



Heavy Civil Construction Safety
Part 4. Hand & Power Tool Safety

A SunCam online continuing education course

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by

John E. Kristensen PE., PLS., PMP.



Heavy Civil Construction Safety
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Introduction

Welcome to this PDH course on Construction Safety. This is the Fourth Part of this series. If interested, please consider taking the previous courses for a better understanding of the series format. Hopefully, you will find the courses interesting and informative. It is the intent of the course to provide the reader with a sound knowledge base of the fundamentals of safety so they can be considered one of the Industry's Competent Safety Personnel. Supervisory engineering responsibilities require this type of training so leaders can help the staff they oversee to avoid accidents.

The series of courses will attempt to make this material easy to read and understand. It does not go into any depth on technical subjects but will provide enough material for the



Heavy Civil Construction Safety
Part 4. Hand & Power Tool Safety

A SunCam online continuing education course

reader to be aware of the basics in a wide variety of subject areas. Some topics may not directly affect a present job, but it is important to become well rounded in all safety areas and to understand why certain things are done for better safety.

Course Topics of this series may include:

General OSHA and MSHA Responsibilities, Personal Protection, Hand and Power Tools, Ladders and Scaffolds, Excavation and Trenches, Equipment Operations, Crane Safety, Rigging Safety, Traffic Control, Fire Protection, & Equipment Transporting

The goal of this fourth course is to review basic hand & power tool safety. The material will include general discussions of the various tools available and some of the hazards/precautions needed to safely work around them. Anyone who works around heavy construction knows that there are hazards involved and that they are not to be taken lightly. It is not the purpose of this course to teach people to be journeymen craftsmen. It is the purpose to teach people safe practices and procedures to reduce the chance of hand & power tool safety accidents.

General

The setup of this section will be a few paragraphs about general tool safety and then specific concerns about specific hand & power tools. The tools covered will include:

Power Saws	Jacks	Pliers
Shovels	Chainsaws	Grinders
Picks	Power Drills	Cutters
Wrenches	Bars	Jack Hammers
Hammers	Hacksaws	Knives
Chisels	Screwdrivers	Power Actuated Tools

The equipment listed above have many safety concerns. While we cannot cover every hazard, we hope to cover some of the more unique ones.



Heavy Civil Construction Safety
Part 4. Hand & Power Tool Safety

A SunCam online continuing education course

General Comments

If we were training Apprentices and Journey Men about how to safely use the skilled tools of their trade, we would just copy the tool manufacturer's owner's manual and have everyone read them. That is not what this course is about. There is no substitute for reading the owner's manual, even though it is rarely done. Think about whether you read the operating manual for the car you're driving. Probably not, even though it covers many safety features that you should be aware of. We all know it all. When it comes to heavy tools, this misconception can lead to accidents and injuries which can be severe.

If you think about most tools, especially the standard ones listed in the previous section, you may feel there isn't much to know about each one. The first tool to be discussed is the circular saw. This tool will be discussed in more depth than the other tools just to show the extent of material that could be covered in each section. After reviewing the circular saw it will become apparent that the course would be too long to cover each tool to such detail and the course would become unmanageable. For the subsequent tools, the subject matter will be condensed to more specific concerns.

Most accidents involving tools can be traced to either the use of the wrong tool or laziness. By laziness it is meant that an individual did not get the right tool, proper support, or proper PPE because of time. Usually preceded by the thought, "I only have to make one cut."

Lastly, we should consider the shock hazards from using electric hand tools. Most electric tools require a ground fault circuit interrupter (GFCI) protection. This will possibly be discussed further in a future course on electrical safety.



Heavy Civil Construction Safety
Part 4. Hand & Power Tool Safety

A SunCam online continuing education course

Circular Saws



What hazards are most often associated with the use of power saws? Experience shows that most injuries from their use are eye injuries from saw dust and foreign objects, and cuts from contact with the blade. There is also the potential for electric shock from improper use or conditions.

What protective devices must be provided with the saw themselves? Key devices are:

- A spring return guard to cover exposed blade when it is cutting



Heavy Civil Construction Safety
Part 4. Hand & Power Tool Safety

A SunCam online continuing education course

- A constant pressure, or deadman, switch which shuts off power to the saw when trigger is released and cannot be locked on (often two switch must be activated to start the saw)
- A method of preventing electric shocks, primarily by use of a proper ground. Look for UL listing on all power equipment.

These items safeguard the equipment, PPE must be used to safeguard the user.

Eye Protection is needed when using a power saw. Under most conditions safety glasses are sufficient for saw dust and some debris. For heavy use or particular materials, the user should consider goggles.

If the saw is being used for an extended period the user should have hearing protection. Either plugs or muffs are acceptable.

Gloves should be worn to prevent splinters.

All other normal PPE should be worn for jobsite hazards.

One thing to consider, the user should not be wearing baggy clothes or have other hanging or loose fit items on their person that can get caught in the rotating blade. Gloves are another important PPE, they will help protect hands from material splinters, abrasions and minor cuts.

Before use, the saw must be inspected:

First inspect the power cord for damages for possible electric shock exposure. Even a repaired cord can be a hazard because they are usually not resistant to dampness or rough handling, and the repair may have neglected to repair the ground wire.



Heavy Civil Construction Safety
Part 4. Hand & Power Tool Safety

A SunCam online continuing education course

Inspect for damages to the housing. Electric shock through a cracked house is a frequent occurrence, especially under damp or wet conditions like a light rain or with the cord draped through a puddle.

Inspect that the saw is setup at the right height and angle adjustment and with the right cutting blade. If not, make adjustments with the cord unplugged. Don't use the wrong blade and don't cut materials not meant to be cut.

Proper use of a saw:

Clear the area of slips or trip items, maintain proper housekeeping (especially look overhead). Provide adequate support for the items being sawed and the portion being sawed off. Do not hold the board or balance the board on a knee while making a cut. Use proper cutting techniques to avoid kickbacks. Use sharp blades, make straight cuts, don't plunge cut the blade to make a cut, bring the saw up to full speed before cutting. Cutting wet wood, cutting materials with damages, knots, or cracks, and recutting materials may also cause kickbacks.



Heavy Civil Construction Safety
Part 4. Hand & Power Tool Safety

A SunCam online continuing education course

Shovels



You can probably guess what type of injuries most often occur from shoveling tasks. Back Injuries. The problem is that it is hard to concentrate on how you are shoveling if you're doing it for any length of time. Shoveling is hard work. We all know you are supposed to lift with your legs and not with your back. This is especially true with shoveling. Proper body positioning should be, one foot in front of the other, alongside of the material you are shoveling. This minimizes the distance that the shovel head is away from the center of your body and allows the legs to provide a thrust force.



Heavy Civil Construction Safety
Part 4. Hand & Power Tool Safety

A SunCam online continuing education course

Keep the loaded shovel close to the body, do not hold the load out with your arms. Move your feet to turn and travel without swinging or twisting your back. Lastly, if there is a large amount of material to be moved over a long distance, get a piece of equipment to do the work. It is faster, cheaper, and safer, that's what they are made for.

Other considerations:

Shovels are not meant to be pry bars or hammers

Shovels work better when the edges are sharp and the handles are tight

Shovel handles should not have splinters and should be replaced not repaired when damaged

Lastly, use the right type of shovel for the task being completed. There are many types of shovels that have specific purposes.

Picks

Picks aren't very different from shovels when it comes to safety. Keep the handles tight, free of cracks and splinters, and don't try to repair, paint, tape, or cover up defects. Use proper body positioning like shoveling and use two hands.

Most accidents occur from trying to dislodge a stuck pickhead. This can produce a strain on your back especially if using a jerking motion.

Safety glasses should be worn if the materials that need to be broken are hard and prone to fragmenting and splintering.



Heavy Civil Construction Safety
Part 4. Hand & Power Tool Safety

A SunCam online continuing education course

Pinch Bars



Pinch Bars may have different names depending on locality. Some may call them Kelley Bars, Johnson Bars, pry bars, cross bars, or convincers, but they all accomplish the same thing. They are all a little different but they are all metal, heavy, one piece, and are useful. In fact, these devices are considered safety devices in a sense since they save backs, fingers, and arms from problems. Still, it is fairly easy to get hurt using one since the most common use is to pry something heavy that is stuck.

Just like shovels, posture and positioning is important. Adequate and clear space with good footing is required. This will avoid an awkward position which can cause falls or strains. Gloves should be worn to prevent cuts from nicks and burrs.

The most common abuse of these tools occurs when the user stands on the end and puts their full weight into it. Sometimes the user will jump up and down on the bar or kick it for added leverage. These practices lead to leg and knee injuries and should be avoided.



Heavy Civil Construction Safety
Part 4. Hand & Power Tool Safety

A SunCam online continuing education course

Hacksaws



The main missuse of hacksaws is utilizing the wrong blade or not properly tightening the blade when in use. Most blades will cut through the intended material but certain blades perform better than others for certain jobs.

When installing the blade, the teeth should point forward so they cut away from the user. The material should be braced securely and the user should be standing firm and off to the side, away from the material being cut. Other considerations are similar to the circular saw section.

Heavy Civil Construction Safety
Part 4. Hand & Power Tool Safety

A SunCam online continuing education course

Screwdrivers



In construction, the hammer is probably the most used hand tool in the industry, but hand tool manufacturers sell more screwdrivers than any other tool, and they are used by more people than any other tool. From age 3 to 103, we all use screwdrivers, but do we use them correctly? A common mistake is to believe that they make good pry bars or chisels when convenient (is your screwdriver blade bent or nicked?)

The internet is littered with tales of screwdriver misuse and the injuries and lawsuits that have arisen from them. Settlements have been won from people using the screw driver as pry bars and when injured from the shaft snapping and they have claimed it was the screwdriver's fault. The screwdriver was made too well, and this caused the injury. If it was made more cheaply, it would have bent, and not snapped when it was used as a pry bar. The manufacturer's defense that the screwdriver was not meant to be a pry bar



Heavy Civil Construction Safety
Part 4. Hand & Power Tool Safety

A SunCam online continuing education course

went unheeded because it did not state this anywhere on the tool. Next time your screwdriver bents or twists as you try to screw in a tough screw, thank these individuals who surely stopped you from getting seriously hurt.

Safety concerns for screwdrivers:

The proper size makes a difference, make sure the tip fits tightly into the screw head and the larger the handle, the more torque that can be applied.

Replace a screwdriver that has a cracked or badly bent blade, redress or replace a nicked or rounded blade, or if the handle is cracked, splintered, or shows other signs of misuse.

Don't use your hand as a brace for small pieces, it exposes it to being stabbed and puncture wounds.

Plastic handles do not mean the screwdriver is insulated against electric shock. Only use tools that specifically state they are meant for electrical work.

Power drivers and pilot holes save time and prevent accidents.

Pliers



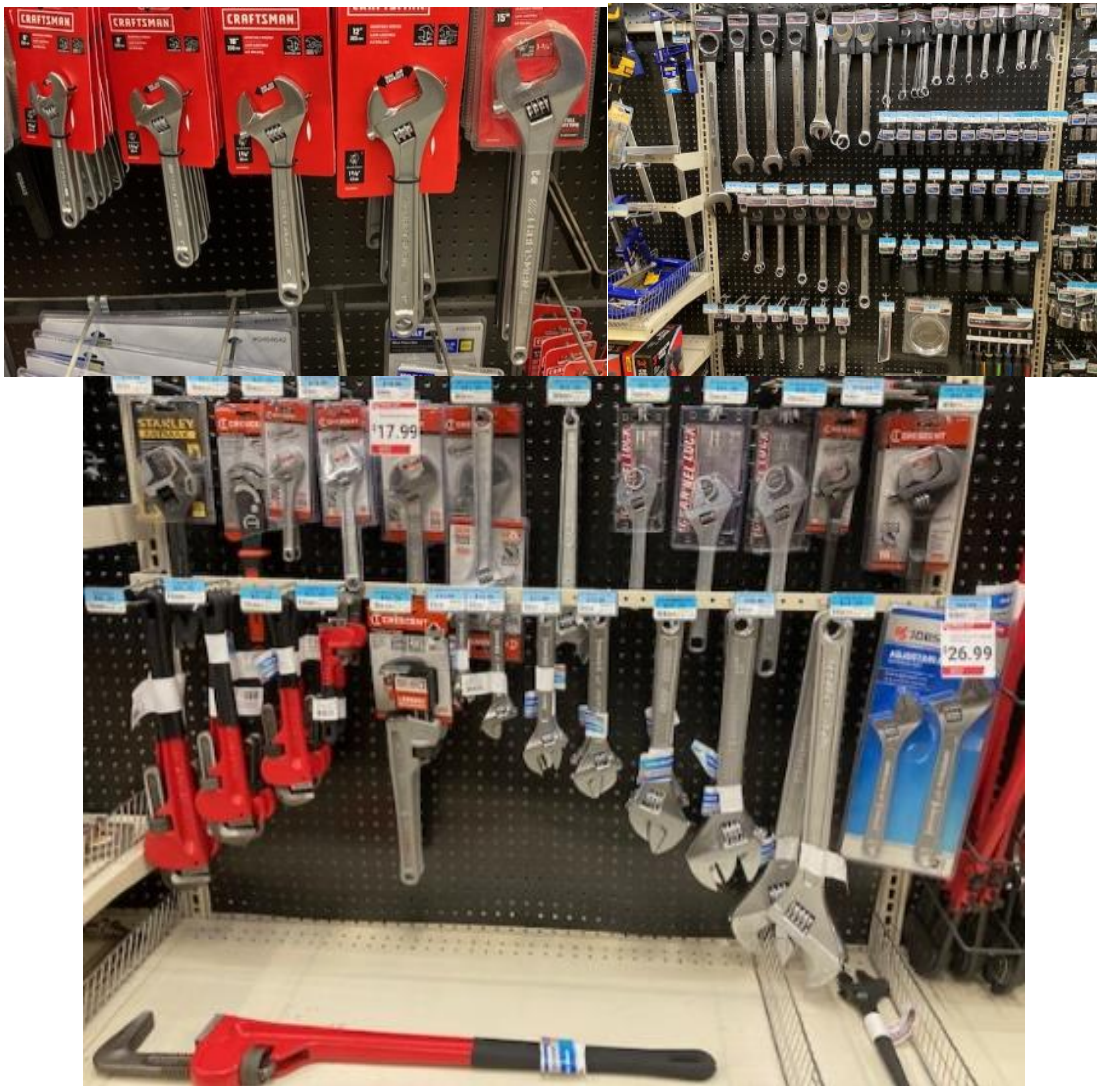
Pliers are meant for gripping, they are not wrenches, cutters, or nail pullers.



Heavy Civil Construction Safety
Part 4. Hand & Power Tool Safety

A SunCam online continuing education course

Wrenches (or knucklebusters)





Heavy Civil Construction Safety
Part 4. Hand & Power Tool Safety

A SunCam online continuing education course

Wrenches are one of the most misused hand tools available. Injuries range from scraped knuckles to broken teeth.

Misuse include: Open end wrenches used in place of box wrenches, adjustable wrenches work for everything, metric and standard wrenches are interchangeable if they fit closely, hand wrench sockets used for power wrenches, and of course a cheater pipe or hammer used if added torque is needed to move a stubborn nut. These are the most common misuses of wrenches and causes of injuries. A carpenter wouldn't use a ball-peen hammer in place of a claw hammer, we don't use a Phillips head screwdriver for a flat head screw, but wrenches tend to be thought of differently.

The worst injuries come from using a pipe or other item as an extender to provide more torque. Either get a bigger wrench, or try penetrating oil to loosen the connection. If it still won't budge, consider cutting or torching if off.

The only wrench made that is meant to be hit with a hammer is a striking face box wrench.

A worn wrench is no good, as well as sprung jaws or rounded edges, they need to be replaced.

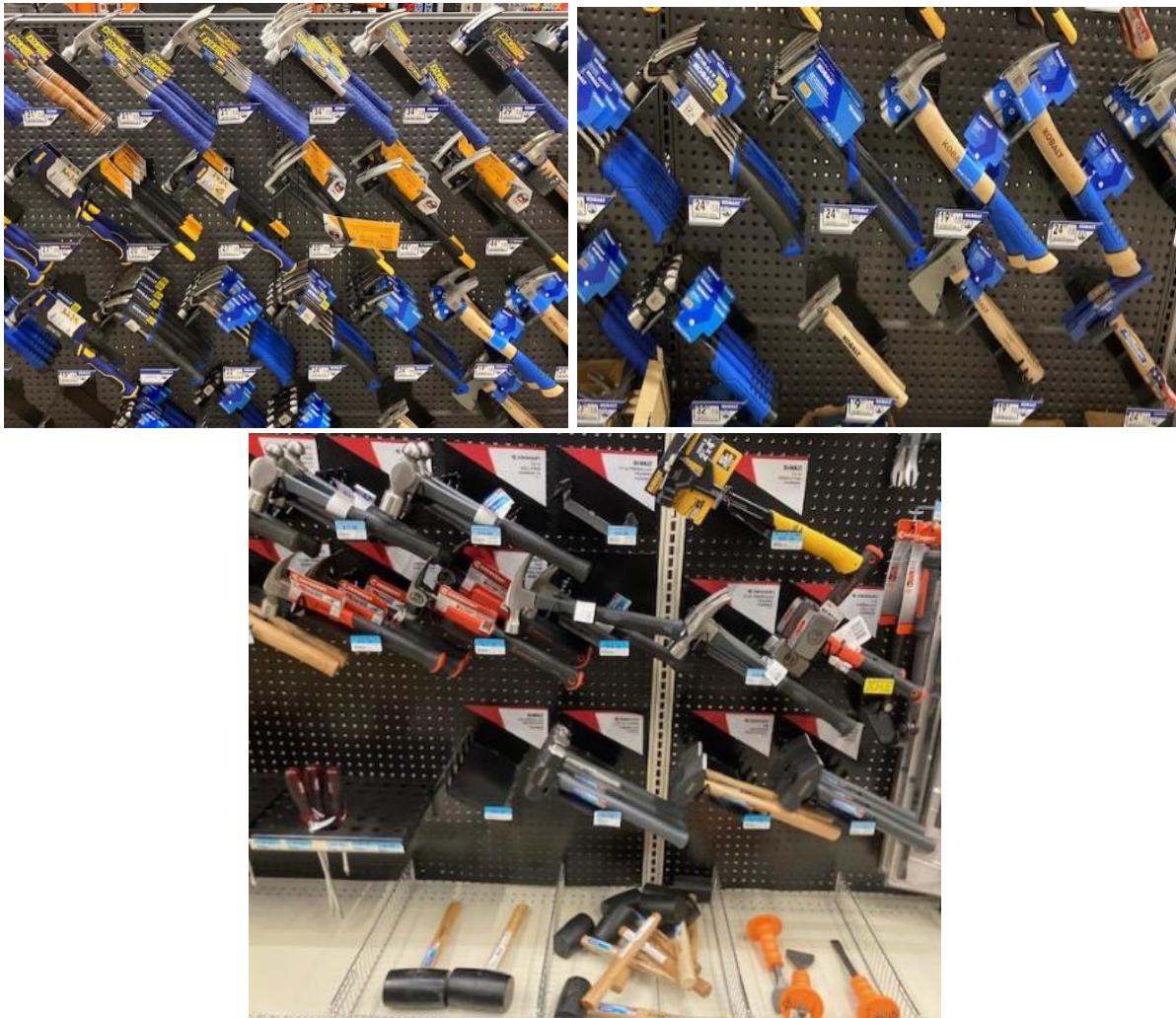
Never use a hand wrench socket on a power tool

When using an adjustable wrench, put it on the nut with the open jaw facing you so you can pull the wrench instead of pushing it.

Heavy Civil Construction Safety
Part 4. Hand & Power Tool Safety

A SunCam online continuing education course

Hammers



Hammers are probably the most utilized tools in construction. Some workers use them all day / every day, and injuries occur from either being hit by a hammer or from



Heavy Civil Construction Safety
Part 4. Hand & Power Tool Safety

A SunCam online continuing education course

something which flew off the item they were hammering. To help avoid these injuries consider some of the following:

Use the right hammer! A claw hammer is not hard enough for metal work. Don't use a claw hammer if you are using a chisel. Don't use a ball-peen hammer for driving in steel pins, use a sledge hammer. Do not use the claw as a chisel, rock hammer or masonry hammer blade. Get the right Hammer!

Don't use a damaged hammer, replace the handle if it is cracked or splintered.

Make sure the hammer head is secure and tight.

Inspect the striking face, it should be flat but not overly smooth to reduce glancing blows.

Wear eye protection, especially for stone, masonry, and metal work.



Heavy Civil Construction Safety
Part 4. Hand & Power Tool Safety

A SunCam online continuing education course

Chisels



Chisels are very basic tools but still cause injuries. When swinging the hammer you can miss and hit your hand. The chisel can slip and hit your leg or arm. The chisel can splinter and fragments can cut you. The material being chiseled can also splinter and strike your eye.

Precautions include wearing eye and hand protection, inspecting tools and materials for points of failure, operating and bracing on a clear and secure area, and utilizing the right tool for the right material.

There is a difference between a wood chisel, a cold chisel, a punch, and a star drill. The chisel should be the right size, and have crisp ends with no burrs. The hammer head striking the chisel should be slightly larger than the chisel. Use a chisel holding device where possible to avoid striking your hand or another worker's hand.

Heavy Civil Construction Safety
Part 4. Hand & Power Tool Safety

A SunCam online continuing education course

Power Drills



Use sharp bits, drill straight (bits can't take side pressure), don't wear loose clothing, and fully secure the bit in the chuck. Disconnect the drill before changing a bit and remove the chuck key before starting. Use the correct bit for the material being drilled, and use a center punch when drilling metal to avoid sideslip. Most injuries are from broken bits, but chips and splinters are also hazards. Proper eye and hand protection will help to minimize these injuries. Do not use a makeshift bit, screwdrivers are not drill bits.



Heavy Civil Construction Safety Part 4. Hand & Power Tool Safety

A SunCam online continuing education course

Jacks



Jacks are a little more specialized than the previous tools but they must be used correctly or the consequences can be catastrophic. Jacks need to be on firm, level, and stable ground. Do not allow workers underneath a jack only supported load. The jack needs to have the load capacity clearly identified on the tool and should have a position stop to prevent overtravel of the lifting cam. Lubrication and maintenance must be scheduled and followed by the manufacturer's requirements.



Heavy Civil Construction Safety
Part 4. Hand & Power Tool Safety

A SunCam online continuing education course

Knives

Sharp- not dull

Kept in holder, preferably foldable with locking mechanism

Cut away from the body – not towards

Not a screwdriver

Cut straight on – no side pressure or blade will snap

Cut on a support – not with object in your hand





Heavy Civil Construction Safety
Part 4. Hand & Power Tool Safety

A SunCam online continuing education course

The reader should be fairly familiar with the above listed tools and probably have them in their personal tool box or have at least used them at some point in their career. The next series of tools are more specific to individual trades and the reader may be less familiar with the operation and safety of these tools.

Powder-Actuated Hand Tools

These tools are better known by their manufacturer's name like Hilti and Ramset. There are others but these two are the most prevalent. They are .22 and .38 caliber guns. They are dangerous without proper training and the law requires that training provided by the manufacturer or distributor must be performed prior to use. The user of the tool must have a training card with him at all times when using the tool.

The safety topics of the certified training must be followed, these are not a substitution but a few of the topics include:

The worker using the tool must have proper training and must carry the certification card

Eye protection is mandatory

Do not remove safety devices for convenience

Clean the tool frequently and after every use, similar to cleaning a fired gun

They must be kept unloaded when not in use

They must be locked up at night

Do not use for tile, hollow concrete block, cast iron, bricks, hardened steel, glass, rock, or mortar

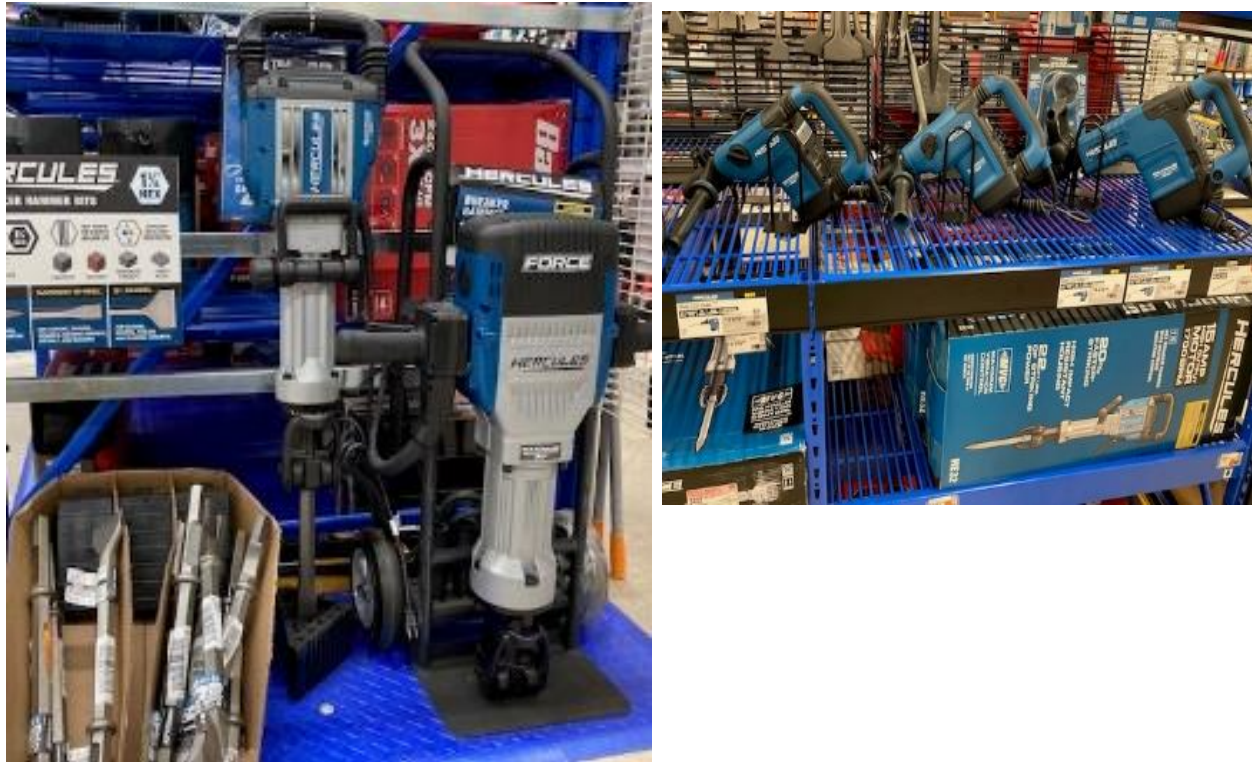
Hearing protection is needed when used indoors

Use the correct shot caliber for the use.

Heavy Civil Construction Safety
Part 4. Hand & Power Tool Safety

A SunCam online continuing education course

Jackhammers



Jackhammers probably cause more serious injuries in heavy civil construction than any other hand tool. They cause serious back injuries, eye injuries, and the occasional foot injury. Extended exposures can lead to hearing loss, and the vibrations /impacts can lead to hand wrist and arm damage. They create silica dust from the demolition activities and precautions must be taken for these risks but they will be the subject of a separate course in Silica Exposure Construction Safety.

Back Injuries:

Jackhammers are heavy and awkward and from the rubble they create, they are usually used on uneven/loose surfaces.



Heavy Civil Construction Safety
Part 4. Hand & Power Tool Safety

A SunCam online continuing education course

Make sure footing is secure and move with lower body avoiding twisting motions, similar to shovel work.

When jackhammer bits get stuck, do not jerk the hammer to pull it loose. It probably won't budge or it will suddenly break free, either way it could easily result in a back injury. Use another hammer to break the surrounding material to free the bit.

Do not use a full size jack hammer for horizontal work, even smaller chipping hammers are heavy and should not be used without supports for extended periods.

Eye Injuries:

Safety glasses are required, more appropriately goggles and face shields should be used.

Foot Injuries:

Steel toe boots should be used, metal shin & metatarsal guards offer additional protection. Stand with feet placed at shoulder width to provide a stable posture and to keep feet away from a skidding bit.

Other items to consider:

PPE to be used - Hearing protection (mandatory), dust masks (see silica protection), sturdy anti-impact gloves.

For pneumatic hammers, hose fittings must be tight with a positive locking connection and an anti-whip device

Know what utilities may be present before breaking concrete encasements, sidewalks, or pavement

Don't hoist hammer by the hose

If quick disconnects aren't present then the air hose lines must be bled first before disconnecting

Air injected into the skin can Kill!



Heavy Civil Construction Safety
Part 4. Hand & Power Tool Safety

A SunCam online continuing education course

Abrasive Grinding



Eye injuries and cuts are the most common and serious injuries from grinders. The use of the grinder requires constant pressure from the user and this can be tiresome. After a while the user can lose his grip and the grinder can slip off the work and end up cutting a leg. The use of the grinder creates a shower of particles (sparks if metal) safety glasses are not sufficient, goggles and face shields must be used.

Gaurds, automatic shut-offs, side handles, and other safety devices are part of the grinder for reason, they must not be removed for ease or convenience.

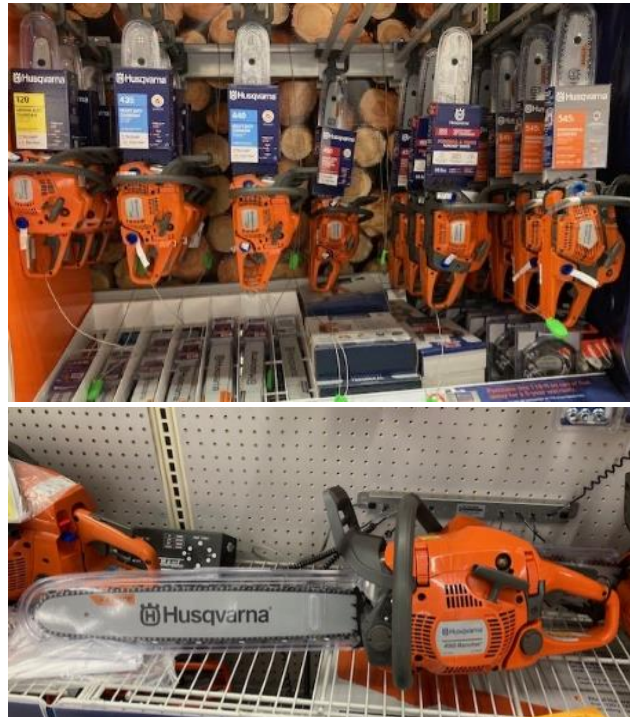
Lastly, abrasive wheels can explode. If the wheel is nicked or cracked and is used at a high speed against an unforgiving object, the wheel will blow apart. They can blow apart simply from being run too fast. The blade speed is printed on the wheel, match the speed of the grinder with the speed marked on the blade. Over-speeding does not improve the results. The wheel works best at the speed specified.



Heavy Civil Construction Safety
Part 4. Hand & Power Tool Safety

A SunCam online continuing education course

CHAINSaws



Chainsaws are probably the most dangerous hand tools regularly used in Heavy Civil Construction. The warnings in the instruction portion of any manufacturer's operation manual reinforce this statement. Some of the critical instructions are:

Workers should not be allowed to use a chainsaw unless they have been trained or are under the Direct supervision of someone who is experienced. Training is mandatory.

Do not take shortcuts or operate when tired.

Hearing protection and eye protection are mandatory.



Heavy Civil Construction Safety
Part 4. Hand & Power Tool Safety

A SunCam online continuing education course

The condition of the saw is critical. The chain must be sharp and properly tensioned. While idling, the chain must stop and hold. It must have a brake and should have a front guard (may incorporate the brake) and an anti-kickback tip.

Operate tool with two hands.

Start chainsaw from the ground with a firm stance. Never drop start it or rest in on your leg.

Loose clothing should be avoided, gloves and chaps are recommended.

Do not use chainsaws alone, have someone nearby for assistance and emergencies.

Chainsaws must be operated at high engine speeds and should reach full speed before use.

Most Kickbacks occur from cutting with the tip. Never start cutting with the tip of the bar and don't let it hit the ground.

Only cut wood with chainsaws.

Don't cut with a chainsaw above shoulder height. Kickbacks are hard to control in this position.



Heavy Civil Construction Safety
Part 4. Hand & Power Tool Safety

A SunCam online continuing education course

CONCLUSION



There are so many other types of tools, and each have their unique hazards. Hopefully each of the tools chosen in this course represents a category of tool that can have transferrable knowledge when applying to pieces not specifically addressed and the reader can use the information as a foundation to learn more about the specific tools they encounter at project sites.



Heavy Civil Construction Safety
Part 4. Hand & Power Tool Safety

A SunCam online continuing education course

As previously stated, this is the fourth course in a proposed series on Construction Safety. The series of courses offer only a brief introduction to each topic and do not offer or imply any type of certification or level of expertise upon completion. For a better understanding, the reader should visit OSHA's website (The Occupational Safety and Health Administration) and should consider getting their OSHA 10-hour and OSHA 30-hour Construction Safety and Health Card by successfully completing OSHA recognized Classes.

Lastly, safety must be a constant focus of every operation. Because of the variability of Heavy Civil Construction Projects, they are often chosen to be constructed in some of the most adverse and inaccessible areas imaginable. Working with extreme weights, at excessive heights, in adverse conditions, and around large equipment requires safety diligence from every stakeholder. Personal protective devices must be worn at all times. **Please be safe.**

