

Chapter Eight

Tools in the Toolbox: Equipment

Wear All Your Gear All the Time

To develop an effective O&M program, amassing materials, supplies, tools, vehicles, and equipment is a must. For the field technicians, this is where the fun starts, and they would probably term this chapter “Toys in the Toy Box” since equipment is what puts the trail on the ground and keeps it there. For the program managers, equipment poses a multitude of questions with not-so-easy answers, including what needs to be bought and when?; how will it be paid for?; where will it be stored and how will it be moved around?; and who will operate, maintain, and repair it?



Often two pieces of equipment are more efficient than just one.

Heavy Equipment

Here are some thoughts regarding heavy equipment:

- There isn't one do-all machine; it usually takes a combination of equipment to accomplish all of the necessary tasks.
- Program managers should identify equipment needed for the short term (construction) and equipment needed for the long term (operation and maintenance).
- Managers should examine options to borrow, rent, or contract the equipment for the short term.
- Program managers should only buy the equipment they know they will need, not what they think they might need.
- In most cases, managers should not buy equipment that is wider than the intended trail widths.
- Equipment is just a tool that is useless and potentially detrimental without a skilled operator who has the finesse, vision, and experience to create a great trail and maintain it as a great trail.
- Trail construction takes a different skill set than road construction, so there can be challenges in trying to train a road builder to be a trail builder.

- Trails are a narrow path on steep, rocky, irregular, and often soft ground. Any machine can quickly go sideways and the operator must instantly know what to do. All operators must be trained. Don't trade expensive, but experienced operators for inexpensive, but inexperienced operators to try to save money. It could be a costly decision.
- As a minimum, managers should ensure that other personnel are on site in the vicinity of equipment operation. On technical terrain, spotters should be working with each piece of equipment.



A dozer can push through a rock pile like this and some of the rocks may roll down the hill. An excavator can create a bed for the rocks and carefully place each one. Rocks like this can be used to support the trail tread or used as anchors or chokes for the trail which will enhance the trail's aesthetics and the rider experience.

There are five main performance categories for heavy equipment: loaders, haulers, pushers, diggers, and other. Some equipment like dozers are purpose-built to perform as pushers, while others, like excavators and skid steers, have the ability to perform well as loaders, haulers, and diggers.

Dozers come in all shapes and sizes, but trail work usually requires only two sizes of dozers. Trail dozers have a track width of less than 50" and full-sized dozers are everything over 50" wide. Mechanized trail building is 10 times faster and cheaper than building by hand, and trail dozers are purpose-built for trail building. Though small in size, they are powerful and versatile with a six-way blade and draw bar with rippers. A variety of attachments are available, and they can grub a stump or move a large boulder. One advantage they have is that they can maneuver easily within the tighter confines of a trail corridor and minimize environmental impacts. The full sized dozers are great for anything which requires a larger foot print than can be accomplished by the trail dozer.

A Closer Look...

Building trails is not about plowing dirt. In fact, most times the objective is to minimize the amount of dirt movement and retain as many natural features as possible. More important than the size and type of equipment is the skill, motivation, and finesse of the operators. Trail planners and designers can have a great vision and a great design, but it's the operators who put it on the ground and keep it maintained. They can turn a great design into a great trail; a mediocre design into a great trail; or a great design into a poor trail.



A 6-way blade makes short work of trails on steeper ground.



With traction, power, durability, versatility, and maneuverability, a trail dozer is an excellent piece of equipment.



Mechanized equipment is faster and cheaper than building by hand.

There are a lot of jokes about the “baby” dozer, but it all comes down to selecting the right tool for the job.

Excavators are diggers and loaders. They are extremely versatile pieces of equipment because they can construct tread, dig holes, dig ditches, pluck rocks or stumps out of the ground, and drag debris in or scatter debris out of the trail corridor. Most have a two-way blade, but some even have six-way blades for efficient grading and shaping. Having a thumb on the bucket increases the machine’s versatility.

With a large selection of excavators in the rental market, it is easy to match the best sized machine to the job; two to look for are mini-excavators and full-sized excavators. It’s hard to beat the versatility and finesse of a mini-excavator, which is less than 50” in track width. Many have adjustable-width tracks, a zero clearance cab, and a bucket with a thumb for handy plucking and placing.



A bucket with a thumb is great for grabbing material and placing it strategically without a lot of ground disturbance. The versatility of a mini-excavator makes it a good choice for finesse or finish work.

The ability to work on steep slopes, scatter debris and reach down to remove woody debris from the embankment area is an advantage.



These are great for building narrow treads, digging ditches and drainage structures.

The operator is digging a hole to plant a boulder for a road-to-trail conversion.

Full-sized excavators are handy for constructing wider trails, closure and rehab, road-to-trail conversion, and facility construction. Often, the ideal equipment combination is a trail dozer and a mini-excavator working together.



A clamshell bucket is also very handy for plucking trees, stumps, or rocks. This one has a built-in grizzly that allows dirt and smaller rocks to fall through.



This excavator is rehabbing old hillclimb trails. It is scarifying the trail, installing waterbars in a herringbone pattern, and strategically placing logs that divert water and deter riders.



Need more reach? Not a problem as this excavator places a blanket of energy dissipaters in this drainage.



Equipped with a 6-way blade, this excavator is a versatile trail making machine.

Small size, fast walking speed, and a host of attachments give skid steers great versatility and make them ideal companions with other equipment to accomplish a wide range of tasks. They can be pushers, diggers, loaders, and haulers. One advantage they have is that they are readily available at most rental stores. Mini-skid steers are commonly called walk behinds because there is no operator cab or seat post. These small machines are maneuverable and have many of the same attachments as their big brothers. The common name is a misnomer since most have a platform for the operator to stand on. They don't have the force of a trail dozer, but they can work well for light excavation on flatter ground or finish work. Many have a six-way blade that helps them cut into shallow sidehills with soft soils. The auger attachment is handy for sign or barrier posts, but a slow walking speed does not make them efficient for widely scattered installations.



Whether used as loaders or haulers, skid steers are versatile trail-sized equipment. Because they are tracked with low center of gravity and good braking ability, they are far more stable and safer as a tow vehicle than an ATV or ROV.



The wide range of attachments for skid steers makes them useful for a variety of tasks. This bucket attachment with a fixed thumb works well for placing these barrier rocks.



This flail or mulching attachment makes quick work out of clearing brush and small trees as it pulverizes logs and woody debris on the ground.



If one thumb is good, two has to be better. A clamshell bucket can hold material with odd shapes and sizes.



Though most are equipped with either a blade or a bucket, mini skid-steers have a huge assortment of handy attachments and they are often available at local rental stores.



A tractor with a backhoe attachment can be very handy to load and haul material and to dig holes for barriers, fence posts, and sign posts. Thus they fall into the loader, hauler, and digger categories. Four wheel drive is recommended for most trail applications. Their fast walking speed gives them an advantage over mini-excavators or dozers with backhoe attachments when work is scattered over a wide area. Their three-point hitch and power take-off (PTO) allow for a wide range of power attachments from box blades to mowers.



The clamshell bucket on this backhoe adds to the machine's versatility. It can scoop, load, back blade, pluck, place, and chop.



The backhoe attachment can increase the versatility of a tractor.



Trail dozers, mini-excavators and mini-skid steers are commonly used to build single-track trails. Motorcycle riders have always coveted sweet single tracks, but when it comes to a designed trail, the issues have always been how to build it and then maintain it. Riders will volunteer to build the trail and do. But it is a slow, laborious process and few volunteers can or will return day after day. Purists will say that the only good single track is hand-built single track because it is more natural. When done properly, it is pretty hard to tell a hand-built trail from a machine-built trail. It all comes down to the skill, vision, and conscientiousness of the operator. After some time, compaction and displacement will cause roots and rocks to show on the surface; the sides will



Whether on the machine or off, the control panel moves with the operator. This not only can increase operator safety, it allows the operator to always be in the perfect vantage point to control and finesse the machine.



Like its big brothers, the mini-dozer has brute force power, yet the agility to finesse. Note the big 6-way blade and pointed blade tips. These are great for digging out stumps and boulders if it's desired to have those features come out.

Tip, Trick or Trap?

Tip: Equipment is useless if it doesn't work or breaks down when you need it

Keep all equipment clean and serviceable, do daily maintenance and inspection, and perform all scheduled preventive maintenance.

With equipment, the production rate is much higher and the cost of construction is much lower. There are now machines that have been purpose-built for single-track trail construction and maintenance. Find more information about these machines at greatohvtrails.com.

Rock crushers fit into the "other" category. There is usually a need for crushed rock on most trail projects. If a trail has sections of loose cobble rock, scree, lava, river rock, or glacial till and if those sections are not consistent with the intended difficulty level of the trail, crushing that rock in place can provide a more rideable and stable trail tread. Rock crusher attachments are available for skid steers, excavators, and some trail dozers. Grinders and pulverizers are available



This manual-feed crusher attachment reduces cobble size rock in place. The smaller, angular rock resists displacement and will provide a more solid, durable trail tread.



If there is a source of suitable rock, a portable crusher can be set up onsite. The crushed rock is then loaded into dumpers and hauled to the work site.



This single track trail was constructed with a mini-excavator and a good operator. It is narrow and has a beautiful flow, notice the roots appearing in the tread through compaction.

Tip, Trick or Trap?

Trick: Riders usually make the best operators

It can be easier to teach a rider how to be an operator than to teach a seasoned heavy equipment operator how to build a trail. Riders know the flow, can understand the vision, and can do a test ride to see and feel how well they did.

for loaders and other equipment. If there is a source of suitable rock, a portable crusher can be brought in and set up on site. The crushed rock is then loaded into dumpers and hauled to the work site.

Rock, aggregate, and good quality soil are a great resource for check dams, bridge abutments, drains, headwalls, energy dissipaters, or trail hardening. The issue is getting the material from the source to the site. One solution is a motorized toter or dumper. They come in all shapes and sizes and some are even self-loading. Because they need to fit on the trail and traverse rough terrain, they can have a slow walking speed and relatively low carrying capacity. If there is a lot of material to be moved for any distance, several dumpers may be needed.

Tip, Trick or Trap?

Trick: Effective grooming: lighter is better

With any drag, making several light cutting passes is more effective than one heavy cutting pass. This produces a better product with less wear on the equipment.



A flexible pasture drag is great for smoothing a newly constructed trail and removing woody debris.

Drags are pull-behind grooming tools that are used in both construction and maintenance. The best drag or combinations of drags is often found by trial and error on a specific site. The choice of implement depends on many factors such as the task at hand, soil type, trail width and alignment, use type, and required maintenance frequency. There are five main types: flexible drags, rigid drags, rock rakes, box blades, and other.



This flexible drag has been modified with a heavier square tubing draw bar and rear channel iron. These work well in soft or disturbed soils, but not in compacted trails where displacement has occurred.

Flexible drags are pasture drags or tine harrows that are made from a draw bar and flexible steel web with steel tines on one side of the web. They can be flipped over when traversing rocky trail sections so the tines don't unearth more rocks.

With the tines down, they smooth the trail tread, remove small rocks, and collect woody debris. As the debris collects under the drag, the operator must sporadically stop, flip the drag over, and clean it out. They are great for dressing up a newly constructed or reconstructed trail. Flexible drags are effective in loose soils, but not effective in compacted soils since they have limited weight and cutting ability. Being flexible, they are also not effective in smoothing out a heavily moguled trail since material is removed from both the humps and the dips.

Flexible drags can be modified in many ways, including replacing the round draw bar with a piece of channel iron or square tubing for more weight and cutting action. A piece of channel iron can also be added to the rear for more rigidity, weight, and cutting and smoothing action.

A downside of flexible drags is that they are always on the ground. They work well for construction since everything needs to be groomed, but not for maintenance where one section of trail may need grooming, but not the next section.

Rigid drags, the second type of drag, are long, rigid, and usually have cutting blades in a variety of configurations similar to a snowmobile trail groomer. Some rigid drags have cutting blades with adjustable angles and heights and most



This rigid drag has non-adjustable angle iron cutting blades that are designed to cut the edges and fill the center of the trail.

have rear wheels that can raise the whole implement off the ground for easy transport. Rigid drags will work in compacted soils to cut and fill moguls and to smooth out the trail tread.

They are heavy and if they are allowed to cut too much, the weight can tax the transmission of the tow vehicle. Being long and low, they are



A rigid drag works well in non-cohesive soils that mogul out quickly. This crew uses a rigid drag followed by two rock rakes.

not very maneuverable and they usually don't work well in super tight trails, but in open country they can be quite effective.

Rock rakes, the third type of drag, have a steel bar with spring steel curved tines bolted to them. Their name is misleading since the equipment is a rake, but not necessarily intended to only rake rocks off the trail. They have either electric motors or electric and hydraulic motors so that both the height and the angle of the comb are adjustable. Most have a u-joint coupler, a handlebar-mounted control box, and a safety breakaway wiring harness. The tines will wear out but they are replaceable. These are the most effective grooming tools on the market and will work in soft soils, compacted soils, and moguls. The small tines have a large psi so they have a powerful cutting action. The adjustable comb allows the operator to direct where the material goes.



This sliding comb rake can reach out and retrieve material that is normally unrecovered and wasted in berms.

With the comb off the ground, these are easy to back up, turn around, or avoid sections that don't need grooming like rock gardens.



This fixed-comb rock rake has hydraulic rams which have proven durability in dusty conditions. The steel tines are replaceable. Which ones wear out first? The outer ones since most trails are cupped by the forces of compaction and displacement.

Most vendors make two models of rock rakes. One has a fixed comb where the comb rotates on a fixed axis, and the other has a sliding comb that not only rotates, but extends out from one side to the other. The advantage of



The rock rake can cut material from the edges and drift it into the center. Combs are available in different widths. At full tilt, this fixed comb extends past the width of the ATV to retrieve berms.

the sliding comb model is that it can retrieve berms that have built up along the sides of the trail. Their downsides are that they are heavier, have a higher center of gravity that may not work well on superelevated curves, and are considerably more expensive. A fixed comb model can also retrieve berms if there is enough clearing width to allow the tow vehicle and the groomer to straddle the berm. For most routine maintenance, the fixed comb groomer is both



Box blades have ripper teeth inside the box, which shapes and compacts the material.

effective and a better value.



This disc and tire combination is being used on sandy trails. Due to its length, this unit would not work well with a tight curvilinear alignment.

Box blades, the fourth type of drag, attach to the three-point hitch of a tractor and are very common in track and arena grooming. Most have a set of ripper teeth mounted inside the box and the teeth can be down or up. The box shapes and compacts the ripped-up material. They are available in a variety of widths down to 4 feet and can work in a variety of soils. Unless

the tractor is equipped with a float mechanism, a box blade will not work well on undulating or moguled trails. Other potential pitfalls are that they tend to cut a trench; the operator cannot drift material from one side of the trail to the other; and it is difficult to reach out and bring in berms.

The last type of drag is for everything else from bed springs to discs to tires. There are a lot of implements commercially available, or the trail team members can get creative and fabricate their own. They shouldn't be afraid to experiment until they find the implement or combination of implements that work the best for their situation.

Compaction equipment compresses soil or rock particles into a denser mass that increases durability and bearing strength. It is essential for the stability of large embankments. It's an important element in the installation of structures such as for the packing material behind retaining walls, bedding culverts, and foundations for bridge abutments. The desired density is best achieved when material is placed and compacted in shallow layers. A compacted trail surface, whether native surface or crushed rock, will retain its shape far longer than a non-compacted tread because it resists the forces of displacement.

A huge assortment of compaction equipment is available, including tampers, plates, and rollers that are either hand operated, self-propelled, or attached to other equipment. Vibratory rollers will compact better and deeper than non-vibratory rollers. Even without specialized equipment, some degree of compaction will occur just by running whatever equipment and vehicles are on site over the full width of the trail.



This sheep's foot roller attachment behind a trail dozer doesn't vibrate, but it does a good job of compaction when there are favorable soil moisture conditions.



this tandem-drum walk behind vibratory roller is labor-intensive, but it produces a well-compacted product.



Moist soil will compact better than dry soil, so try to time compaction operations during periods of favorable moisture content.



These handy vibratory plates will not exert the same compactive effort as a smooth drum roller, but they do a good job smoothing and compacting the surface of the tread. One advantage of compaction attachments is that they can be raised by the equipment to avoid root or rock sections.



This trail size ride-on vibratory roller beats a walk-behind any day, however for safe operation, the tread surface must be relatively smooth and level from side to side. These will not work well with protruding roots or rocks.

Tip, Trick or Trap?

Tip: You cannot roll out pie crust in a bowl

Do not use compaction equipment on a trail that has a concave or convex shape. The entire tread surface must be uniform from side to side and the soil density must be uniform or only the high points and dense points will receive compactive effort.

A wide range of trailers are useful to haul equipment, materials, and supplies. There is not one do-all trailer and most O&M programs have a fleet of highway trailers and off-highway trailers. Highway trailers are usually full-sized flatbed trailers designed to haul equipment or utility trailers designed to haul materials. Off-highway trailers can help bring materials, equipment, and supplies to a trail work site. They can be pulled by ATVs, ROVs, or skid steers. The trail team members should heed towing capabilities of the tow vehicle before loading up a trailer. Uneven terrain and steep grades add to the challenge of towing off highway so exceeding the tolerances can be risky.



Without road access, it can be a challenge getting materials and supplies into a trail work site. Trailers in a variety of configurations can be a big help.



Flatbed trailers with a built-in ramp like this are great for hauling OHVs, drags, materials, and supplies.

Tip, Trick or Trap?

Tip: Properly secure all equipment and materials

Never transport equipment that isn't tied down securely even for short distances

Tip, Trick or Trap?

Trap: Bigger equipment isn't always better

Although trails can be constructed with equipment that is wider than the intended trail width with care and some extra work, they cannot be maintained with equipment wider than the trail



Rubber tracks are flexible and have no grousers. With a low PSI and a careful operator, this machine can walk over hand placed trail armoring stones without breaking or displacing them.

A Closer Look...

How to Approach Equipment

It takes hand, foot, and eye coordination to be an operator and intense concentration to make the machine do what the operator wants it to do. The operator's focus is on safely and efficiently accomplishing those tasks, and not necessarily what is going on around him. It is dangerous to come within 20' of a machine being operated unless directed to do so by the operator. Workers should not assume an operator has seen them approach or they will put themselves at risk.

A good trick is the Stick Method. When approaching equipment, even from the front, pick up a good-sized stick (a lath or roll of flagging will also work). If you are unable to get the attention of the operator, throw the stick over the cab or beside the cab at the eye height of the operator. An astute operator will immediately stop to figure out where that came from. Once you have the attention of the operator, wait for a signal that it is okay to approach. A good operator will lower the blade or the bucket to the ground, throttle down, and take his hands off the control levers.

Equipment Drive Characteristics

Steel Track	Rubber Track	Tires
Durable	Durable on dirt, but a lot of sharp rocks will eat them up	Durable
Low PSI due to high ground contact area	Low PSI due to high ground contact area	Higher PSI due to lower ground contact area
Excellent traction in dirt and mud	Good traction in dirt and mud	Poor traction in dirt and mud
Poor traction on rocks	Better traction on rocks	Poor traction on rocks
Will not slip off in uneven terrain, but they can bind up when clogged with debris	Can slip off in uneven terrain	Potential to break the bead or puncture sidewalls in uneven terrain
Higher potential ground impact	Lower potential ground impact	Higher potential ground impact
Better on steeper grades	Good on steeper grades	Poor on steeper grades, better suited on flat grades
Smooth ride	Smother ride	Bouncy ride
Highest potential to break or dislodge roots and rocks	Lower potential to break or dislodge roots and rocks	Lowest potential to break or dislodge roots and rocks
Steel grousers can damage bridge decks and other structures	Much less potential for structure damage	Much less potential for structure damage

	Dozers	Excavators
Functions	Push, sidecast, rip, back blade; good for construction and maintenance	Dig, pluck, place, load, scatter; limited push and back-blade; good for const., finish work, local maint.
Material Handling	Push, sidecast	Pluck and strategically place
Brushing	Unable to remove debris from embankment area on steeper ground	Able to remove debris from embankment on any slope
Cut slopes	Unable to shape steeper cutslopes	Able to shape any cutslope
Maneuverability	Needs flatter area to turn around. Locking tracks increase ground disturbance	Only needs enough clearance to swing cab to change direction
Stability	Low center of gravity helps stability but stability affected by rocky or slippery slopes	Higher center of gravity can hinder stability but ability to use boom to stabilize on rocky or slippery slopes
Compaction	Excellent embankment compaction by track-splitting or optional mechanical roller	Can use boom to compact embankments or use optional mechanical roller
Slash and Debris	Clears debris deposited in mound or ball	Able to scatter debris on any slope
Objects	Can roll objects but creates ground impacts outside trail prism	Can reach, grab, place objects while staying in trail prism
Digging	Good for trenches and large holes	Good for ditches, post, barriers

Hand and Mechanized Tools

No trail can be constructed by heavy equipment alone. Hand tools do the clearing, pruning, root cutting, structure assembly, and the final finesse work to make it all look pretty. Three common mistakes that are made when purchasing tools are: 1) not buying a good variety of tools like shovels, Pulaskis, and McLeods; 2) not buying enough of each tool; and 3) not buying or renting the right specialty tools (like drills, augers, and rock hammers) that make tough tasks easier. Each tool has a purpose and not having the right mix of tools can make a task much more difficult. Building a single-track trail with just shovels is a waste of time and energy. Tools have a tough life and often a short life as they get misplaced, broken, dulled, and misused.



It can be challenging just getting the tools and gear to the work site. From L to R, chainsaws, brush cutters, shovels, McLeods, pulaskis, and loppers.



Camaraderie is important with any crew, but this group is working too closely together for safety. There should be a minimum of 6' between workers. It is a good example of the use of hardhats and the number of tools that are needed for a work crew.

The following paragraphs describe some of the most common hand tools for trails.

Pulaskis are one of the most essential trail tools because they can cut, chop, dig, and pry.

McLeods are the second most essential trail tools. They combine a hoe and a rake and are great for chopping, moving dirt around, raking out rocks, and shaping the tread, rolling dips, or lead-off ditches.

Chainsaws, with a variety of chain and bar configurations, are essential for cutting trees, logs, brush, and trimming posts, barriers, and other wooden structures.

Loppers are great for pruning small limbs and cutting roots out of the cut bank or trail tread.

A good quality folding saw makes cleaner and closer cuts than a chainsaw and is very handy for final touch-up pruning. Adjustable pole pruners are great for trimming long droopy limbs and they're much safer and faster than using a ladder or standing on top of a vehicle.

Gas-powered brush cutters and hedge trimmers are great for removing or cutting back underbrush, both in construction and maintenance. Hedge trimmers come in either standard or pole units. They are good for keeping new growth from side vegetation from creeping into the trail in places where the tread is already established. Brush cutters come with a variety of implements from blades to nylon string. Choose the correct implement for the largest growth which needs to be cut.

In a deciduous forest, leaves can be a nuisance. Leaf blowers can remove leaves from the work site or blow leaves back onto cut or fill slopes to provide a natural appearance and to protect them from exposure to the elements. Blowers are also handy for removing dirt from bridge decks and other structures.

Spade shovels are indispensable for digging holes, moving dirt, prying out rocks, and cutting roots.

Bow rakes or smaller landscape rakes smooth out the surface and remove small rocks and woody debris. They are great for final shaping and finish work.

It is always amazing how many rocks there are in the exact place a hole needs to be made. Rock bars and tamping bars help to break up or dislodge rocks. A tamping bar is pointed on one end and has a small flat plate on the other, so it can be used for digging and compacting.



The pulaski is an essential trail tool.



McLeods are also essential trail tools.



Chainsaws are an essential trail tool for several functions besides tree removal.



Leaf blowers can move away nuisance leaves in a deciduous forest.

Depending on soil type and time of year, post hole diggers and power augers can be great for digging holes for sign posts and barriers.

Portable air compressors are essential because there is always a need for compressed air. Tires go flat, filters need to be cleaned, dirt needs to be blown off parts or personnel, air tools can be more powerful than hand tools, and the list goes on. An industrial-grade air compressor is an essential component in the shop, shop truck, or field staging area. Some heavier equipment offers a compressor as an accessory and this is usually a worthwhile option to consider. Having the ability to use pneumatic drills, rock splitters, and compactors can save a lot of manual labor and is more efficient.



Gas powered augers save time and hands for sign post or fence installation.

Portable generators are another essential tool because there is always a need to power lights, tools, battery charging stations, etc.

Sometimes, just the tip of a rock needs to be moved out of the way, not the whole rock. And sometimes seems that rocks are anchored to the other side of the world. In those situations, having a pneumatic, gas, electric rock hammer or drill is both safer and faster than ordinary hand tools.



Brush cutters are great for clearing underbrush from a single-track trail.



Pneumatic rock splitters clear away stubborn rocks in the tread.

Many of the wooden structures require the drilling of holes for bolts or drift pins. This can be a tough task that requires electric- or gasoline-powered drills and long drill bits.

Equipment and tools break. Being able to weld on site with a portable welder can save on downtime and expensive trips to a repair shop.

Equipment will also get stuck or find its way into a precarious position. Having a winch suddenly becomes an essential item in these situations. When ordering equipment, it is usually wise to purchase a winch if it's an available option. Chainsaw winches, come-alongs, and OHV winches can be invaluable in moving rocks or logs and in placing bridge stringers, puncheon, and other structures.



Equipment can find its way into precarious positions.



Drills and bits are invaluable for on-site structure assembly.

The list can go on forever, but some other tools worth mentioning include the following:

- pick mattock
- hazel hoe or adze
- mallet
- sledge hammer
- hand seeder
- fence stretcher
- fiberglass marker installer and removal tools
- T-post driver
- pop rivet tools
- complete mechanics tool sets (both standard and metric)
- cordless drill and drivers
- hand saws
- corded or cordless circular saws
- A tool bag is great for everything else:
 - a drill and driver with spare battery and bits
 - sockets and wrenches for whatever size hardware is being used on the project
 - an assortment of hardware
 - an assortment of decals
 - a fencing tool
 - torpedo level to make sure the signs and posts are straight
 - 25' tape measure
 - notebook and pencil
 - hammer
 - scrench saw tool
 - ear plugs
 - 4-way screwdriver
 - pliers

Tip, Trick or Trap?

Trick: Want to be ready for just about anything?

When reviewing a project site, consider carrying:

tool bag
pulaski
McLeod
folding pruner
loppers
hand axe
lath or stakes
flagging

A Second Look...

Personal Protective Equipment (PPE): PPE includes gloves, hardhats, chaps, hearing protection, eye protection, boots (or steel toe boots), long-sleeved shirts, long pants, etc. For equipment, PPE includes the seat belt. Whatever personal protective gear is needed, HAVE IT and WEAR IT.



Did we mention the #1 function of hand tools?

A Look Back...

Here are some of the elements discussed in this chapter:

- There isn't one do-all piece of heavy equipment; it usually takes a combination of equipment to accomplish all of the tasks
- Identify equipment needs for the short term and long term
- Rent or contract short-term equipment
- In most cases, do not buy equipment that is wider than the intended trail widths, especially for maintenance
- Tracked equipment has better traction and less ground impact than wheeled equipment
Steel tracks have more traction, but potentially more ground impact than rubber tracks
- Keep all equipment and tools clean, serviceable, and properly maintained
- Equipment is useless without a skilled operator who has the finesse, vision, and experience to create a great trail
- It can be easier to teach a rider how to be an equipment operator than to teach a seasoned heavy equipment operator how to build a trail
- Buy a full variety of hand tools and buy lots of them
- Whether operating equipment, working around equipment, or using hand tools, always have and wear appropriate PPE
- Ensure that all equipment and materials are properly secured during transport
- Never approach a piece of moving equipment unless directed to do so by the operator