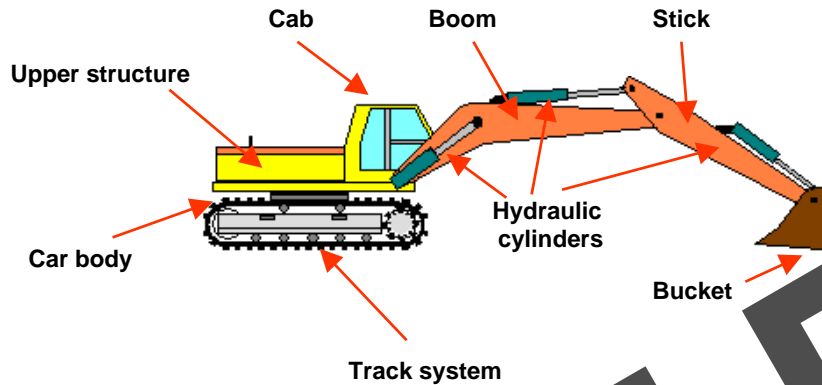


# EXCAVATOR SAFETY TRAINING



## STUDENT MANUAL

## BASIC COMPONENTS



The figure above identifies the typical components of an excavator. Some excavator may have additional attachments used to perform specific tasks. The excavator should be inspected by the operator prior to being used. The following list of items should be included in the pre-shift check.

- All safety devices: Horns, lights, guards and shields, fire extinguish, glass and wipers.
- Engine and hydraulic fluid levels
- Boom, stick, and bucket
- Hydraulic leak
- All controls for proper function

A more thorough inspection should be conducted on a periodic basis. Typically, this is done monthly, but depending on the amount of time the machine is being used and under what conditions, more or less frequent inspections may be necessary. The inspection check list shown here is an aid in conducting the thorough inspection. The operator's manual should be consulted to identify any additional inspection requirements.

### INSPECTION CHECKLIST

INSPECTION AREA	INSPECTION RESULTS			Comments
	Sat.	Unsat.	N/A	
<b>Carrier &amp; Car Body</b>				
Rotation system				
Tracks				
Rollers				
Frame, welds, bolts				
Drive system				
<b>Upper Structure</b>				
Radiator fluid				
Engine oil				
Belt tensions				
Batteries				
Hydraulic fluid				
Hydra. pumps & hoses				
Engine exhaust syst.				
<b>Cab</b>				
Seat belt				
Gauges				
Controls & Labels				
Fire extinguisher				
Glass				
Warning Alarms				
Lights				
Swing Brakes				
Electrical System				
Safety Equipment				
Operator's Manual				
<b>Boom &amp; Stick</b>				
Hydraulic cylinders				
Hydraulic hoses				
Hinge pins & bushings				
Deformations, Cracks				
<b>Bucket</b>				
Teeth				
Welds & bolts				
Pins & busings				

## WARNING LABELS



All warning labels need to be legible and replaced as necessary.

Warning labels that were on the machine when manufactured need to be maintained in readable condition. Damaged labels need to be replaced.

The standard three levels of warning are Danger, Warning, and Caution. Review the intent of these labels with the students. Remind the students that it is the operator's responsibility to know and understand the intent of each label.



Indicates imminently hazardous situation. If not avoided will result in death or serious injury.



Indicates potentially hazardous situation. If not avoided could result in death or serious injury.



Indicates potentially hazardous situation. If not avoided may result in minor or moderate injury.

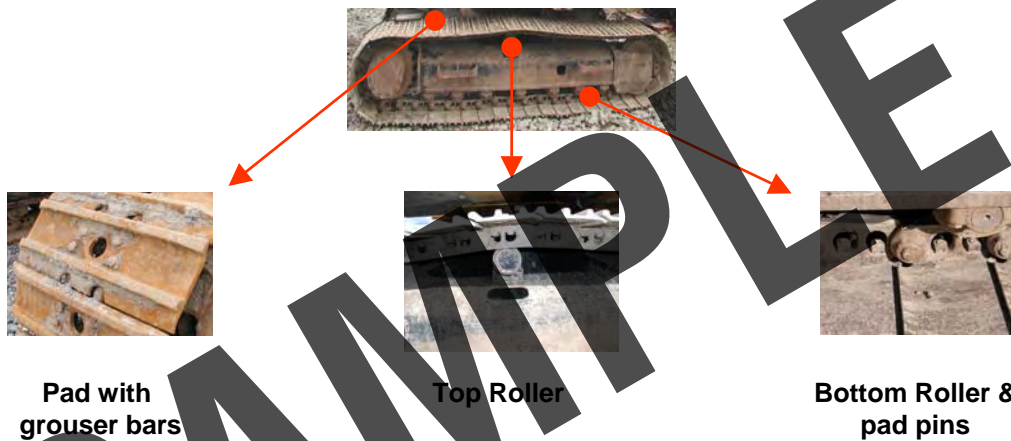


The frame of the excavator needs to be inspected for cracked welds and loose bolts. This will require crawling under the machine to perform this inspection. Often because of wet or muddy conditions, these inspections are overlooked. As the machine gets older, the potential for failed welds or fasteners increases.

An illustration of a typical rotation bearing is shown above. One half of the bearing is attached to the frame and the other half is attached to the upper structure. The only thing holding the two halves of the bearing together are the ball bearings.

When digging and lifting with the excavator, this bearing experiences tremendous loads and therefore needs to be lubricated regularly. Excessive bearing wear can be detected by first observing the relative location of the two bearing halves with each other with the bucket off of the ground. Next, place the bucket on the ground and slightly lift the tracks off the ground with the boom. Again, observe the relative location of the two bearing halves. If the bearing halves separate more than .060 of an inch, the manufacture should be consulted to determine the amount of allowable play.

## TRACK SYSTEM



**Pad with grouser bars**  
The number of grouser bars on a pad is dependent on the type of surface on which the machine is operating on.

**Top Roller**  
Inspect roller for wear. Examine track for sag and adjust as necessary.

**Bottom Roller & pad pins**  
Rollers need to be checked for wear. Check pad pins for damage, wear, or missing keepers.

The tracks need to be checked for cracked or damaged pads. Also, the condition of the grouser needs to be examined. The number of grousers per pad is normally dependent on the surface on which the machine will be working. For earth work, normally only one grouser would be needed. For working on pavement, the pad may have three grousers to prevent surface damage when maneuvering the machine.

- Check for loose bolts attaching the pads to the track links and check the pins connecting the pads together for wear or damage.
- Check the top and bottom rollers for wear and especially for flat spots.
- Check the operator's or maintenance manual for the proper track adjustment.

## TRACK SYSTEM



**Drive Sprocket**



**Front Idlers**

Inspect the drive sprocket for worn or cracked teeth. A broken tooth on the sprocket will cause excessive wear to the pad sockets. Check the drive seals for leaks.

The front idler needs to be checked for wear and flat spots. Depending on the type of material the excavator has been working in, the perimeter of the idler can be chipped or nicked which can result in wear to the pad sockets.

## UPPER STRUCTURE *Engine Compartment*



**Inspect the engine for leaks. Keep the radiator free of dirt.**

At the beginning of every shift the level of all fluids should be checked and depending on the condition of the engine more often than that.

Check belts for proper tension and wear. A broken belt can result in a project being shut down for several hours.



**Check the oil level frequently.**



**Check the belts for proper tension and radiator hoses for cracks.**

Check radiator and other hoses for cracks.

The engine compartment can become very dirty, especially the radiator. Frequent cleaning may be necessary to keep dirt from building up in the radiator and on the engine itself. Excessive dirt can cause the engine to run hotter than normal which will reduce its life.



**Check the radiator for coolant.**



## UPPER STRUCTURE



**Check for proper hydraulic fluid level.**



**Inspect all lights to ensure proper working order.**

Before operating the machine, the hydraulic fluid level needs to be checked. The fluid level is normally checked with the stick and bucket fully retracted and the boom down. Check the operator's manual for specific instructions.

Check the hydraulic pump and compartment for leaking fluid and general condition of the hoses and fittings.



**Check the hydraulic system, pumps, hoses, lines and cylinders, for leaks.**

Inspect all hydraulic hoses for leaking fluid. Where hoses bend over metal edges, check the hoses for chaffing. Even though the edge may be smooth, chaffing can still occur. Fluid weeping out of the compression flange on a hose fitting needs to be investigated and the hose replaced as necessary.

Hydraulic cylinders need to be inspected for fluid leaks at the fittings and where the cylinder rod comes out of the cylinder. All leaks need to be corrected and any nicks in the cylinder rod need to be smoothed out to prevent damage to the cylinder's wiper seal.

All lights on the machine should be in working condition

## CAB

The operator's cab needs to be kept clean of dirt, grease and objects which could interfere with the safe operation of the machine. It is recommended that basic housekeeping items be kept on the machine to facilitate keeping it clean. The glass in the machine needs to be free of cracks that would impair the vision of the operator. Clean the glass regularly to increase visibility and to avoid reflection in sunlight. The windshield wipers need to work and the blade replaced periodically to avoid streaking.

All controls need to be properly labeled with their function and direction of motion. Test each control before starting work to confirm they are in proper working order.

The cab should have a fire extinguisher that has a current inspection label.



**Clean cab glass frequently.**



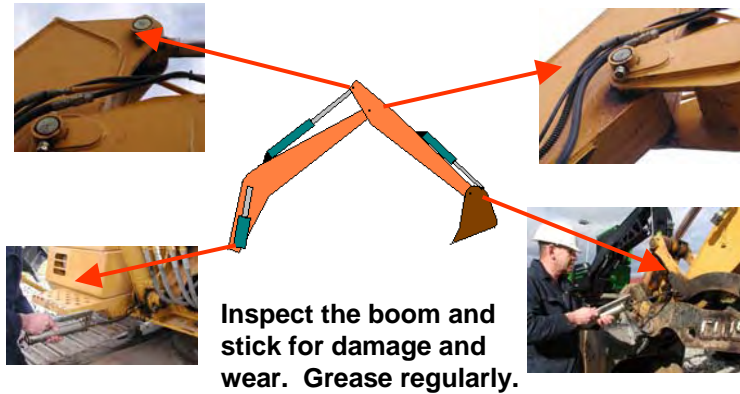
**Keep the cab floor clean & free of debris**



**Test all controls before using the machine.**



## BOOM AND STICK



Inspect the boom and stick for damage and wear. Grease regularly.

Inspect the boom and stick for dents and bends. Significant dents need to be evaluated by a competent individual to determine if the structural strength has been compromised. This is especially critical when the excavator is being used for lifting. All welded joints need to be inspected for cracks.

The hinge joints need to be greased regularly according to the manufacturer's recommendations.

After greasing, excessive grease should be wiped away with a rag. Keeping these components free of excessive grease will reduce the buildup of grit which can accelerate wear. Check the hydraulic hoses at the hinge points for wear.

## BUCKET



Check the 'thumb' for damage



Inspect the bucket linkages for damage & worn pins

Inspect the bucket for cracked welds, particularly where the hinge gussets are attached.

Inspect bucket hinge pins and linkages for excessive wear, missing keeper pins and other damage.

Make sure the pins or bolts used to attach the teeth to the bucket are in place and not excessively worn. Also, evaluate the wear on the teeth for planning the next change out.



Check the locking pins that hold the teeth for damage.



Inspect the lifting points on the bucket and stick damage.

If the excavator is fitted with a thumb, inspect the hinge pin and associated linkages for wear and damage.

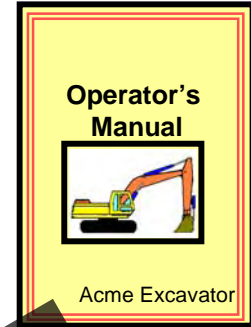
The frequency of greasing the bucket hinge pins is dependent on the weather and the type of material being excavated. In sanding or powdery material it may be necessary to grease these components two to

three times a shift. The fine material will have a tendency to work its way into the hinges and accelerate wear. Frequent greasing will keep pushing this material out. Buckets that will be digging below water need frequent greasing to keep it fresh. At the end of the shift where the machine will sit overnight, grease all these areas again to prevent corrosion. After greasing, exercise the bucket to distribute the grease.

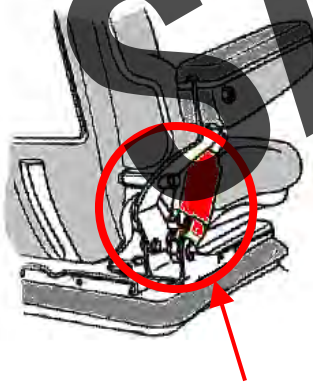
## OPERATOR'S MANUAL

The operator's manual is required to be on the machine or readily available to the operator. Being kept in the job shack or back in the office does not meet this requirement.

The operator is also responsible for having read and understood the manual. It is the employer's responsibility to ensure the operator has read the manual before allowing him to operate the machine.



The manual contains important information about the operation and maintenance of the excavator. Though very similar, not all excavators are the same, particularly with respect to maintenance. The manual will contain operating information and load capacity charts that must be used when the machine is utilized for lifting.



**Inspected Each Day**



**Should Be Worn When Operating The Machine**

Seat belts are a safety device and as such must be kept in operating condition. Worn or damage belts need to be replaced.

When moving the machine over rough terrain or on a steep slope, the seat belt will help keep the operator in the seat allowing him to maintain control of the machine.

Some manufactures recommend replacing the whole seat belt assembly every three years regardless of appearance



## CLIMBING ON AND OFF THE MACHINE



When climbing on and off the machine, the operator should always face the machine. Use the three point contact method when climbing: Two hands and a foot or two feet and a hand.



One of the prime causes of ankle and back injuries to operators is the improper method to climbing on and off the excavator. The standard three point method is recommended. This method is simply keeping two feet and a hand or two hands and foot in contact with the machine while moving the remaining hand or foot. Enter and exit the machine while facing it. This will allow the operator to use all the handrails provided. Avoid jumping from the machine.

Cleaning footwear of excessive mud or grease will help prevent slipping.

## OPERATOR RESPONSIBILITIES

The operator of an excavator is responsible for safe operation of the machine and the safety of those working in the vicinity of it. He needs to stop operations when he observes unsafe conditions.



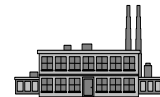
Operator



People Around Machine



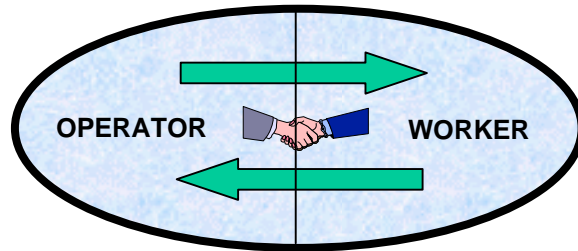
The Machine



Property

## JOB SITE SAFETY

**EVERYONE IS RESPONSIBLE FOR THEIR SELF AND THE OTHER PERSON**



Job site safety is everyone's responsibility. When performing operations with an excavator, the operator of the machine and those assisting him on the ground need to work together as a team. Those on the ground need to notify the operator if they notice anything out of order with the machine. The operator needs to be aware of where workers on the ground are and stop operations when anyone comes within range of the machine. Everyone on the job site is responsible for himself and the other person.

## OPERATOR AWARENESS FACTORS



Several factors can affect an operator's ability to stay focused on operating their machine.

**Fatigue & Hunger:** Fatigue can result from working too many hours, lack of sleep, hunger or monotonous, repetitive work. When an operator shows signs of fatigue, they should be relieved to get rest or exercise to refresh their alertness.

**Weather:** Some excavators are open to the elements. An operator needs to dress appropriately for the weather to prevent stress on their body.

**Physical Health:** Operators suffering from health problems affecting their machine operating ability should not be allowed on a machine. Even workers taking cold medicine may have their alertness compromised.

**Other People:** People should not attempt to talk to or in any way distract an operator who is operating a machine. Wait until they are finished with an operation before approaching or talking to the operator.

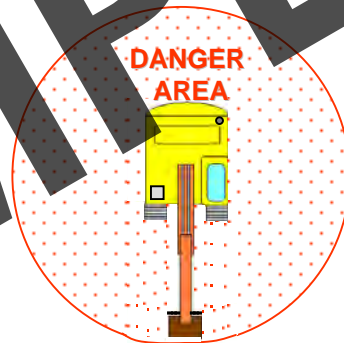
**Emotional Level:** Operators under emotional stress may not be able to stay focused. It may be necessary at times to remove such an operator from a machine until emotional equilibrium is restored.

**Working Conditions:** Some worksites that have many activities occurring simultaneously can distract an operator. Operators must be able to block out such distractions while operating a machine.

## FOR SAFE OPERATION

- ✓ Never Take Anything For Granted
- ✓ Face the Machine When Climbing on and off
- ✓ Keep The Machine Clean
- ✓ Clean Mud And Grease From Shoes
- ✓ Avoid Loose Clothing And Jewelry
- ✓ Wear Protective Equipment
- ✓ Never Operate Machine Without Protective Guards
- ✓ Always Check Height, Width, and Weight Restrictions
- ✓ Keep all Safety Devices in Place and Working
- ✓ Plan Ahead
- ✓ Learn Beforehand About the Work Area

### DANGER AREA

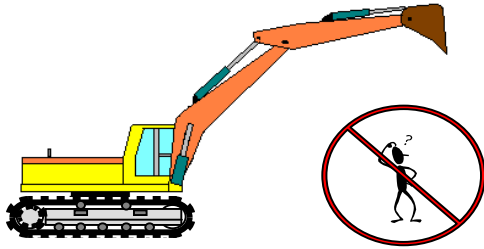


When the excavator is in operation, no one should enter the full swing area of the machine. The operator's vision of this area is not always clear and anyone entering may not be seen by the operator. Workers not only need to watch for boom and bucket movement but also for the counterweight.

Before excavating work begins, access to the worksite by unauthorized persons needs to be controlled. Barriers of cones, barrels or other structures can establish the work area perimeter. Caution tape, barricade safety fencing or other well-marked material should be placed between the vertical barriers to prevent people from accidentally entering the work area.

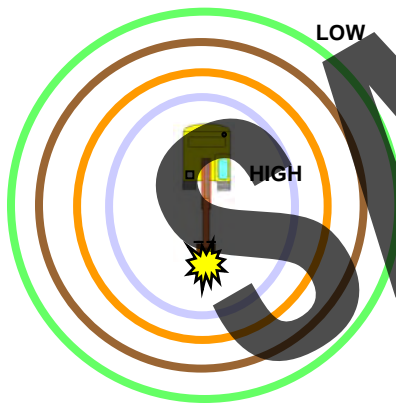


## ALWAYS WORK FACING THE MACHINE

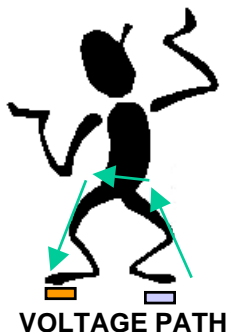


When working around an excavator, the worker should always work facing the machine. The worker should consider the machine as a continuous threat to his safety and thus constantly keep an eye on its movements

## POWER LINE CONTACT



**GROUND IS ELECTRIFIED  
OUT FROM THE EXCAVATOR**



When the excavator comes in contact with a live power line, the whole machine becomes electrified. Due to the different current paths that the electricity can follow, parts of the machine could be at different voltages. If the operator touches different parts of the machine, his body could create a current path which could result in electrocution.

The ground around the excavator can also become electrified. The voltage in the soil nearest the machine will be greater than that further away from it. When moving away from the excavator, individuals should shuffle to avoid creating a current path from one foot to the other.

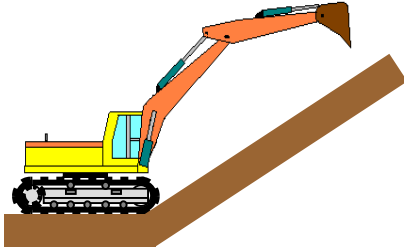
The operator should remain with the excavator if at all possible until the power company indicates it is safe to leave the machine. This is because the excavator components could be at different voltages and touching parts of the machine could result in being electrocuted.

No one should be allowed to approach the excavator or to touch it. If the operator is unconscious, no attempt should be made to rescue him until the power company indicates it is safe to do so.

If the operator must leave the excavator due to fire, he should move slowly to the edge of the cab without touching it and carefully jump to the ground. Once on the ground, he should shuffle away from the machine.



## MOVING UP A SLOPE

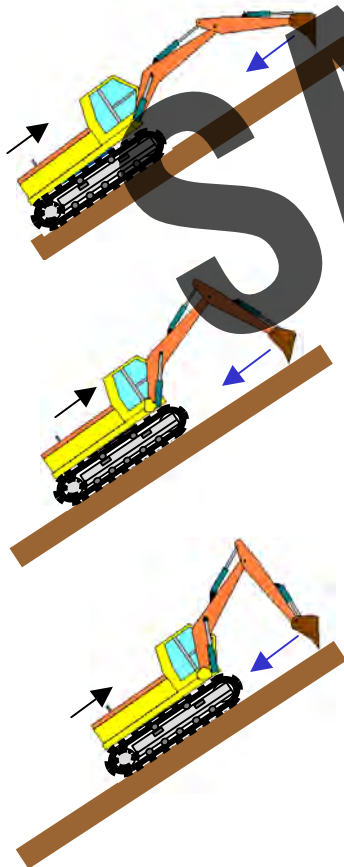


**Fastened seat belt before moving up the slope.**

Before moving the excavator up a slope, the operator should make sure that his seat belt is properly fastened.

When approaching the slope the position of the drivers either in front or in the rear is a matter of opinion. Some prefer them in the rear but others, including some manufacturers recommend them to be in the front.

As the excavator starts up the incline the boom will need to be lowered to keep the bucket a foot or so off of the slope. When the machine is on the slope and climbing, the operator needs to monitor the traction of each track and make sure the machine is traveling in a straight line up the slope. If one track has less traction than the other the machine will tend to veer to one side causing the down hill track to dig in which may make the machine unstable. On soft material, the excavator tracks may tend to dig in at the rear which will tip the machine backwards and could result in a rear roll over.

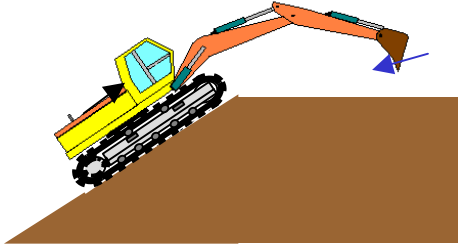


If the slope is too steep and the material is loose, the rear of the machine may settle allowing the excavator to roll over backwards. Keeping the boom and stick extended will help distribute the load on the tracks more evenly which improves traction. If the excavator is unable to continue to climb due to slope, set the teeth of the bucket into the slope and start pulling the machine with the stick.

The operator will need to watch the front of the tracks to make sure the machine is not being tipped backwards as the stick is pulled in. He will need to raise the boom as the stick is pulled in to keep the full surface of the tracks in contact with the slope.

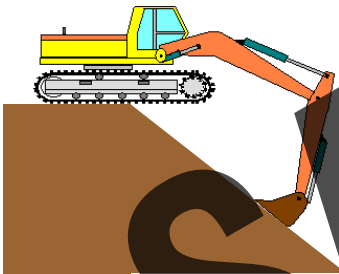
When the bucket comes close to the machine, the bucket will need to be extended up the slope for another bite. As the bucket is pulled out of the hill to get another bite, the operator needs to watch the machine to make sure it will not slide back down the hill. On steep slopes, the bites need to be made more frequently so as to keep boom and stick uphill for better traction and stability.

## MOVING UP A SLOPE



When the excavator comes close to the top of the slope, reach out with the stick and boom and sink the teeth into the ground beyond the crest of the slope. Continue to pull the machine up until it wants to tip forward. Lower the front of the machine with the boom and continue to tack from the slope.

## MOVING DOWN A SLOPE

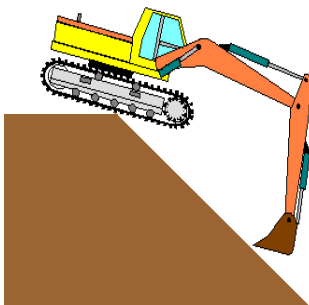


**Fastened seat belt before moving up the slope.**

Before moving the excavator down a slope, the operator should make sure that his seat belt is properly fastened.

When approaching the crest of the slope, position the machine so that both tracks will go over the crest at the same time. If possible, to reduce the teetering of the excavator as it moves over the crest, cut the top off at two places where the tracks will break over the crest.

With the machine at the crest, extend the boom and stick over the slope and put the bucket on the ground. As the machine tracks forward, the boom will need to be lowered to keep the bucket on the ground.

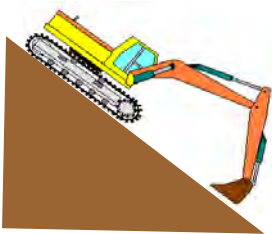


When the center of the machine is at the crest of the slope, raise the boom slightly to see if the machine will tip forward. If it doesn't nose over to match the slope, lower the boom and track forward a little more and try again. Once the machine noses over smoothly, the excavator can be tracked forward down the slope.

## MOVING DOWN A SLOPE



The excavator should slowly nose over the crest. Gently lower the machine with the boom until the tracks are in contact with the surface of the slope.



Raise the bucket off the surface of the slope and see if the track will hold the machine on the slope. If the tracks will hold the machine, continue tracking down the slope with the bucket slightly off of the ground.

## HAND SIGNALS



STOP

LOAD DOWN SLOWLY



EMERGENCY STOP

OPEN BUCKET



LOAD UP SLOWLY

CLOSE BUCKET



# HAND SIGNALS



**RAISE  
BUCKET**



**LOWER  
BUCKET**



**STICK  
(DIPPER)  
IN**



**STICK  
(DIPPER)  
OUT**



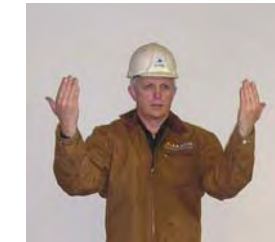
**BOOM  
UP**



**BOOM  
DOWN**



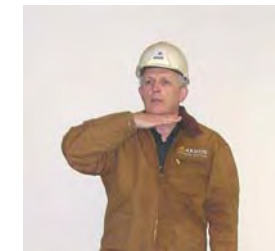
**MOVE  
AWAY  
FROM  
ME**



**MOVE  
TOWARD  
ME**



**DOG  
EVERYTHING  
(HOLD)**



**STOP  
ENGINE**



**SWING/MOVE MACHINE  
TO THE RIGHT**



**GO THIS FAR**



**SWING/MOVE MACHINE  
TO THE LEFT**



## EXCAVATING

**Before starting to excavate, assess the situation:**



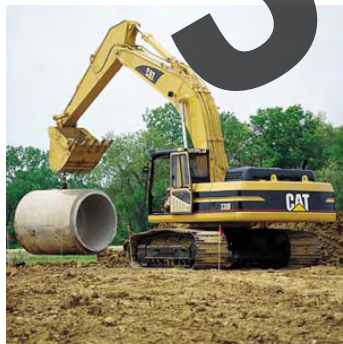
Before beginning work, the operator and those working with him should take a moment to assess the site to plan how the work will progress. An assessment of soil conditions is important to ensure that the excavator will be stable throughout the project.

When excavating a large site, taking time to plan out the excavation process can save time and money. Things to consider are:

- Will the spoil be placed along the excavation or need to be removed?
- If material is to be moved away from the excavation by truck, what type will be used and how will they access the site for loading?
- To check the depth and grade of an excavation, will the grade checker be required to enter the excavation and can it be done safely?



## EXCAVATING



Besides excavating, the excavator is often used to perform other tasks at the job site. If the machine will be used for lifting, the type and size of the lift load needs to be considered to ensure the excavator is adequate.

- **Is the work site on a slope?**
- **What other work will be taking place in the area of the excavation?**
- **If compaction is required, how will it be done?**
- **Will the excavator be required to place objects in the excavation?**



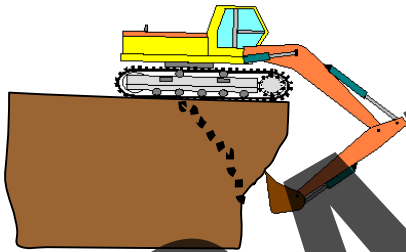
## EXCAVATING

### *Call Before You Dig!*



Excavating in an area where utilities are present always a challenge and can be deadly. Before starting an excavation of any type, it is important to determine if there are any underground utilities in the area. Planning the site work will allow time for the utility providers to send out representatives to locate and mark their underground utility.

Most areas have a One-Call number which will contact local utilities companies of your location. Representatives from these companies will come to your work site and mark the location of these utilities. Contact one of your local utility companies or search the Internet for the 1-800 number.



**AVOID UNDERCUTTING!**

When excavating, the operator must always be alert to where the machine is in relationship to the edge of the excavation. Even if no undercut is made, the edge of the excavation may not be strong enough to support the weight of the machine.

## TRENCHING



Before trenching begins, the location of the excavation should be clearly marked with all buried utilities clearly identified.

When excavating along side of an existing structure, care must be exercised not to weaken the structure's supporting soil.

If trench shielding or shoring will be required, the trench must be wide enough to accommodate them.

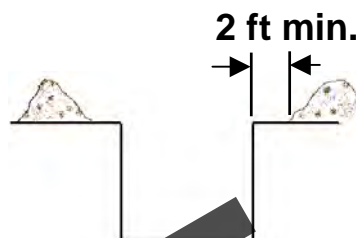


## GENERAL TRENCH PRECAUTIONS



Material excavated from a trench should be placed a minimum of two feet from the edge of the trench. This distance may need to be greater depending on soil type. The slope of the spoil pile should be flat enough to prevent material from sliding into the trench.

Also note in the above picture that there are workers in the trench without having adequate shielding or shoring in place.

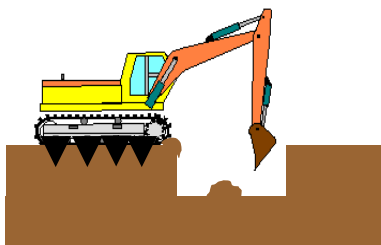


Workers are not to be in a trench while it is being excavated. Based on soil type, shoring normally is required before a worker enters the excavation.

**SAMPLE**

### TRENCHING

#### Cleaning Out Cave-ins



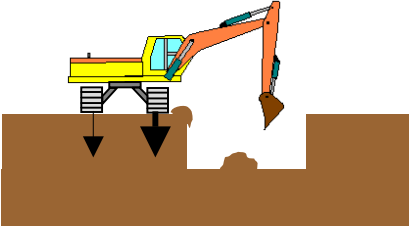
Cave-ins may occur requiring the excavator to clean or dig the trench back to grade. One way is to clean the trench from the top edge.

If the soil is soft sand or loam, position the excavator with the tracks perpendicular to the trench. This will distribute the weight of the machine back away from the edge reducing the possibility of more cave-ins. The disadvantage to this approach is the machine will need to be repositioned frequently.



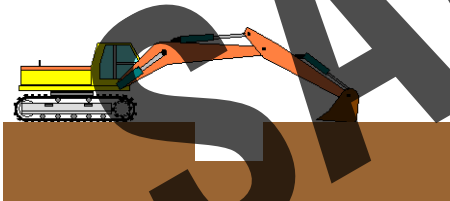
## TRENCHING

### Cleaning Out Cave-ins



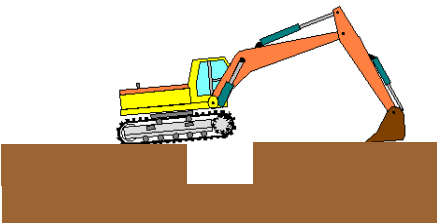
When the machine needs to be positioned along a trench with the track parallel with it, greater pressure is placed on the edge of the trench. If the soil is weak additional cave-ins may occur or the excavator may slide into the excavation. This approach should only be used if the soil is stable enough to support the concentrated weight. The operator must continually monitor the condition of the soil and watch for cracks which will indicate potential soil failure.

### STRADDLING A TRENCH *Vertical Walls*



When the trench walls are vertical and the soil is firm, the excavator can be positioned over the trench to do cleaning or additional excavations. Make sure the trench width is less than the length of the machine's tracks.

Position the excavator with the tracks perpendicular to the trench and back a few feet from the edge. Extend the boom and stick and place the bucket on the opposite side of the trench, a minimum of 6 feet from the edge.

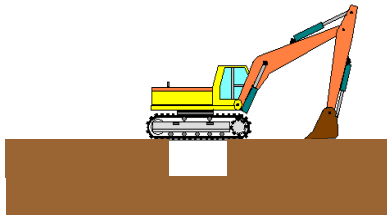


Raise the front of the machine so the front of the tracks are off the ground and begin to track forward. At the same time, raise the boom slowly and pull the stick to maintain the slight up angle of the tracks.



## STRADDLING A TRENCH

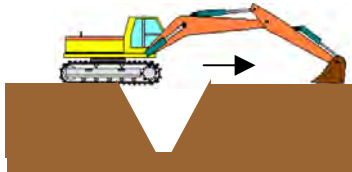
### *Vertical Walls*



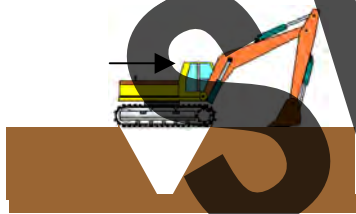
Continue this forward motion process until the tracks are evenly positioned on each side of the trench. While straddling the trench, all movements should be slow to prevent disturbing the trench walls. To move the excavator off of the trench, reverse the process. Start backing up slowly to prevent the trench wall at the rear of the machine from being pulled into the trench.

## STRADDLING A TRENCH

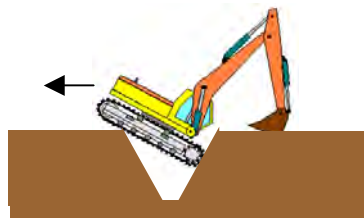
### *Sloping Walls*



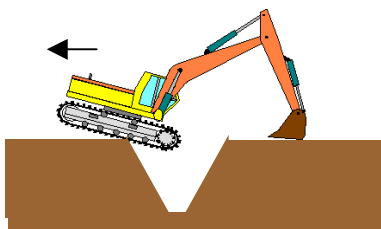
If it becomes necessary to straddle a sloping wall trench to reset the grade due to cave-ins or other problems, bring the excavator up to the edge of the trench with the tracks perpendicular to the edge. Extend the boom and stick beyond the edge of the other side and place the bucket on the ground. Watch the earth movement under the front of the tracks when extending. Elevate the front of the tracks with the boom and begin to track forward, keep the machine at the same angle with the boom and stick.



When the front of the tracks reach the other side of the trench the rear of the machine may begin to settle. Adjust the boom and stick to level the machine. Once the excavator has settled into the 'V' of the trench, excavating can begin.

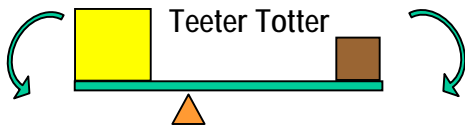


To remove the excavator from the trench, track the excavator in reverse and allow the front to dip down into the trench. This will help keep the rear tracks from digging into the wall. Track in reverse and use the stick to push the excavator backwards.

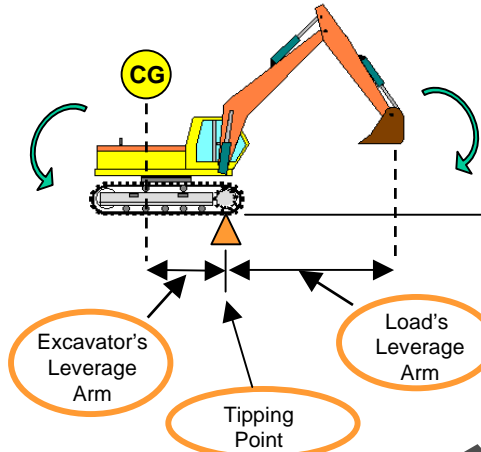


Continue the reverse process until the machine is back on the surface of the trench edge.

# EXCAVATOR STABILITY



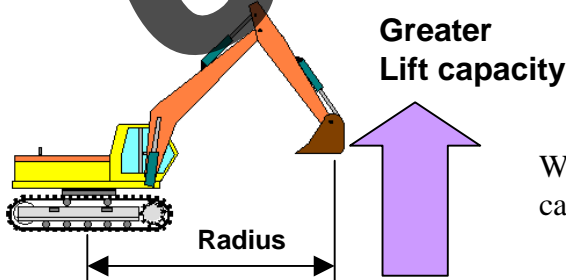
For riders on a teeter totter to be in balance, the leverage created by one rider has to equal that of the other rider. The leverage of each rider is the result of the rider's weight times his distance from the tipping point. If one rider is heavier than the other, then he will have to be closer to the tipping point than the other rider.



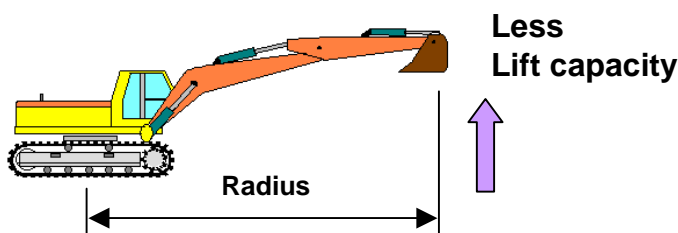
For an excavator, the tipping point is the point of the tracks which is under the boom. This could be at the end of the tracks or at the side of the tracks. The excavator's leverage is the weight of that part that is behind the tipping point times the distance from the tipping point to its center of gravity. This leverage is basically fixed. The load's leverage is the weight of the load and that portion of the boom, stick and bucket plus the load attached to the bucket. The load's leverage is not fixed. When the boom and

stick extend the load away from the machine, the load's leverage increases due to its increased leverage arm. Based on the dimensions of the excavator's tracks, the machine typically will have more lifting capacity over the ends of the tracks than over the side.

## LIFTING WITH THE EXCAVATOR



When the 'radius' of the load increases, the lifting capacity of the excavator decreases.



## LIFTING WITH THE EXCAVATOR

### Over the Front

Load Point Height	Radius (Horizontal distance rotation centerline)			
	10 ft	15 ft	20 ft	25 ft
25 ft		6895 lbs		
20 ft		10496 lbs	10248 lbs	
15 ft		13218 lbs	11176 lbs	10390 lbs
10 ft			13030 lbs	10979 lbs
5 ft			14874 lbs	10968 lbs
Ground level			15206 lbs	10728 lbs
-10 ft	8768 lbs	18281 lbs	13790 lbs	

The Lift Capacity chart has a section for “Over the Front” and for “Over the Side”.

### Over the Side

Load Point Height	Radius (Horizontal distance rotation centerline)			
	10 ft	15 ft	20 ft	25 ft
25 ft		6895 lbs		
20 ft		10496 lbs	10248 lbs	
15 ft		13218 lbs	10212 lbs	6913 lbs
10 ft			9668 lbs	6717 lbs
5 ft			9132 lbs	6467 lbs
Ground level			8797 lbs	6285 lbs
-10 ft	8768 lbs	13766 lbs	8828 lbs	

Note the difference in capacity.

If the load is lifted over the front and will be swung to over the side, use the over the side chart for determining maximum capacity.

The chart is divided into two sections: One for a lift made straight over the front of the machine and one for lifts made with the machine swung to the side. Notice how the capacity for lifts made at the same radius decreases as the machine is swung to the side. Maximum capacity lifts made over the front of the machine can, if swung to the side, tip the machine over.

## LIFTING WITH THE EXCAVATOR

### ATTACHING THE LOAD



Lifting eyes mounted to the end of the stick and bucket.



Attach the load to the lifting eyes with a load rated shackle.



The operator's manual for each machine includes a section on load capacity for the loader bucket. On some machines, lifting capacity is limited by the capacity of the hydraulic system. Some buckets come with lifting eyes welded to its back side. Chain slings can be attached at these points and the chain run over the front of the bucket. Blocking or some other form of protection should be used to prevent the chain from being damaged where it bends over sharp edges. Slings should not be attached to the lifting arms of the loader, or around any of the hydraulic lift cylinders.

If a load is moved by traveling the machine, it should be kept as low to the ground as possible. This will help to maintain control of the load while traveling and allow the load to be quickly lowered if it gets out of control. Always travel at the slowest speed when traveling with a suspended load.

For buckets which do not have designated lifting attachment points, a chain can be attached as shown in the above figures. The excavator bucket needs to be rotated outward so that the teeth point downward at all times during the full range of motion of the boom and the stick. The chain is attached to the bucket as shown in figure A. The chain then is placed over the back of the bucket as shown in figure B. Where the chain bends over sharp edges, blocking between the edge and the chain should be used to prevent damage to the chain. Such damage could result in chain failure.

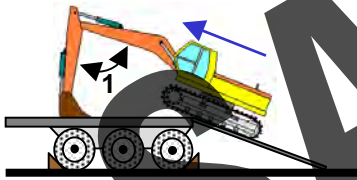
## LIFTING WITH THE EXCAVATOR



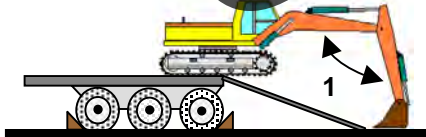
Various lifting hardware have been manufactured for different lifting applications. All hardware used for lifting must be load rated by the manufacturer and used according to their instructions. Prior to use, this hardware needs to be inspected by a competent individual. When not in use, the hardware should be stored to prevent damage and deterioration due to weather.

## TRANSPORTING THE EXCAVATOR

### Loading



### Unloading



**When loading and unloading, use bucket for support with angle (1) between boom and stick at 90°. Move the machine with bucket facing toward the direction of motion.**

When preparing to transport the excavator, consult the operator's manual to identify specific things to be done.

When loading the machine onto a ramp truck or trailer, make sure wheels are blocked. Clean off any mud from the ramps to prevent the machine from slipping off them. Once the machine is in position for traveling, lower the bucket as necessary and chain the machine to the transport vehicle. Avoid running the tie-down chains over hydraulic cylinders and/or other parts that could be damaged. Tie-down chains should be installed in a cross configuration, both side to side and fore to aft.

When unloading the machine, make sure all tie-down chains are removed and the transport vehicle wheels blocked. Carefully descend the ramps, keeping the bucket high enough to clear the ramp and ground.

- **Always wear seat belt**
- **Locate transporter on level surface**
- **Chock transporter wheels**
- **Use loading ramps attached to transporter**
- **Use low speed operating modes**
- **Secure machine to transporter**