workers were using strap to lift 4in conduit. The conduit slipped out of the strap and fell. On its way down in scraped the knee and shin of the worker, breaking the skin. The worker also complained of a sore knee after the incident.	Yes
7/14/2017	First Aid Only	[redacted]	[redacted]	Worker got a wood chip/debris in his eye while working. He used eye wash to dislodge debris. No further medical attention required. Supervisor was made aware of incident.	No
6/9/2017	First Aid Only	[redacted]	[redacted]	Worker was working on wall studding, when he retracted his hand from the stud framing a sharp piece of debris punctured through his glove.	Yes

46. Business Intelligence for Safety Management

Activity Name

Safety Management Systems

Task

Providing Safety information for leaders and employees

Problem

Business leaders require data about and the status of their business to manage it effectively. Safety information is not an exception. However, safety information is often not provided in a timely manner and the data may not be consistent without using a robust safety management system.

Solution

Create a framework to consistently transform raw data or safety reports into readily available actionable information for business leaders through data visualization of a safety management system. A safety management dashboard significantly changes how company leaders (management and field) discuss and think about safety. Instead of waiting for a monthly report to be generated or guessing about what is going on, a dashboard lets leaders know in real-time what is happening on their projects. This data includes, but is not limited to, recordable incident rates, cost of injury, hours worked, types of incidents,

who is getting hurt and at what level (trade/experience), on time reporting, training completion, audit scores, jobsite hazard observations, etc. All of the data can be reviewed down to the actual input reports to gain as much clarity as is needed.

Additional Items to Remember

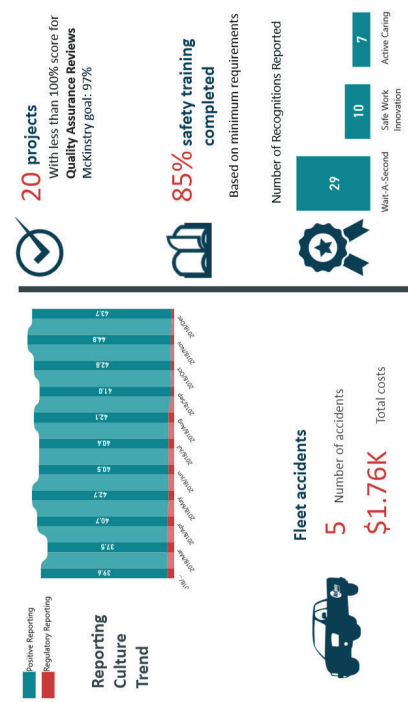
Contractors should:

- Standardize the reporting process
- Create a process for data collection
- Develop a communication plan to share data analytics with employees
- Encourage employees at all levels to utilize the tool for data driven decision making

Acknowledgements

The information provided in this section was used with permission from McKinstry Co.

Dashboard sample based on example (Picture Courtesy of McKinstry Co.)



47. PPE Glove Station

Activity Name

All activities that expose a worker's hands to hazardous conditions and substances.

Task

All tasks that expose a worker's hands to hazardous conditions and substances.

Problem

Mechanical construction involves an intense amount of work with a person's hands. As a result, hand protection is an important aspect of a safety program for mechanical contractors. Protecting employees' hands from injury can greatly reduce injury rates. Adequately protecting an employee's hands will depend on the work task being undertaken. Many different types and styles of gloves are available, and each is designed for a specific application. In cases where the appropriate pair of gloves is not available, or it is inconvenient for the employee to go get the gloves, the employee may choose to use a pair of gloves not designed for the task at hand or choose not to wear gloves at all. Making sure that gloves are conveniently stored, and that the employees know the correct type of glove to wear in each situation, are important to ensure proper hand protection.

Solution

A highly organized glove station, like that used by McKinstry Co. shown in the figure below, can help overcome this potential problem. The glove station has two parts. On the top is a board that shows the different types of gloves available and indicates the situations in which each type of glove should be used. The bottom part of the glove station includes a cabinet in which the gloves are located. The gloves are organized in the cabinet in an orderly fashion so that it is easy for the employees to pick out the right type of glove. The orderly organization of the gloves also makes it easier to identify when the supply of a certain type of glove is getting low and more need to be ordered.

Additional Items to Remember

The appropriate type of gloves for the task should be made available for all of the work tasks to be undertaken. PPE will be provided by the employer to protect employees from hazards they are exposed to. In addition, gloves of different sizes should be available to accommodate employees with different hand sizes. Gloves made available to employees should be clean and maintained free of holes, loose materials, and hazardous chemicals. Gloves that are worn out, contaminate, and deteriorated should be discarded. Best practice is to stock only new gloves in the glove station. The glove cabinet should be kept in an orderly fashion; a disorganized cabinet will discourage employees if they have to take extra time to search for the right type, size, and hand (left or right) of gloves.

Also, gloves that have deteriorated over time should not be used. Regular, long-term glove use, and extreme glove use, may lead to holes in the gloves, reduced thickness of the glove material, or other damage to the gloves that decreases their effectiveness. Special attention should be given to making sure the gloves are not worn out. The gloves need to be able to provide complete protection on all areas of the hands and fingers, and also enable gripping of tools, materials, and equipment. A plan should be in place to monitor the quality of the gloves. Gloves that are worn out should be discarded.

Acknowledgements

The information provided in this section was used with permission from McKinstry Co.

PPE Glove Station (Picture Courtesy of McKinstry Co.)

48. Safe Work Planning

Activity Name

Work Planning

Task

Safety Planning

Problem

One of the challenges for project employees is to figure out the sequence of tasks, associated safety controls, and their role in completing the tasks. This challenge can cause confusion between project management personnel, safety professionals, and craft employees about who is responsible for completing which task. When the roles and responsibilities are vague, it is harder for leaders to manage accountability, discover systematic issues, and create effective actions for improvement.

Solution

All employees are responsible for the safety of the project. In order to solve the above-mentioned issues, creating a standardized tool for effective planning and documentation of the safety steps is necessary. The Safe Work Planning process is a thorough set of steps that covers all safety-related concerns from project conception

through completion using best known safety practices. All of the steps should have an assigned employee for clear roles and responsibility. This process should be an integral part of the overall project plan, and be completed prior to deployment of resources onto a site.

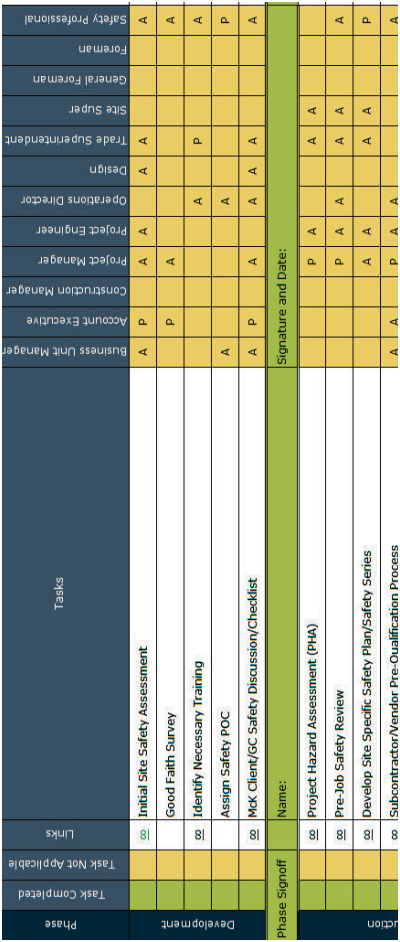
Additional Items to Remember

- Integrate this tool into work planning of the projects
- Create classes for employees to understand the tool
- Periodic audit of the tool completion and process

Acknowledgements

The information provided in this section was used with permission from McKinstry Co.

Safe Work Planning Sample
(Picture Courtesy of McKinstry Co.)



49. Shipping and Dispatch Calendar

Activity Name

The material fabrication pipeline that includes the material request from construction site team (e.g., pipe spools), receiving orders, fabricating materials, and shipping the material to the site.

Task

The material pipeline that includes the material request from construction site team (e.g., pipe spools), receiving orders, fabricating materials, and shipping the material to the site.

Problem

A lack of a material fabrication and shipping system in place to receive fabrication orders, complete fabrication, and ship materials to the sites may create productivity, quality, and safety issues (e.g., schedule pressure).

Solution

To overcome the problem described above, McKinstry Co. and many contractors use a fabrication/shipping calendar that shows the shipping details such as project, product requests, delivery date, etc. The shipping calendar streamlines the scheduling, avoids confusions

with orders, and assists in the timely delivery of materials to the job sites. It reduces congestion in the dispatch area where finished products are staged for shipping. It also helps with material handling in the loading zone and ensuring the right size delivery vehicle.

Acknowledgements

The information provided in this section was used with permission from McKinstry Co.

Shipping Calendar accessible to all employees (Picture Courtesy of McKinstry Co.)

50. Ladder Last Program

Activity Name

All activities that traditionally require the use of ladders.

Task

All tasks performed at elevation or access to and from elevated work areas.

Problem

Construction craft employees are exposed to fall hazards and are at high risk of falls while performing work on ladders, which is evident from the high number of incidents involving falls from ladders. The exposure and resulting incidents impact worker safety, costs associated with falls, decreased work quality and productivity, and negative impact on worker job satisfaction and morale.

Solution

In 2010, Turner Construction Company, in consultation with its insurance partners and the National Institute for Occupational Safety and Health (NIOSH), began studying and analyzing Turner's ladder and other work from heights incidents to determine better alternatives to complete a task without the use of a ladder. To improve safety and mitigate or control the risk Turner created a

Ladder Last Program (LLP). The program was designed to govern how activities involving work at heights are specified, designed, planned, and executed on Turner job sites.

The LLP looks at productivity, quality, and safety as mutually supportive functions. Turner engaged the trades by demonstrating how this program reduces wear and tear on the body; specific items can be pre-fabricated, delivered, and installed, and proving time efficiency can be increased. Within the program, ladders must be considered as a last means of access and egress for all work, and only used where no other means (other than safer methods) is possible. The ladder tag (see picture) is used as a pre-planning tool to achieve this goal. A safer means of access could be stairs, rolling stairs, scissor and aerial lifts, scaffolds, and Tele-towers (see picture).

Turner launched the LLP in May 2011 and published the full policy requirements to be implemented on all new projects in August 2011. The success of the program is evident from an experienced reduction of fall incidents involving ladders, which was 9% in 2012 and 12% in 2013. The LLP policy and procedures are listed below.

Ladder use on Turner Construction projects will be allowed only when it has been determined there is no other feasible option to complete the task. Prior to

beginning work, the subcontractor or superintendent shall evaluate all tasks that require individuals to work at elevated heights. If it is determined that a ladder must be used the subcontractor shall complete the Turner Construction Ladder Use Permit, Job Hazard Analysis, and Pre-Task Plan, and have it reviewed and approved by the Turner Superintendent. Prior to starting work each shift, the Turner Ladder Safety Inspection Checklist shall be completed and affixed to all ladders. At no time will a ladder be on site without a current permit and safety checklist. For repetitive work, a "multi-day" permit may be used in lieu of a daily permit. Daily ladder inspections still occur but the permit/tag should be modified. Platform or podium ladders shall be the ladder of choice on Turner Construction projects.

Work platform with Handrails
(Picture Courtesy Turner Construction Company)

Additional Items to Remember

The program may achieve better success if it is implemented during the contracting phase of a project so that subcontractors can budget proper costs for alternative equipment costs. Contractors must include the program requirements in the contract language to support this program. Contractors should remember the following safety precautions when implementing the LLP:

- Do not rely too heavily on the ladder tags themselves because they can give a false impression (old tags on ladders or no preplanning before use).
- The ultimate goal of the ladder tag is to create a conversation. The tag should only be issued after all parties understand the need for the ladder, decide that there is no alternative to ladder use, and discuss safe operations of the work using the ladder.
- The goal of this program is to remove possible fall hazards when working from ladders and to promote the use of other alternatives for work at elevations.
- The primary focus is about the preplanning and removal of fall hazards when working from ladders.
- Training should be a critical component of the program implementation. Develop and implement training for the whole organization

on the program goals, preplanning skills, and current best practices, and on the proper use of the tags and ladder inspections.

Acknowledgements

The information provided in this section was used with permission of Turner Construction Company. The opinions and guidance expressed in this handbook are those of the author and not necessarily those of Turner Construction Company. This best practice tool is only included as an example, and the users should be aware that the checklist may reference safety regulations depending on the company's regulatory jurisdiction. It is the user's responsibility to ensure that they adapt the best practices provided in this checklist for their jurisdiction and comply with all applicable local, state, and federal regulations affecting their workplace.

Sample Ladders Last Permit Tag (Picture Courtesy

Turner Construction Company)

LADDER INSPECTION CHECKLIST

Inspector:	Date:
Location:	Time:

- Complete Permit on reverse side and submit to Turner.
- Once permit approved, inspection and tag all ladders passing inspection.
- Tag defective ladders "Out of Service" or dispose of.
- Note deficiencies/corrective actions in "Comment" section.
- Return expired permit to Turner Superintendent.

Broken, bent or missing steps, rungs, cleats, or rails?
M T W TH F SA SU
Y/N Y/N Y/N Y/N Y/N Y/N Y/N

Steps and rungs free of water, grease, oil or other slippery substance?
M T W TH F SA SU
Y/N Y/N Y/N Y/N Y/N Y/N Y/N

Free of splits, cracks, rust, corrosion and dry-rot?
M T W TH F SA SU
Y/N Y/N Y/N Y/N Y/N Y/N Y/N

Free of sharp edges, cuts, burrs, etc.?
M T W TH F SA SU
Y/N Y/N Y/N Y/N Y/N Y/N Y/N

Loose or bent hinges that can't be fully opened or locked in place?
M T W TH F SA SU
Y/N Y/N Y/N Y/N Y/N Y/N Y/N

Stable and completely balanced (not shaking or swaying) with all legs resting firmly on the floor?
M T W TH F SA SU
Y/N Y/N Y/N Y/N Y/N Y/N Y/N

Loose, broken or missing extension locks to ensure safe overlap of extension ladder sections?
M T W TH F SA SU
Y/N Y/N Y/N Y/N Y/N Y/N Y/N

Damaged or worn non-slip bases, safety feet, wheels or casters?
M T W TH F SA SU
Y/N Y/N Y/N Y/N Y/N Y/N Y/N

Cross-over ladders have railings and non-slip steps?
M T W TH F SA SU
Y/N Y/N Y/N Y/N Y/N Y/N Y/N

Weight capacity label attached? Type 1A Minimum (300 lbs)
M T W TH F SA SU
Y/N Y/N Y/N Y/N Y/N Y/N Y/N

Other structural defects or operating problems?
M T W TH F SA SU
Y/N Y/N Y/N Y/N Y/N Y/N Y/N

Comments:

LADDERS LAST PERMIT

DATE ISSUED: _____

PERMIT IS AUTHORIZED FOR (specify a period of time or a task – not to exceed 1 week):

LOCATION FOR LADDER (BE SPECIFIC):

WHY IS A LADDER THE ONLY OPTION? Explain why a safer alternative to a ladder (such as a scissor or mast-climbing lift, or aerial lift) cannot be used:

SIZE AND TYPE OF LADDER TO BE PERMITTED? Note: Must be Type 1A (300 lb) min. Stepladders must be platform-type.

WILL WORKERS FEET EXCEED 6' ? Y/N
WILL TASK REQUIRE WORKER TO USE BOTH HANDS? Y/N

If either answer is yes, what fall prot. equip. will be used? Note: Retractables required.

WHAT WILL YOUR 5000 LB. ANCHOR POINT BE?

WORKER'S NAME	STICKER #

Approver of Permit (Turner) **Date**

Subcontractor Competent Person **Company**

Contact Phone Number

By signing this permit, both the Turner employee and Subcontractor Competent person agree that no safer means is feasible to perform the task and that a ladder is necessary. Post this permit on the ladder. Post PTP in work area.

51. Minor Operation Hazard Analysis

Activity Name

All construction activities.

Task

All construction tasks.

Problem

One of the best ways to prevent construction injuries is to develop and implement a task hazard analysis (HA) process as part of a jobsite's overall project site-specific safety plan. The HAs help prevent injuries, by identifying workplace hazards associated with a task and implementing the adequate controls (eliminate or minimize) for the dangers. Many contractors require the crew to complete comprehensive HAs typically printed on an A4 sheet. One of the limitations of these full, traditional HAs is that employees do not use them when there is a change in a task or for small activities. Failure to complete HAs for small tasks can lead to worker injuries.

Solution

Kiewit developed and implemented an innovative pocket-sized "Minor Operation Hazard Analysis" that is

used as a mechanism for the crew to identify and discuss the hazards associated with a short-term or changed operation, before starting the work. The use of the Minor Operation Hazard Analysis form is strictly applied to the following:

- Operations that result from a change and are not covered in the full hazard analysis.
- Short-term, non-repetitive operations lasting less than four (4) hours (i.e., unloading an unexpected truck, repairing an access system, moving materials out of the way to start the operation).

The same concept can be applied to near miss reports, safety innovations, etc.

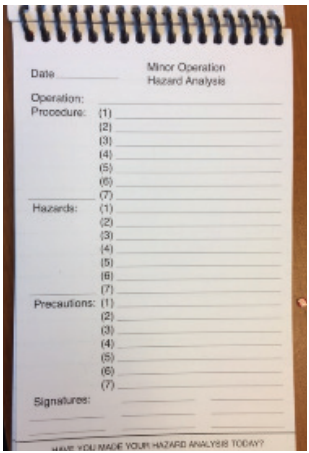
Additional Items to Remember

The Minor Operation Hazard Analysis can easily be reused if performing the same task (e.g., fueling equipment), but it should be reviewed and signed each time it is used. Employees should be trained on when to use the Minor Operation Hazard Analysis. For operations involving high risk tools or the need for fall protection, mini JHA's shall not be used.

Acknowledgements

The information provided in this section was used with permission of Kiewit.

Minor Operation Hazard Analysis
(Picture Courtesy of Kiewit)



52. Forklift Warning Lights

Activity Name

All activities that require the use of an industrial forklift in fabrication shop areas with pedestrian traffic.

Task

All material handling tasks performed using an industrial forklift in fabrication shop areas with pedestrian traffic.

Problem

Forklift traffic around areas where there is pedestrian activity such as in fabrication shops exposes employees to struck-by hazards. A common cause of incidents in this situation includes employees either not seeing or hearing the forklift and coming into too close proximity to the equipment resulting in an injury.

Solution

One way to control the struck-by hazard is to install warning devices on the forklift. In 2017, MacDonald-Miller fitted their forklifts with warning lights to provide a visual warning to nearby pedestrians. They mounted two Red Zone Side-Mount Pedestrian Safety Warning Lights, and a Blue LED Forklift Pedestrian

Safety Warning Spotlight on the front and another on the back. The Forklift "Red Zone" Pedestrian Safety Warning Light provides a visual warning for warehouse personnel by projecting a bright red beam pattern onto the floor, on both sides of the forklift, helping to promote greater workplace safety. When the LED Safety Warning Spotlight assembly is mounted on a forklift or other moving vehicle, it projects a bright blue spot beam pattern on the floor surface.

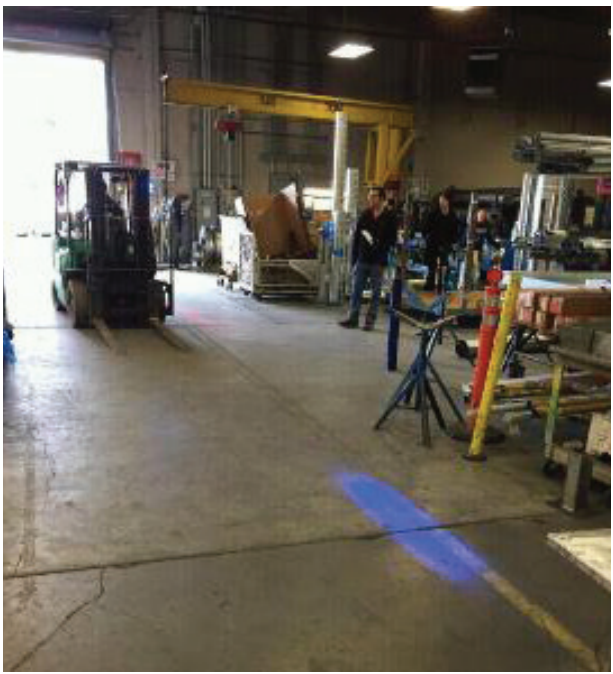
Additional Items to Remember

- Companies should always use this solution in conjunction with other control measures such as fab shop traffic management, other warning devices (e.g., alarms), and training.
- Manufacturer/Vendor Information:
    - Red Zone Lights: http://www.globalindustrial.com/p/material-handling/forklifts-attachments/forklift-lights/led-forkli-red-zone-side-mount-pedestrian-safety-warning-light
    - Blue Lights: http://www.globalindustrial.com/p/material-handling/forklifts-attachments/forklift-lights/best-value-led-forkli-pedestrian-safety-warning-light
- Video(s):
    - Red Zone Lights: https://youtu.be/9djAW8HcIkQ
    - Blue Lights: https://www.youtube.com/watch?v=RdDu59cFUjM

Acknowledgements

The information provided in this section was used with permission of MacDonald-Miller.

Forklift Warning Blue Lights – Front and Back (Picture Courtesy of MacDonald-Miller)



Forklift Warning Red Light – Sides
(Picture Courtesy of MacDonald-Miller)

53. Mounting hoses and cords in the air

Activity Name

All fabrication activities.

Task

Use of extension cords and hoses.

Problem

Extension cords and air hoses cause tripping hazards around the workplace and make the workplace look disorganized. Cords are exposed to being damaged by other equipment.

Solution

Moving all the hoses/cords onto an overhead location (e.g., on a swing arm) keeps them out of the way when moving around the workplace, eliminating tripping hazards. Also, by utilizing mechanical means such as swing arms and retractable devices, it is easier and less ergonomically impactful to move them around.

Additional Items to Remember

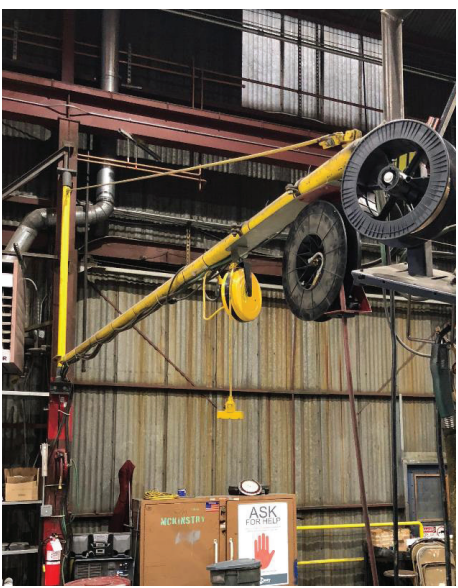
- Secure all equipment

- Inspect equipment before use
- Post swing arms capacity
- Know and make sure to never exceed weight capacity of swing arm.

Acknowledgements

The information provided in this section was used with permission from McKinstry Co.

Cords and hoses on a Swing Arm
(Picture Courtesy of McKinstry Co.)



54. Hard Line Gas

Activity Name

Pipe fabrication.

Task

Pipe fabrication-related activities.

Problem

Lifting, pushing, and pulling of individual gas tanks exposes employees to ergonomic risk factors. Gas tank storage in the work area also creates a tripping hazard in addition to potential struck-by vehicle traffic.

Solution

Using hard line gas supply instead of individual gas tanks is a good solution. The gas is supplied to each work area via hard lines. The hard lined gas reduces the amount of lifting and disconnecting of gas tanks to welders and air tools. Hard lines keep the workplace more organized, reduce tripping hazards, and prevent tanks from being knocked over.

Additional Items to Remember

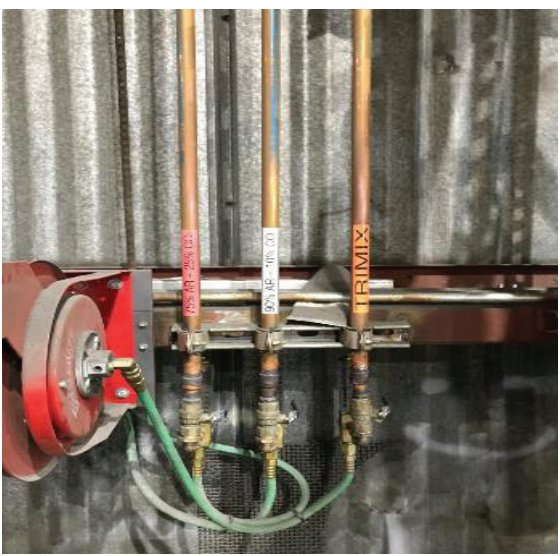
Contractors ensure all hard line pipes are built according

to safety regulations and the building code. They should inspect the lines per regulations. Gas lines must be rated to transport gases, joints must not leak, and depending on use, they may need to be rated for high pressure (e.g., not PVC).

Acknowledgements

The information provided in this section was used with permission from McKinstry Co.

Hard lined gas supply to each station (Picture Courtesy of McKinstry Co.)



55. Entry Way Personal Protective Equipment Station

Activity Name

Entering / exiting shop area

Task

Donning of doffing personal protective equipment

Problem

Lack of a safe location for the donning and doffing of PPE prior to entering a shop. Employees entering a shop area without required PPE is a concern. Maintaining a supply of PPE at the entrance to the shop for employees entering the shop.

Solution

The creation of a designated personal protective equipment (PPE) station, blocked off by hand rails, which provides information and a supply of the required PPE needed before entering the shop.

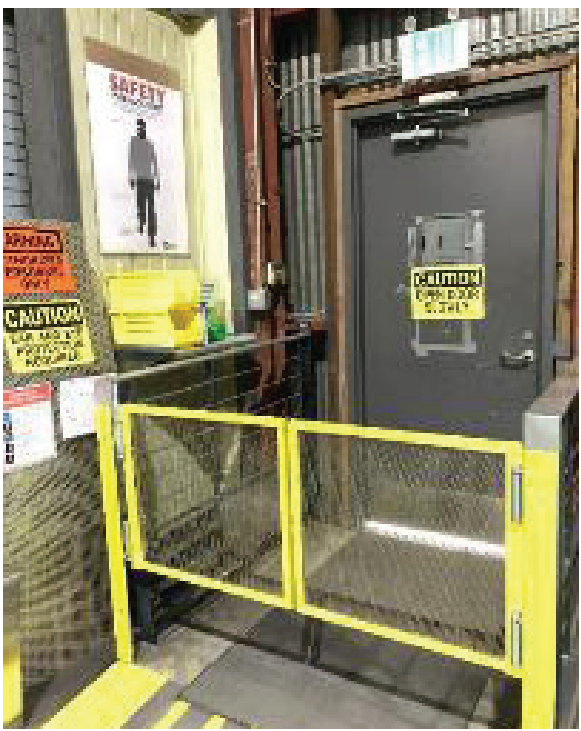
Additional Items to Remember

The safety zone should be periodically inspected to ensure an adequate supply of PPE is maintained.

Acknowledgements

The information provided in this section was used with permission from McKinstry Co.

PPE Station example
(Picture Courtesy of McKinstry Co.)



56. Pre-fabricated Multi-trade Racks

Activity Name

All mechanical construction activities in multi-story buildings.

Task

Installation of mechanical piping, HVAC ductwork, etc. at upper floor levels.

Problem

It is often the case where mechanical construction employees are required to work around other trades on a jobsite. Mechanical systems may also need to be installed above or behind other systems that have already been installed. These issues create make the installation process more difficult and, in turn, more hazardous. Crowded areas increase tripping hazards. Installing materials where other systems have already been installed can increase the chance of lacerations due to tight spots, and strains/sprains due to awkward employee positioning to reach an installation spot. In addition, it may be the case that some previously-installed systems may need to be altered or reworked in order to install subsequent systems. Productivity drops off as well when employees have to fit their materials in tight spots or work in a crowded area with many other trades present.

Solution

McKinstry Co. utilizes a multi-trade pipe rack as a solution to alleviate the issues with crowded work areas and difficulty inserting materials above or behind previously-installed materials. The racks are constructed at ground level or in the shop. After their construction, the piping, HVAC ductwork, electrical cables, and other systems are installed on the racks. Multiple racks with the mechanical/electrical sections already attached are built. Then each rack is raised into place with a crane, and the systems from adjacent racks connected to create a complete system. The procedure reduces the amount of time and employees needed to install the systems, and allows for the work to take place under safer site conditions (at ground level). As a result, tripping hazards are mitigated, as well as hazards associated with crowding and the use of ladders and manlifts. Strain/sprain injuries are prevented because the time working overhead and lifting heavy materials is reduced by using the racks. In addition, using the racks eliminates rework due to having to remove and replace the work of other trades in order to install the work. Prefabrication of multi-trade racks increases overall productivity on the job by having the work from all of the trades complete and ready to bolt up or connect when the assembly is put into final location.

Additional Items to Remember

The design of the racks should be sufficient to support the weight of the materials both when on the ground

prior to installation and also after it has been lifted into place. In addition, the racks need to be structurally designed so that they can safely be lifted by a crane with all of the materials attached. Careful attention should be given to the connections between racks and method of attachment of the rack to the building frame. The connection points should be designed for easy access and to facilitate making the connection.

Acknowledgements

The information provided in this section was used with permission from McKinstry Co.

Racks with piping installed and ready for lifting into place (Picture Courtesy of McKinstry Co.)

57. Packaging Ductwork

Activity Name

All activities that involve ductwork.

Task

Unloading, transporting, shaping, and installing ductwork.

Problem

Ductwork comes in many different diameters, and is shipped to the jobsite in different lengths. When the ductwork diameter is large, or the lengths of ductwork sections are long, the ductwork can be difficult to handle. As a result, the processes of unloading, transporting, shaping, and installing large ductwork may create safety hazards for sheetmetal employees. Special precautions may be needed when packaging the ductwork to eliminate safety hazards on the jobsite when handling the ductwork.

Solution

Ductwork is often covered with plastic wrap on its openings to prevent dust from getting inside the ductwork. Additional efforts during packaging can eliminate many unsafe exposures for employees on the

jobsite. For example, using four bolts to connect ductwork together during transport can eliminate safety hazards when unloading. The bolts should be clearly marked for easy removal when appropriate. Another example is to place the ductwork on wood supports that have been notched or cut to fit the ductwork size. The wood supports prevent the ductwork from rolling and enable securing the ductwork tightly to the truck/trailer during transport. Raising the ductwork a small amount by placing it on the wood supports also provides room for a forklift to easily pick up the ductwork. Wood bracing can also be provided between ductwork to prevent the ductwork from caving in during transport and handling on site. When delivered to the site, all the employees need to do is unbolt the connections and remove the plastic wrap. This process keeps the ductwork clean and secure.

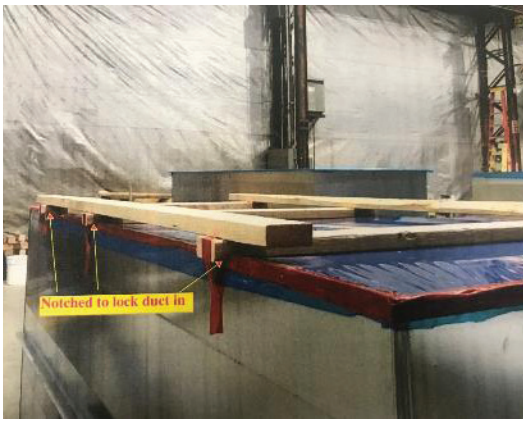
Additional Items to Remember

During transportation of the ductwork, employees should check that all of the components are secured, including the ductwork, wood supports, braces between the sections of ductwork, and the plastic wrap covering the ductwork openings. If any of the material inadvertently falls off of the truck, it could injure a bystander or an employee.

Acknowledgements

The information provided in this section was used with permission from McKinstry Co.

Packaging Ductwork
(Pictures Courtesy of McKinstry Co.)



58. Sealed and Panned Floors

Activity Name

Sheetmetal fabrication.

Task

Sheetmetal fabrication.

Problem

While using chemicals for fabrication activities (e.g., glue), there is a possibility of spills. The spilled chemical can go through the concrete or create slip hazards.

Solution

Sealing and panning the floors helps contain the chemical spills. Floors coated with a non-slip coating will decrease the chance of slips, and the different color works as a caution to employees that there is a possibility of slip hazards. Also, by utilizing this solution it is easier to clean up the chemical.

Additional Items to Remember

Contractors should ensure all environmental/chemical regulations and safe work practices are followed when

using this solution such as:

- Making all safety data sheet available.
- Labeling all chemicals
- Posting spill procedures

Acknowledgements

The information provided in this section was used with permission from McKinstry Co.

Sealed and panned floors
(Picture Courtesy of McKinstry Co.)

59. Workplace Access

Activity Name

All construction activities.

Task

All construction tasks.

Problem

Safe and adequate access to all activities and locations within a jobsite and a fabrication shop are critical to the safety of the employees. On a construction site, craft employees encounter numerous areas where there is a break in elevation in their work path. On a fab shop floor, fabrication of large ductwork or pipes often requires tradespeople to either go around or lunge over/under materials as part of their work. Provision for inadequate or no access in both these scenarios can expose employees to risks that can lead to injuries.

Solution

McKinstry came up with an idea to install temporary and movable stair towers (see picture) to provide access to fab shop employees. The movable tower has stairs that go over material so that people can walk over the material instead of trying to step over and exposing employees to trip hazards. In addition, companies

should try to locate the access issue from the source first, engineer the problem out as much as possible without having to build anything, and then utilize the temporary stair towers that go over the material as a last resort.

On construction sites, GLY Construction has come up with different solutions, such as those shared in the pictures, ranging from slip resistant plywood ramps to mini stairs.

Additional Items to Remember

- The fab shop manager or site superintendent should proactively plan for safe and adequate access.
- Any shop or job made access shall meet all safety and regulatory requirements.

Acknowledgements

McKinstry Co. and GLY Construction. The information provided in this section was used with permission of McKinstry Co. and GLY Construction.

Stair Bridge (Picture Courtesy of McKinstry Co.)

Walkway Ramp
(Picture Courtesy of GLY Construction)

Walkway Ramp
(Picture Courtesy of GLY Construction)

60. Rigging Storage

Activity Name

All construction activities that involves rigging equipment.

Task

All construction tasks that involves rigging equipment.

Problem

Improper care and storage of rigging equipment can severely reduce its service life. Whether it is a fabrication shop floor or construction site, rigging equipment that is exposed to unnecessary environments subject it to a higher degree of wear and tear, damages tags, etc. Damaged rigging put into service can cause serious incidents and injuries. Improperly stored rigging equipment can also cause housekeeping issues and trip hazards.

Solution

Slings should be stored and appropriately cared for on vertical racks and in designated locations when not in use. McKinstry shop employees built a stand that stores all unused slings by size as seen in the picture. The stand not only helps with the proper storage, but also

organizing slings by size allows employees to access them easily and quickly which helps with productivity. Additionally it also keeps slings off of the ground so that no one trips over them. There are many commercially available rigging equipment storage solutions/products, so contractors should consider procuring them to protect and preserve their investment in rigging equipment.

Additional Items to Remember

- Employees using rigging equipment should properly care and store them.
- Ensure that the tools and equipment used are regularly inspected for defects and are replaced or repaired as needed.
- Ensure that proper equipment is used for the lift. Both the type of equipment and the load capacity of the equipment must be reviewed to provide a safety margin.
- Ensure that employees who use cranes are trained in rigging procedures.

Acknowledgements

The information provided in this section was used with permission of McKinstry Co.

Concept of Rigging Equipment Storage Organized by Size (Picture Courtesy of McKinstry Co.)

61. Welding Rod Storage Tubes

Activity Name

All construction activities that require welding.

Task

Welding material storage.

Problem

Some trades on construction sites and fabrication shops perform welding. Welding activities involve consumable materials and equipment to complete the work safely. Proper organization and storage of these materials and equipment are critical to success both in terms of safety and productivity. Poor organization of material such as welding rods may expose employees to trip hazards and may require additional employee time to sort through materials to find what they need to complete their tasks.

Solution

Developing and implementing an organized system to store and use welding rods is a recommended solution. As shown in the picture, the storage is arranged and labeled by rod size and the type of metal. The storage system makes the workplace organized and reduces tripping hazards due to rods laying around on the floor

surface. By organizing the welding rods by size and metal type, access to material is efficient and positively impacts productivity.

Additional Items to Remember

While there are benefits to this solution, there is a potential that the rods can get mixed up. Hence, proper care must to taken when filling these tubes with rods.

Acknowledgements

The information provided in this section was used with permission of McKinstry Co.

Welding Rod Storage
(Picture Courtesy of McKinstry Co.)

62. Utility Avoidance

Activity Name

Excavation and trenching, and also cutting concrete slabs on tenant improvement projects with existing utilities.

Task

Installing utilities such as conduit, plumbing, piping, gas lines, etc.

Problem

Striking underground utilities is unfortunately common during excavation work to install electrical and mechanical lines. Employees should be protected when performing subsurface work.

Solution

BNBuilders uses a utility avoidance permit (see picture) procedure that involves a combination of locating, awareness, and planning to identify and mitigate the risk of hitting buried utilities. The utility avoidance permit system is in addition to the legally required utility locate. In conjunction with a utility avoidance permit, it helps to identify areas of high risk involving underground utilities. A lot of companies know to call

for utility locating services, but how do they know that the locations are accurate, and the information has been communicated to the crews? BNBuilders requires the utility avoidance permit (live utility awareness work authorization) for any work operating within 10 feet of any new or existing live utility. They require an applicable job hazard analysis, live utility map (see picture), and pre-task plan to be completed and attached to the utility avoidance permit. This system can also be used for any concrete cutting work on tenant improvement work when there is a possibility of underground utilities in the slab.

Additional Items to Remember

- Verifying accuracy of the locations requires someone to walk with the locate project team. Once identified, careful planning with the excavation subcontractor is necessary for avoidance of underground utilities.
- Safety precautions to consider are the risks associated with hitting live electrical, gas, water, or other utilities.
- Communication with the crews (especially excavation subcontractor) is a critical part of making this process successful.

Acknowledgements

The information provided in this section was used with permission of BNBuilders.

Utility Avoidance (Picture Courtesy of BNBuilders)

AUTHORIZATION VALID FOR_____**ON**____/____/____**ONLY.**
(Contractor)

IDENTIFY LIVE UTILITY _____

This Live Utility Awareness Work Authorization is required for any work operation taking place **within 10 feet of any new or existing live utility** (Electrical, Sprinkler Supply, Gas, Water Supply, Sanitary/Storm Sewer, Etc.). This includes, but is not limited to trenching, excavating, and boring. **Applicable Job Hazard Analysis (JHA), Live Utility Map, and Pre- Task Plan must be completed and attached to this document.**

Project:

One Call (811) Ticket #_____Date Called:_____/_____/_____Past 45 days?_____Yes_____No

- ❑ Is the current (date on drawing_____/_____/_____) Live Utility drawing attached?
- ❑ Is there a JHA for scope of work?
- ❑ Is the Pre–Task Plan attached?
- ❑ Have you reviewed the Live Utility Map?
- ❑ Is the Live Utility Map attached?

Activity Description: _____

Mitigation (how you are not going to hit utility or cause a disruption): _____

Activity Start Time:_____Schedule Completion Time: _____

Activity Location (Circle on attached Live Utility Map):_____

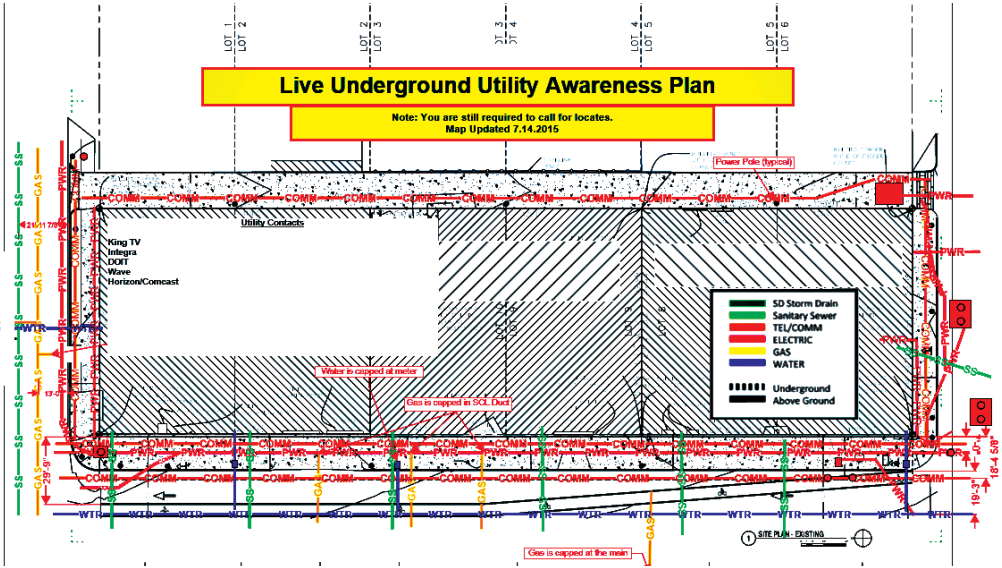
Contractor Competent Person Assigned to Task (print name): _____

Site supervisor has reviewed work plan (Signature): _____

Date Reviewed:____/____/____ **Reviewed with whom at ABC CONSTRUCTION:** _____

I have reviewed this Live Utility Awareness Work Authorization and understand that I am required to carry out the above–described work in accordance with this document, including the attached Job Hazard Analysis (JHA), and Pre–Task Plan.

Sample Live Utility Map Example (Courtesy of BNBuilders)



63. Overhead Load Warning Device

Activity Name

The installation of pre-cast concrete panels.

Task

The process lifting pre-cast concrete panels using a crane.

Problem

When hoisting loads to elevated work areas, it is vital to keep all non-essential personnel from walking/working underneath the overhead suspended load. The two conventional methods to control this hazard are:

1. Deploy a signal (typically an air horn) that warns all jobsite employees in the area that there is going to be a load flying overhead, which allows them to get out of the way if necessary.
2. Establish a fly zone which restricts all personnel from entering the area in which the overhead load is traveling, which includes delineation by a physical barrier (e.g., danger tape, guardrail, etc.).

Although the employees sound an air horn from the

ground level, the blast may not be heard from the roof of the structure. The fly zone concept is the least favorable option due to anticipated access/egress issues and the hindrance of other critical path scope of work in the proximity (e.g., roofing). Finally, having an employee staged at the roof to sound an additional air horn has cost-related challenges due to the additional cost of employing an extra individual that may not be accounted for in the budget. Hensel Phelps needed an innovative solution to keep employees out from underneath the suspended load, stay within their budget, and continue their critical scope of work on the roof.

Solution

The Foreman for the operation purchased two outdoor fire alarm bells and installed them at each access point to the roof. Electricians installed the alarm bells, and the controls were made accessible from the ground level near the crane. Once complete, the worker in charge of sounding the air horn on the ground level now could sound the fire alarm bells whenever there was a suspended load being hoisted toward the roof.

Safety - This solution allowed for the employees to receive proper notification when there was going to be a suspended load. When a fire alarm bell rings, employees were trained to stop what they are doing and get out of the way of the suspended load as it travels overhead.

Cost and Production - The procedure prevented the contractor from needing to hire an additional person to facilitate an air horn blast on the roof. Furthermore, this

solution allowed the roofing scope and pre-cast erection to continue simultaneously without any schedule delay.

The procedure is innovative because it helps the project succeed in all areas! This is a fitting example of thinking "outside the box" and how creative ideas can save companies injuries and money as a result. **While the procedure focuses on a pre-cast concrete hoisting activity, the concept can be easily applied to any mechanical construction related hoisting activities.**

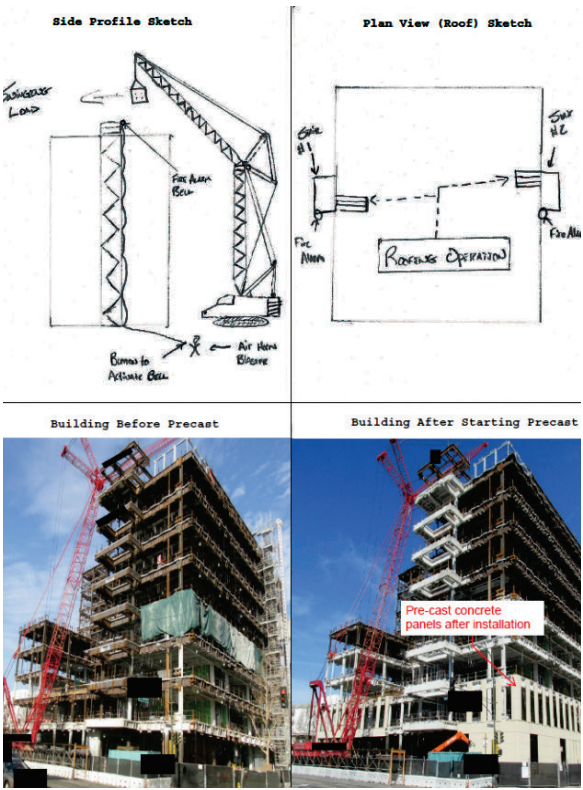
Additional Items to Remember

- Ensure the purchase of fire alarm bells that are loud enough to be heard consistently. Bells come in a variety of sizes and produce different volumes of sound. Before proceeding, ensure that it is going to work.
- Ensure the selection of an appropriate place to mount the fire alarm.
- Train jobsite personnel in this process/ procedure. Everyone needs to know what the fire alarm bell signal means for it to be effective. This training should be included in Activity Hazard Analysis/Job Hazard Analysis, and the site-specific orientation.
- Ensure the system is inspected before each shift to ensure it is operable and in excellent condition.
- Ensure that there is enough extension cord to route from the location of the fire alarm bell to the ground.

Acknowledgements

The information provided in this section was used with permission of Hensel Phelps.

Fire Alarm Picture and Sketch
(Picture Courtesy of Hensel Phelps)



64. Accessible Modern Technology for Field Safety Planning

Activity Name

All field mechanical activities.

Task

All field construction tasks.

Problem

A majority of the construction workforce still uses the traditional paper-based 2-dimensional drawings to visualize design intentions, which sometimes leads to installing product not meeting client expectations, which in turn leads to rework and change orders. Research shows rework is correlated to safety performance. Also, with 2D drawings employees may have difficulty visualizing the finished product, hence limiting their ability to identify hazards and suggest controls effectively. While some contractors have started to incorporate modern technology such as BIM into the pre-planning process to improve the effectiveness of work and also safety planning, accessibility has been a concern.

Solution

Hermanson makes BIM carts (see picture) readily available to craft employees and field management.

Before the project has started, Hermanson leads the coordination with designers and contractors to develop a fully coordinated 3D model. This 3D model is accessible through the BIM carts. By virtually looking at the elements to be built, (1) employees complete tasks faster and safer by quickly identifying the hazards and control measures to develop pre-task plans for each work area, and (2) field management personnel receive proper up-to-date design communication avoiding rework resulting in better safety performance.

Additional Items to Remember

None.

Acknowledgements

The information provided in this section was used with permission of Hermanson.

Building Information Modeling (BIM) Cart (Picture Courtesy of Hermanson)

65. Accessible Safety Training

Activity Name

All construction activities.

Task

All construction tasks.

Problem

Safety training is considered a major defense against workplace incidents, and critical for employees to effectively identify and control hazards. There is a growing need to make safety training more accessible than in the past.

Solution

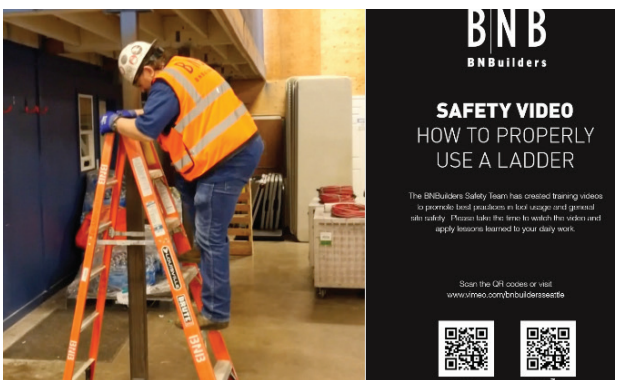
Use of mobile communication devices and mobile application software (Apps), computer programs that run on these portable devices, has increased several fold over the last five years. BNBuilders saw this as an opportunity to make safety training more accessible to their employees. Their safety team created safety training videos to promote best practices in tool usage and general site safety and made it available to employees by posting quick response (QR) codes on posters. All employees have to do it download a QR

reader app on their smartphone, and scan the provided QR code using the app. BNBuilders encourages employees to take the time to watch the video and apply lessons learned to their daily work.

Acknowledgements

The information provided in this section was used with permission of BNBuilders.

Accessible Safety Training via QR Codes (Picture Courtesy of BNBuilders)



66. Material Handling – Prefabrication of Pipe Trestles

Activity Name

Prefabrication of pipe trestles.

Task

Installing mechanical and electrical systems on elevated trestles.

Problem

Pipe trestles are typically located between 20ft and 30ft above the ground and involve working at heights, exposing employees to fall hazards and ergonomic risk factors. Falls continue to be one of the leading causes of death in the construction industry.

Solution

The pipe trestle was constructed in sections in an offsite location at ground level. Mechanical and electrical systems were installed on each section at ground level. The mechanical and electrical systems were designed specifically to enable prefabrication, utilizing flex connectors and valves, to minimize installation time. Once the trestle sections were complete, they were transported to the site, hoisted into their final location, and successfully installed.

By moving the construction offsite and only installing trestle sections when needed, the overall congestion on the project was reduced. By constructing the trestle in sections and installing mechanical and electrical systems on the ground the amount of time personnel were required to perform work at heights was also reduced. This process also reduced the overall time that cranes were active on the project site. Trestle section construction at the ground level is a common practice, but loading of mechanical and electrical systems is typically performed at height once trestles are installed. JE Dunn has used this process on two projects (in Hillsboro, OR and Santa Clara, CA). See pictures for pipe trestle installation on the ground and flown into place.

Additional Items to Remember

- Pre-manufacturing trestles will require the use of cranes with higher capacities than other construction methods.

Acknowledgements

The information provided in this section was used with permission of JE Dunn Construction.

Pipe Trestle Section Installation on the ground
(Picture Courtesy of JE Dunn Construction)

Pipe Trestle Section Flown into place
(Picture Courtesy of JE Dunn Construction)

67. BIM for Safety Pre-planning

Activity Name

All construction activities that will perform safety pre-planning.

Task

All construction tasks that will perform safety pre-planning.

Problem

Safety processes such as completing Job Hazard Analyses (JHAs) and Pre-task Plans (PTPs) are predominantly used to identify and control hazards on construction sites. For PTPs, a majority of the workforce still uses the traditional field meetings relying on crew experience and resources such as paper-based 2-dimensional drawings for hazard identification and control. Depending on the complexity of the tasks, sometimes employees are unable to visualize the finished product, hence limiting their ability to identify hazards and suggest controls effectively. Contractors can incorporate modern technology into the pre-planning process to improve the effectiveness of PTPs.

Solution

Pre-task planning offers the most opportunities to use a modern tool called Building Information Modeling

(BIM) for construction safety planning. The construction industry has started to look at BIM as a tool to improve worker safety. By virtually looking at the elements to be built, employees can better identify the hazards and control measures so the task can be completed faster and more safely. BIM can be used to evaluate construction sequencing of various hazards involving mechanical activities. The evaluation can eliminate a variety of conflicts with other work in that area before activities commence. For example, the pictures provide an example of BIM use for pre-task planning. In this case, the task involved installing all MEP items. By virtually looking at the elements to be built (left), employees can better identify the hazards and control measures so the task can be completed faster and more safely. Crafts can identify the sequence of activities, and material and tool requirements before work starts.

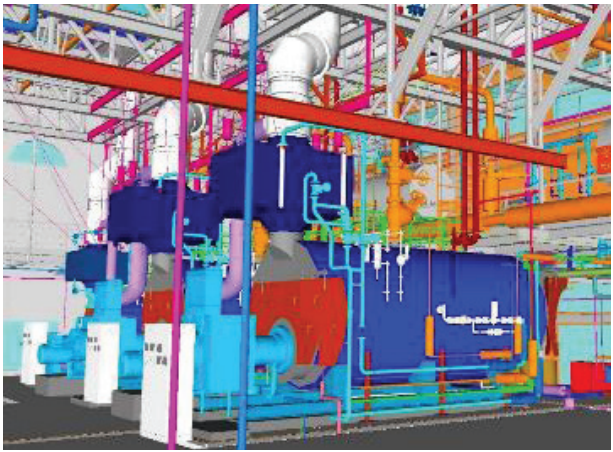
Additional Items to Remember

- None.

Acknowledgements

The picture provided in this section was used with permission of Shinn Mechanical, Inc.

Pretask Planning and BIM: Model vs. Actual As-Built (Picture Courtesy of Shinn Mechanical, Inc.)



68. Activity Based Lock out/ Tag out (LOTO) Training

Activity Name

All activities that traditionally require the use lock out and tag out procedures.

Task

All material handling tasks that require employees to use lock out and tag out procedures.

Problem

Failure to control hazardous energy is one of the major causes of serious accidents in the mechanical construction industry. Proper lock out/tag out (LOTO) practices and procedures safeguard employees from the release of hazardous energy.

Solution

One way to control the release of hazardous energy is by training all exposed employees on basic hazardous-energy concepts and the purpose of the devices used to control it. Employees should also know what tasks might expose them to hazardous energy and how it can be controlled. Usually, employees receive lecture-type training. However, it is best practice to provide

hands-on training on LOTO practices. Hence, the LOTO simulator shown in the pictures was developed with assistance from Shinn Mechanical. The simulator includes components such as a butterfly valve, true union PVC ball valve, gate valve, check valve, a variety of ball valves, pump trap, tank, and a pump connected to an electrical disconnect, capturing a real-world scenario typically encountered in the industry. The LOTO simulator can expose employees to the importance of the LOTO process using a visual model. Employees can be given a hypothetical LOTO scenario to demonstrate their ability to control hazardous energy types and sources.

Acknowledgements

Shinn Mechanical Inc., and Central Washington University Safety and Health Management Program.

Lock Out/Tag Out (LOTO) Electrical Simulator (Picture Courtesy of Central Washington University Safety and Health Management Program)

Lock Out/Tag Out (LOTO) Simulator (Picture Courtesy of Central Washington University Safety and Health Management Program)

69. Driver Selection

Activity Name

All construction activities that require use of company fleet.

Task

All construction tasks that require use of company fleet.

Problem

Motor vehicle accidents are the leading cause of both occupational and non-occupational accident death. According to Association for Safe International Travel (ASIRT), road crashes cost the U.S. $230.6 billion per year, or an average of $820 per person. Auto accidents involving a rear-end type loss is the largest auto loss trend for construction trades. Causes of motor vehicle accidents impacting construction trades include:

- Not managing who is in a Vehicle – Driver Selection
- Not managing the driver behaviors when they are on the road.
- Driver distractions – cell phone use.

Solution

Being selective in the employees who drive for contractors is critical to managing commercial auto

fleet risks and reducing contractor and worker exposure to loss. SambaSafety has an innovative driver risk management platform, which continuously monitors drivers to deliver a comprehensive view of driver behavior and performance. The SambaSafety solution is unique as it delivers actionable alerts that improve driver performance and reduce accidents – ultimately improving driver and community safety. It manages all driver data and automatically checks for new violations, DUI/DWI convictions, invalid licenses, and approaching license or medical certification expiration dates. The Samba DriverProfile® aggregates all information for a comprehensive view of individual driver performance. Each month concise reports identify new violations and alerts management to the most critical driver behavior issues. In addition, utilizing a common coding system for violations, license status, and crashes that goes beyond standard MVRs, the Samba DriverScore® provides a single standardized "score" to assess individual driver performance independent of each state's point system.

Additional Items to Remember

To learn more about the program, visit www.sambasafety.com

Acknowledgements

The information in this section was provided by CNA Insurance.

70. Driver's Alert Telematics

Activity Name

All construction activities that require use of company fleet.

Task

All construction tasks that require use of company fleet.

Problem

Motor vehicle accidents are the leading cause of both occupational and non-occupational accident death. According to Association for Safe International Travel (ASIRT), road crashes cost the U.S. $230.6 billion per year, or an average of $820 per person. Causes of motor vehicle accidents impacting construction trades, the #1 auto loss being rear-end accidents, include:

- Not managing who is in a Vehicle – Driver Selection
- Not managing the driver behaviors when they are on the road.
- Driver distractions – cell phone use.

Solution

Fleet telematics is a way of monitoring the location, movement, status, and behavior of a vehicle within a fleet. This monitoring is achieved through a combination

of a GPS receiver and an electronic Global System for Mobile Communications (GSM) device that is installed in each vehicle, which then communicates with the user and web-based software. In addition to location data, fleet telematics solutions provide a list of vehicles showing the status of each. A company can know when a vehicle starts and shuts down, plus its idling status, location, and speed. This information provides complete, up-to-the-minute knowledge of fleet activities in one centralized, web-based interface.

Driver's Alert advanced telematics technology cost-effectively puts a "supervisor" in every vehicle to monitor location, fuel consumption, engine health, speed, acceleration, harsh braking, and much more. In addition, Driver's Alert provides a customizable online portal, and a points-based setup allows for communicating what is most important, how often to report it, and what action to take. Driver's Alert claims that no solution is more efficient or effective in helping convert data into a safer, more profitable fleet.

Additional Items to Remember

To learn more about the program, visit https://www.driversalert.com/fleet-safety-vehicle-telematics/

Acknowledgements

The information in this section was provided by CNA Insurance.

71. bSafeMobile Cell Phone Use Management

Activity Name

All construction activities that require use of company fleet.

Task

All construction tasks that require use of company fleet.

Problem

Distracted driving from the use of cell phones and tablets while driving poses significant risk to every business that has employees who drive for company business or who have a company issued cell phone. Similar to driving while intoxicated, using a cell phone while driving unnecessarily puts the driver and others at risk of injury - or even death. Because text messaging requires visual, manual, and cognitive attention from the driver, it is one of the most risky distractions that can lead to an accident.

Solution

Cell blocking technology is software for smartphones and tablets that detects the driving state and automatically puts the device in safe mode while driving. In safe mode, a curtain screen blocks access to

the keyboard and screen and all notifications and alerts are suppressed – including incoming calls, texts and emails. Emergency calls (i.e., 911) are always allowed. When the vehicle is no longer in motion, all calls, messages and texts will be delivered.

Cogosense offers bSafeMobile to help reduce the number of vehicle accidents by eliminating a leading cause of crashes; driver distraction from the use of smart phones while driving. bSafeMobile for smartphones and tablets detects the driving state and automatically puts the device in safe mode while driving. In safe mode, a curtain screen blocks access to the keyboard and screen. All notifications and alerts are suppressed – including incoming calls, texts and emails. bSafeMobile works together with a Bluetooth connector in the vehicle to determine the driving state, protecting any device with the client and registering with the Bluetooth connector in the vehicle. Each unit is capable of monitoring up to five drivers.

Additional Items to Remember

To learn more about the program, visit http://cogosense.com or contact Olen Vanderleeden at Olen.vanderleeden@cogosense.com

Acknowledgements

The information in this section was provided by CNA Insurance.

72. Spider Box

Activity Name

All construction activities that utilize spider boxes.

Task

All construction tasks that utilize spider boxes.

Problem

When properly used per manufacturer recommendations, spider boxes are a safe and dependable source of power. One of the problems with spider boxes is that they are normally placed at the ground level, creating housekeeping issues and making it hard to keep extension/flexible cords overhead over walkways and work areas to avoid tripping, vehicular traffic, and general poor housekeeping. How can cords be run overhead when they are connected to spider boxes?

Solution

GLY Construction employs an innovative way to mount spider boxes off the ground as shown in the pictures. GLY has found it be extremely useful and safe. There are many ways to mount the spider boxes, for example using 2x4 and all threads as shown in the picture.

Additional Items to Remember

- While there are benefits to this solution, it does create an overhead hazard. Use caution tape to make people aware of the overhead hazard and eliminate the possibility of employees bumping their head.
- Ensure the spider boxes are adequately secured and inspected daily to avoid creating a falling object hazard.
- There is a potential of water leaking from overhead going directly into sockets. A possible solution is to create an awning above the spider box using plastic material.
- The location of spider boxes is critical. Contractors should avoid hanging them near a drain pipe where they can potentially get water into them or near areas which present a fire hazard due to work activities such as welding.

Acknowledgements

The information provided in this section was used with permission of GLY Construction.

Temporary Extension Cord Protectors
(Picture Courtesy of GLY Construction)

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