

# Chapter 19

## Dozers

### Topics

- 1.0.0 Dozers
- 2.0.0 Major Components
- 3.0.0 Controls
- 4.0.0 Attachments
- 5.0.0 Operations
- 6.0.0 Safety

To hear audio, click on the box.



### Overview

The dozer, technically known as a crawler tractor, is used as a prime mover for pushing or pulling loads, a power unit for winch operations, or a dozer for earthwork operations and demolition work.

This chapter provides you the information needed to successfully execute such operations. It describes the types of dozers used by Naval Construction Force (NCF), including description of major components, controls, and attachments. In addition, this chapter explains how to perform operational techniques such as side-by-side and slot dozing. It also lists safety practices.

### Objectives


When you have completed this chapter, you will be able to do the following:

1. Understand the use of dozers.
2. Identify types of dozers used by NCF.
3. Identify the major components of dozers.
4. Identify the controls on the dozer.
5. Identify dozer attachments and their use.
6. Understand how to perform dozer operations.
7. Understand dozer safety.

### Prerequisites

None

This course map shows all of the chapters in Equipment Operator Basic. The suggested training order begins at the bottom and proceeds up. Skill levels increase as you advance on the course map.

Miscellaneous Equipment		E
Paving Operations and Equipment		Q
Rigging Operations		U
Cranes		I
Rollers		P
Dozers		M
Scrapers		E
Graders		N
Ditchers		T
Excavators		
Backhoe Loaders		O
Front-End Loaders		P
Forklifts		E
Truck Driving Safety		R
Truck-Tractors and Trailers		A
Tank Trucks		T
Dump Trucks		O
Medium Tactical Vehicle Replacements		R
Earthwork Operations		
Electrical and Hydraulic Systems		
Chassis Systems		B
Power Train		A
Engine Systems		S
Transportation Operations		I
	C	

## Features of This Manual

This manual has several features which make it easy to use online.

- Figure and table numbers in the text are italicized. The figure or table is either next to or below the text that refers to it.
- The first time a glossary term appears in the text, it is bold and italicized. When your cursor crosses over that word or phrase, a popup box displays with the appropriate definition.
- Audio and video clips are included in the text, with italicized instructions telling you where to click to activate it.
- Review questions that apply to a section are listed under the Test Your Knowledge banner at the end of the section. Select the answer you choose. If the answer is correct, you will be taken to the next section heading. If the answer is incorrect, you will be taken to the area in the chapter where the information is for review. When you have completed your review, select anywhere in that area to return to the review question. Try to answer the question again.
- Review questions are included at the end of this chapter. Select the answer you choose. If the answer is correct, you will be taken to the next question. If the answer is incorrect, you will be taken to the area in the chapter where the information is for review. When you have completed your review, select anywhere in that area to return to the review question. Try to answer the question again.

## 1.0.0 DOZERS

Dozers, also called bulldozers, are powerful diesel-powered crawler tractors equipped with a front mounted blade. Not only are dozers use to **drift** and side cast material, they are also used to clear land by moving debris, boulders, and trees. In addition, dozers are used to push and pull other heavy equipment.

Dozers are usually rated by size and power. The pull developed at the **drawbar** is expressed in pounds or as **drawbar horsepower**. The **drawbar pull** is greatest in the lowest transmission gear range. Although the specifications for dozers may vary among different manufacturers, the maximum speeds are seldom in excess of 8 mph.

### 1.1.0 Types of Dozers Used By Naval Construction Forces

The NCF uses two types of dozers: the low and high track dozer.

#### 1.1.1 Low Track Dozer

The low track dozer, like the one shown in *Figure 19-1*, is commonly used for grading.



Figure 19-1 – Low track dozer.

### 1.1.2 High Track Dozer

Designed with a high drive system, the high track dozer, shown in *Figure 19-2*, has an elevated drive sprocket. This specific type of dozer is commonly used for pushing in muddy conditions.



**Figure 19-2 – High track dozer.**

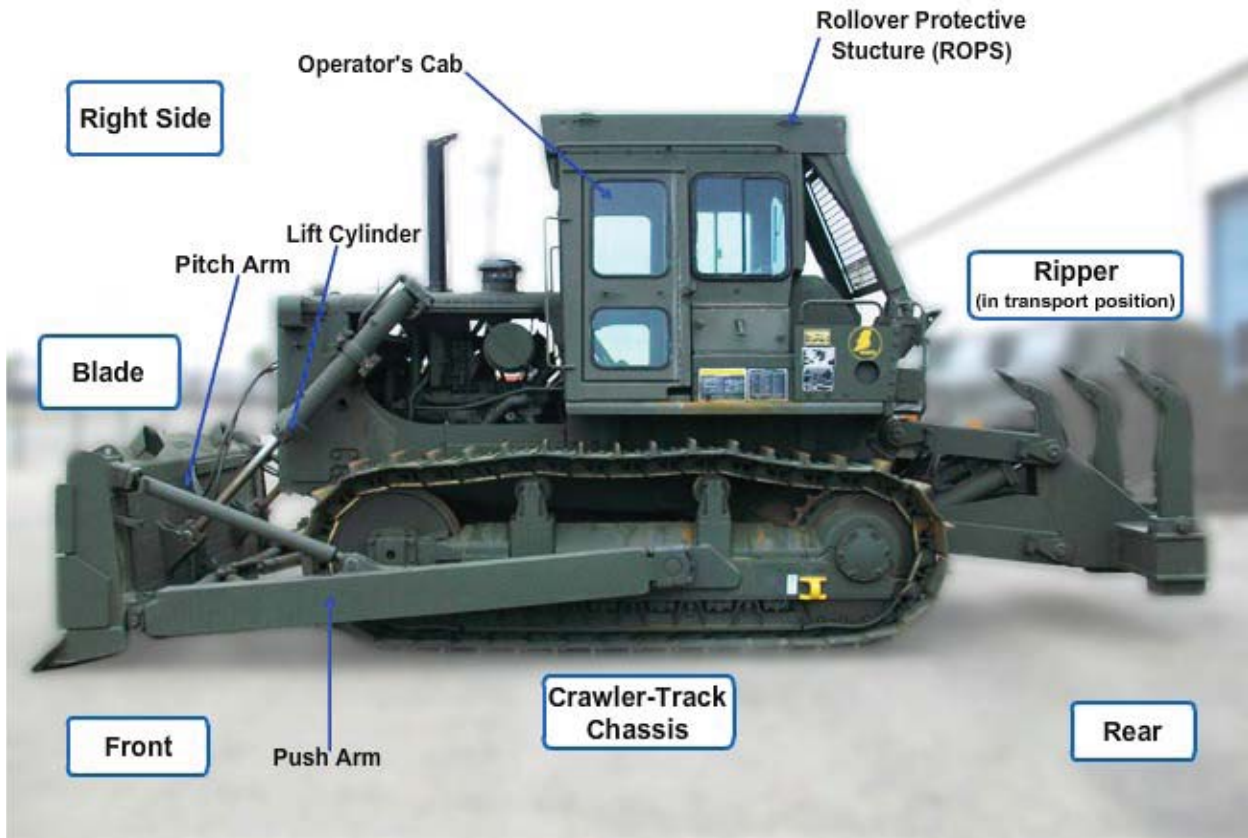
#### **Test your Knowledge (Select the Correct Response)**

1. (True or False) The high track dozer has an elevated drawbar.
  - A. True
  - B. False



## 2.0.0 MAJOR COMPONENTS

Major components vary among makes, models, and configurations. You are responsible for reading the operator's manual for specific information. For general understanding, *Figure 19-3* shows the major components of a Caterpillar D7G low track dozer.



**Figure 19-3 – Major components.**

### 2.1.0 Operator's Cab

Mounted behind the engine, the operator's cab is the central location of most instruments and controls. Fully enclosed by a rollover protective structure (ROPS), the operator's cab provides the operator, instruments, and controls protection against harsh weather. The dozer's wide, side mounted tracks provide the operator a step for getting into and out of the operator's cab.

### 2.2.0 Track Assembly

The track assembly consists of a continuous chain surrounding the track frame and drive sprocket. The links of the chain provide a flat surface for the track rollers to pass over, as the rollers support the equipment. Track shoes are bolted to the outside of the chain links and distribute the weight of the equipment over a large surface.

The track assembly provides all-type-terrain versatility due to the low **ground pressure** at the track. This lower ground bearing pressure has a distinct flotation advantage over the ground bearing pressure of rubber-tired equipment. Dozers are capable of operating efficiently in muck or water as deep as the height of the track for short periods of time. When the dozer is properly waterproofed, it can operate in fairly deep water.

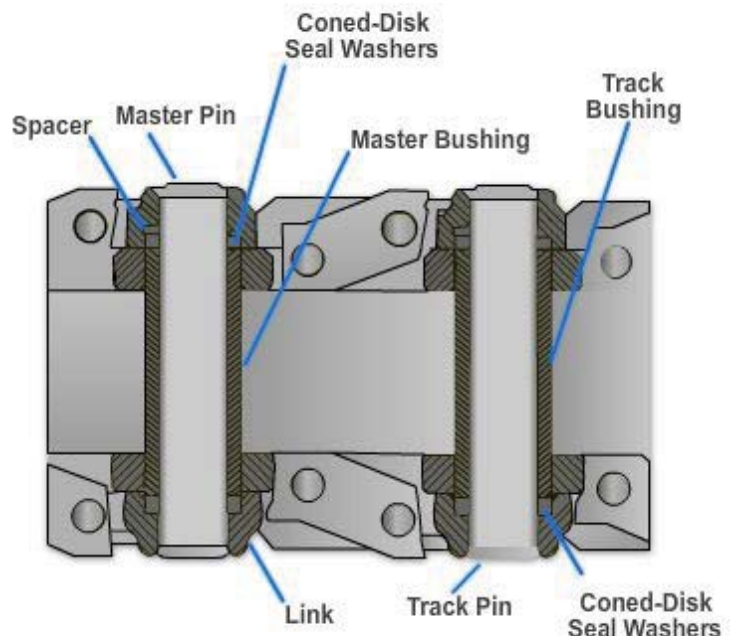
**! CAUTION !**

When working in water that is deep enough to reach the radiator, be sure to disconnect the fan belt. If the fan blades hit the water while under power, they could bend or break off, possibly causing damage to the radiator. Additionally, exercise extreme caution to ensure the engine does not overheat when the fan or water pump belts are disconnected.

If needed, dozers can move from jobsite to jobsite under their own power at slow speeds; however, this is a poor practice because it tends to shorten the operational life of the dozer. For this reason, dozers should be transported by tractor-trailer from jobsite to jobsite.

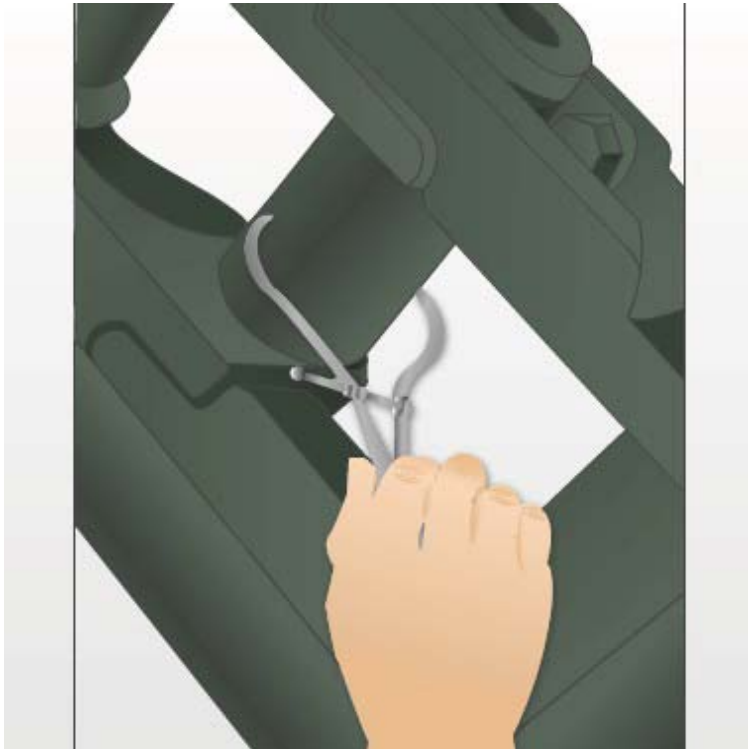
### 2.2.1 Track Chain

*Figure 19-4* is a cutaway view of a section of track. It shows the internal arrangement of pins and bushings. As the dozer operates, the drive sprocket teeth contact the track pin bushings and propel the dozer along the track assembly. The pins and bushings wear much faster than other parts of the track because of their constant pivoting as the track rotates around the track frame. As the pins and bushings wear, the track lengthens. When this occurs, adjust the track to remove any slack.

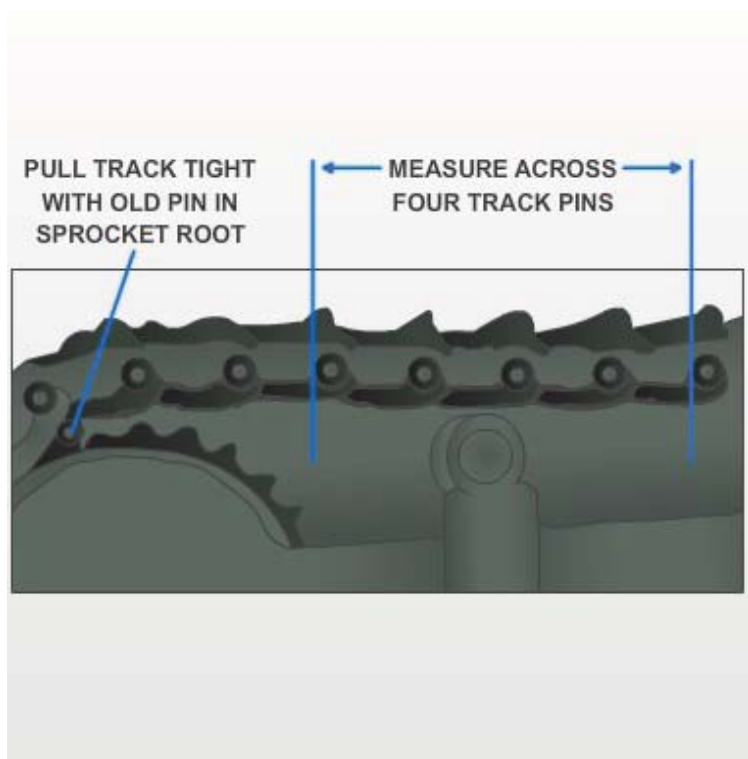


**Figure 19-4 – Track chain.**

Extensive wear on the outside of bushings is a good indication of inner wear. Manufacturers have set specifications for the maximum wear allowed before a track has to be rebuilt. To determine if a track should be removed for rebuilding or replacement, measure the outside of the bushings and track pitch (length of the track). Using a caliper and ruler, as shown in *Figure 19-5*, measure the outside of the bushing at the location at which it shows the most wear. Compare this measurement with the manufacturers' specifications. Measure the track pitch with a ruler or tape measure after tightening the track to remove any slack, as shown in *Figure 19-6*.



**Figure 19-5 – Bushing wear measurement.**



**Figure 19-6 – Track pitch measurement.**



## 2.2.2 Track Shoes

Track shoes are available in two configurations: the grouser shoe and extreme service track shoe.

The grouser shoe is the most common type of track shoe. It is standard on crawler-mounted dozers.

The extreme service track shoe, shown in *Figure 19-7*, is found on crawler-mounted dozers that operate primarily in rocky locations such as rock quarries and coral beaches.

The grouse, the projecting lug, on the extreme service track is thicker than the one on the standard grouser shoe; therefore it provides greater traction.



**Figure 19-7 – Types of track shoes.**

### NOTE

The grouser absorbs most of the wear. Its condition can indicate when a track needs replacement or overhaul.

## 2.3.0 Track Frame

The track frame serves as a framework and support for the track assembly, rollers, front idler, recoil spring, and adjusting mechanism.

### 2.3.1 Track Frame Rollers

Two types of track frame rollers are used on tracked equipment: carriers and track rollers.

The carrier rollers are mounted on brackets that extend above the track frame. They support the track as it passes over the track frame assembly. Two carrier rollers are on each side of the dozer. The single flange on the rollers extends upward between the links of the track chain and keeps the chain in alignment between the drive sprocket and the front idler.

The track rollers are mounted on the lower portion of the track frame. They support the weight of the dozer and ensure the track chain is in alignment with the truck frame as the track passes under the rollers. Track rollers, both single and double flanged, are installed alternately. In the normal arrangement, a double-flanged roller is positioned directly in front of the rear drive sprocket, followed by a single-flanged roller. The rollers alternate forward to the front idler.

### 2.3.2 Front Idler

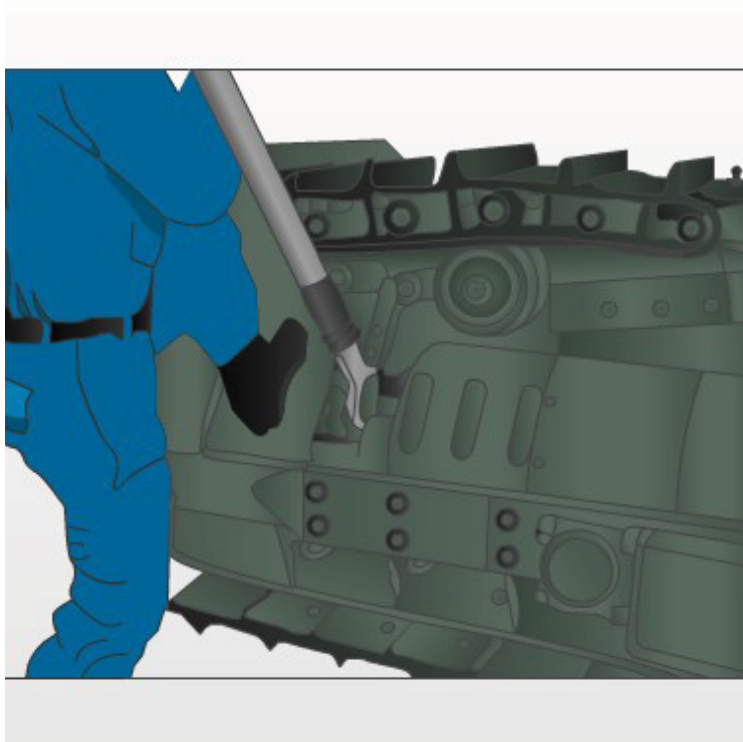
The front idler serves as a guiding support for the track chain. The idler is spring-loaded and mounted on slides, or guides, that allow it to move back and forth inside the track frame, as the dozer passes over uneven ground. The spring-loading effect causes the idler to maintain the desired tension regardless of operating conditions.

### 2.3.3 Recoil Spring

The recoil spring is a large coil spring placed in the track frame in a way that enables the spring to absorb shock from the front idler. The spring is compressed before installation and held in place by stops or spacers. The track adjusting mechanism, by pressing against the spring stop, maintains the desired tension on the track assembly by holding the idler and yoke in the forward position. The operation of the coil spring depends on the amount of tension on the track.

### 2.3.4 Track Adjusting Mechanism

The adjusting mechanism must be extended enough to remove slack between the front idler and spring. The adjustment is made either manually, as shown in *Figure 19-8*, or hydraulically, as shown in *Figure 19-9*. Older model dozers have manual adjustments; whereas, newer dozers are adjusted hydraulically with a grease gun. Grease is pumped into the yoke cylinder and extends it until enough tension is placed on the recoil spring to remove the slack from the track. Tension is relieved by loosening the vent screw located next to the adjustment fitting.



**Figure 19-8 – Manual track adjustment.**



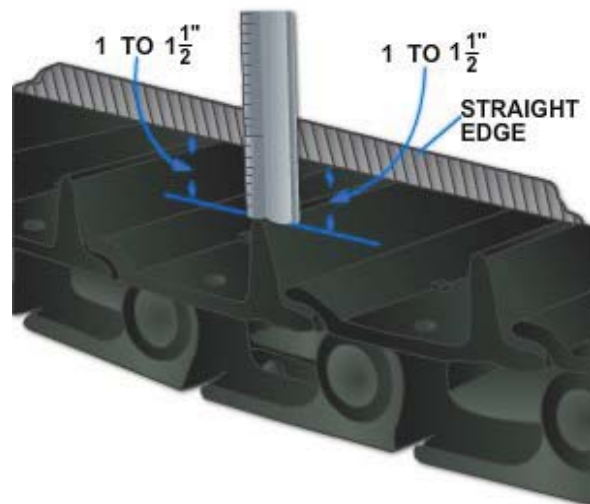
**Figure 19-9 – Hydraulic track adjustment.**

**NOTE**

Do not lubricate this fitting when performing daily operator's maintenance. Grease the track adjuster fitting only when the tracks require adjustment.

Track Adjustment – To determine proper track tension, position the dozer on a hard surface. Then place a straightedge over the front carrier roller and idler with all slack removed from the rest of the track. The tension is correct when the measured distance is as shown in *Figure 19-10*.

Track tension should be suitable for the type of area in which you are working, such as tighter for rock and looser for sand and snow. However, if the tracks are adjusted too tightly, there will be too much friction between the pins and bushings when the track links swivel, as they travel around the sprocket and front idler. This friction causes the pins, bushings, links, sprocket, and idler to wear rapidly. Friction in a tight track also robs the tractor of needed horsepower.



**Figure 19-10 – Checking track adjustment.**

Tracks that are too loose fail to stay aligned and tend to come off when the tractor is turned. As a result, the idler flanges, roller flanges, and the sides of the sprocket teeth wear down. A loose track will whip at high speeds, damaging the carrier rollers and their supports. If the track is loose enough, the drive sprockets will jump teeth (slide over the track bushings) when the tractor moves in reverse. Should this happen, the sprocket and bushings will wear rapidly.

#### **NOTE**

Checking and performing track adjustments are the operator's responsibility, always refer to the technical manual to perform the proper adjustment.

Lubrication – The track pins and bushings are hardened and require no lubrication. Many roller idlers are equipped with lifetime seals that are filled during assembly and require no lubrication. However, track rollers, carrier rollers, and idlers equipped with grease fittings must be lubricated on a schedule based on the manufacturer's specifications.

#### **NOTE**

Clean fittings before lubricating to prevent forcing dirt and grime into the bearings.

### **2.4.0 Blade**

The blade is the dozer's primary working tool. Equipped with a bottom cutting edge and corner bits, it is used to drift and side cast material. The blade can be moved in many positions. Depending on the specific type of blade and dozer, the blade is manually or hydraulically positioned. It can be raised, lowered, tilted, pitched forward or back and angled so that one side is more forward than the other.

#### **NOTE**

Remember, checking the cutting edge and corner bits for wear is the operator's responsibility.

### **2.5.0 Push Arms**

Most push arms are attached to the bottom of the blade. They may be located outside track frame at the trunnion or between the tractor and track.

## 2.6.0 Pitch Arms

Pitch arms are diagonal members between the push arm and the top of the blade. They brace the blade against loads above the push arms and provide a means of regulating the blade tilt and pitch. The pitch arms may be threaded or have a hydraulic cylinder, as shown earlier in *Figure 19-3*.

On the Caterpillar D7G the hydraulic pitch arm raises and lowers the right side of the blade. If additional tilt is required, the brace on the threaded pitch arm must be manually adjusted. Shorten the brace to make the left side of the blade lower; lengthen it to make the left side higher.

To pitch the blade forward, manually lengthen the brace and extend the hydraulic pitch arm. Use this pitch position when dozing extremely hard materials. To pitch the blade back, shorten the brace and retract the hydraulic pitch arm. Use this pitch position when leveling, spreading, or cleaning loose material without digging the blade in.

## 2.7.0 Ripper

The ripper is an attachment mounted on the rear of the dozer. It can be hydraulically raised and lower. On some dozers, it can be hydraulically adjusted for a greater ripping angle. It is used to break up compacted materials, uproot boulders and stumps; loosen shale, sandstone, and asphalt pavement; and rip up concrete slabs. After these materials are uprooted or ripped, supporting equipment can remove them more easily.

### NOTE

Take care when turning with the ripper teeth in the ground; damage to the ripper teeth and assembly can occur.



## Test your Knowledge (Select the Correct Response)

2. (True or False) The carrier rollers are mounted on the lower portion of the track frame.
- A. True
  - B. False

### 3.0.0 CONTROLS

Control configuration depending upon the dozer's make and model. Some dozers have a set of levers, while others have joysticks to control vehicle movement and blade and attachment operation.

Figure 19-11 shows the set of levers on a Caterpillar D7G. The engine's speed is controlled by the governor, decelerator, and brake pedals. Because the Caterpillar D7G is a tracked dozer, its movement is controlled by a transmission control, a right and left steering clutch, and a brake control. Other controls include a blade lift and tilt control and a ripper height control.

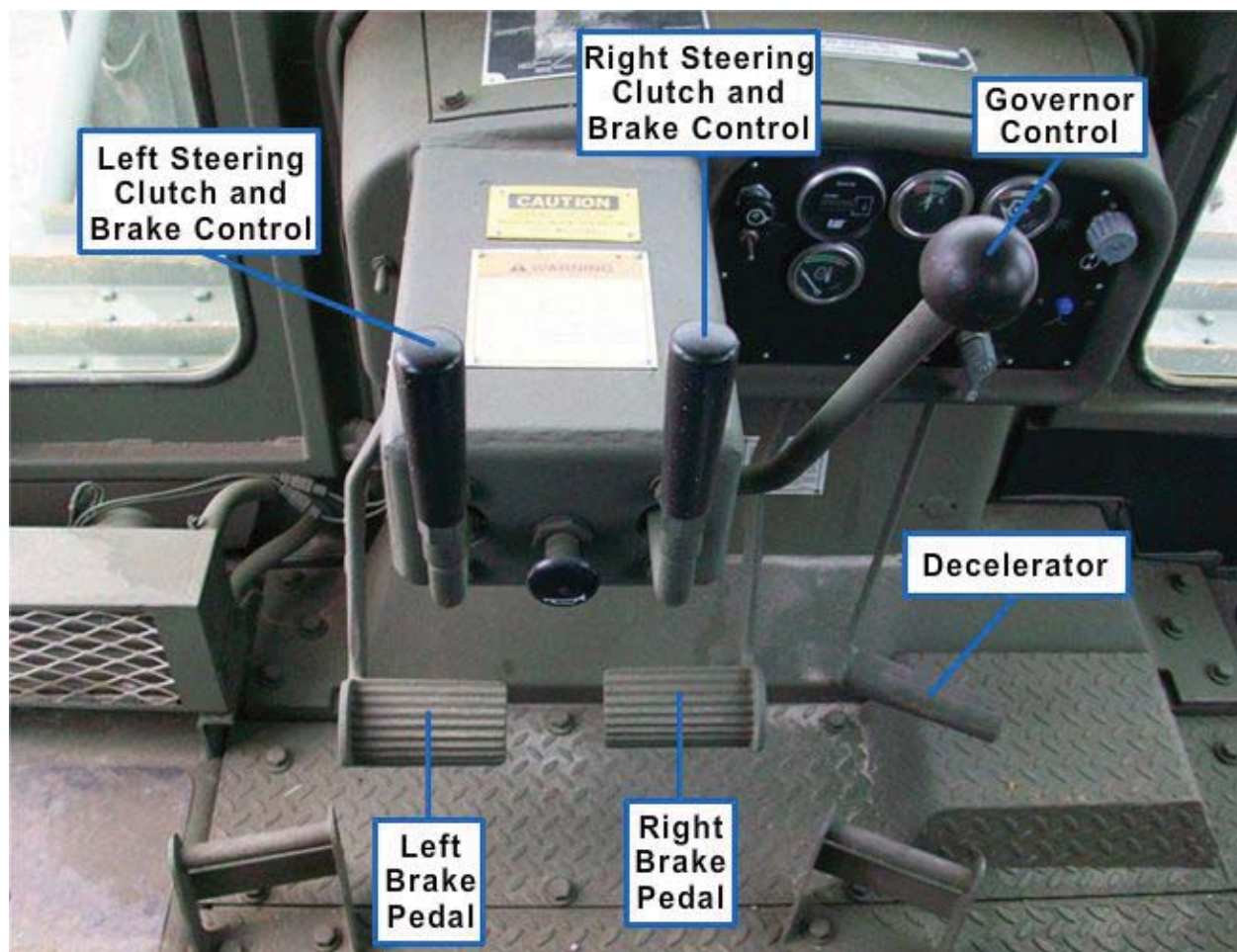


Figure 19-11 – Controls.

### 3.1.0 Blade Lift and Tilt Control

The blade lift and tilt control raises and lowers the blade as well as tilt the blade left or right. It can be moved forward, back or, and side to side. Its vertical positions are as follows: slightly and completely forward, center, and back. Its horizontal positions are left, center, and right.

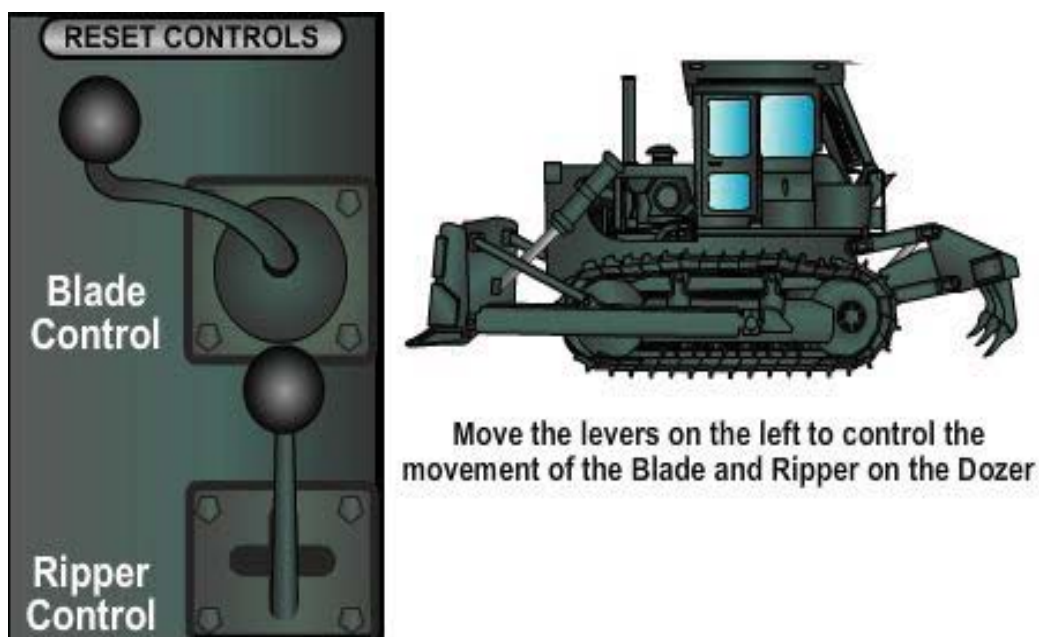
- To lower the blade, slightly push the blade lift and tilt control forward.
- To float the blade, completely push the control forward.
- To raise the blade, pull the control back.
- To lower the left side of the blade, move the control left.
- To lower the right side of the blade, move the control right.
- To suspend the movement of the blade, move the control into the center position.

### 3.2.0 Ripper Height Control

The ripper height control raises and lowers the ripper. It can be moved forward, back, and side to side. Its vertical positions are forward, center, and back. Its horizontal positions are left, center, and right. The center position suspends the ripper's movement.

- To raise the ripper, move ripper height control left.
- To lower the ripper, move the control right.
- To suspend the movement of the ripper, move the control into the center position.

Figure 19-12 allows you to operate these two controls.



**Figure 19-12 – Operating dozer controls.**

## Test your Knowledge (Select the Correct Response)

3. On the Caterpillar D7G, how would an operator raise the blade?
- A. Push the blade lift and tilt control slightly forward.
  - B. Push blade lift and tilt control completely forward.
  - C. Pull blade lift and tilt control back.
  - D. Move blade lift and tilt control left.

### 4.0.0 ATTACHMENTS

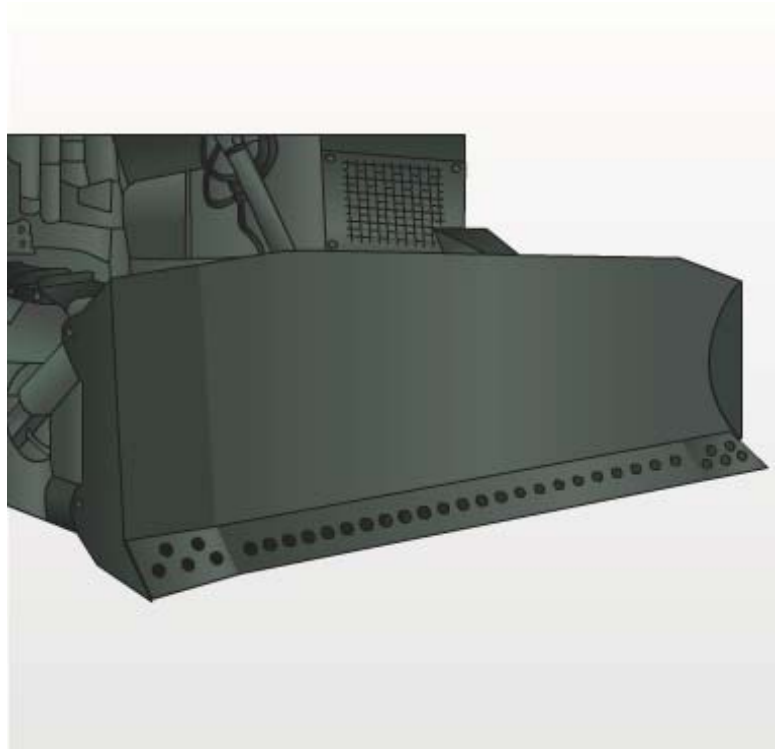
Compared to other equipment, very few attachments are used with or on dozers. The attachments that are used include a variety of blade configurations and a rear mounted winch.

#### 4.1.0 Blades

Blades vary in size and design based on specific work applications. Before using a blade, ensure that it is suitable for the specific type of dozer and work application for which you use it.

##### 4.1.1 Straight Blade

The straight blade is ideal for general dozing when materials are to be drifted a short to medium distance (*Figure 19-13*). Blade curvature lifts the dirt high with a rolling action to lower resistance and speed drifting. These blades have the side advanced ahead of the center section, and they tilt up to 15 degrees, left or right.

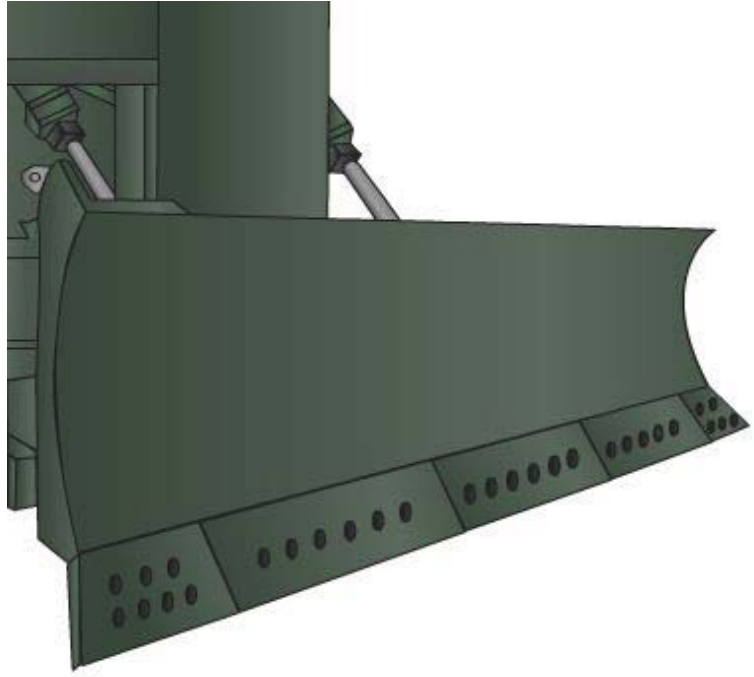


**Figure 19-13 – Straight blade.**

### 4.1.2 Angle Blade

The angle blade is a multipurpose tool that can be used for general dozing and for the side casting materials (*Figure 19-14*). The angle blade can be positioned straight ahead or angled 25 degrees to either side. The moldboard has a greater curve than a straight blade to produce more rolling action.

On dozers equipped with an angle blade, the push arms are in a “C” frame configuration. The “C” frame is attached to the trunnions and wraps around the front of the dozer. The blade is attached to the “C” frame with a steel pin.



**Figure 19-14 – Angle blade.**

### 4.1.3 “U” Blade

The “U” blade shown in *Figure 19-15* drifts large volume loads efficiently over long distances. The center section lifts material high with a forward roll. The side sections are angled so they lift and roll materials inward, keeping the load centered with a minimum loss of material to the side. This type of blade has the sides well advanced ahead of the center section, causing a “U” shape. It may also be tilted 15 degrees, right or left.



**Figure 19-15 – “U” blade.**



## 4.2.0 Winch

A winch can be mounted on the rear of the dozer and is directly geared to the rear power takeoff (Figure 19-16). This arrangement permits development of a line pull 50 to 100 percent greater than straight dozer pull. The winch is used for uprooting trees and stumps, hoisting and skidding felled trees, freeing mired equipment, and supporting amphibious construction operations.

Some limitations to consider when performing winch operations are the pulling capacity of the winch and the size and weight of the dozer. Also, the terrain may affect maneuverability of the dozer.

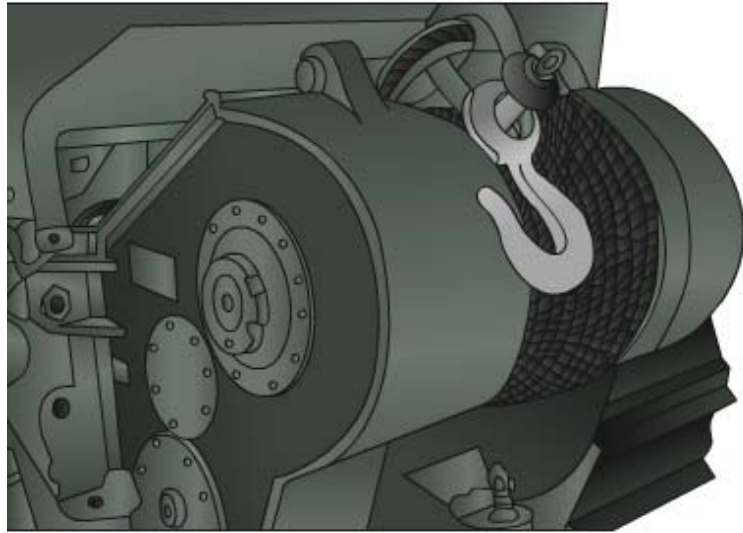


Figure 19-16 – Winch.

### **WARNING**

Breakage of the wire rope is a serious hazard to both the operator and the helpers. Wire rope stretches under strain, and if it breaks, it whips with great force. The danger to the operator is greatest if the operator and dozer are in direct line with the wire rope when it is under strain. When the wire rope is under strain, everybody in the area should stand clear of the full length of the paid-out wire rope. When rewinding the wire rope back onto the winch drum, ensure riggers' hands are clear of the winch drum by at least 3 feet. Be safety conscious and ensure the wire rope used is of the best quality, meets the manufacturers' specifications, and is properly inspected before use. Always wear leather-palmed gloves when handling the wire rope.

A good practice is to work a winch at less than its maximum capacity and to avoid anchoring the dozer unless absolutely necessary. Moderate loads give long life to the wire rope and winch parts and avoid severe catching on the drum. If the work is heavy, strain can be reduced with pulleys and multiple lines. When pulling from the winch, always be sure to pull straight off the winch. When wire rope is pulled from an angle, it slips sideways, possibly causing damage to both the wire and winch.

### Test your Knowledge (Select the Correct Response)

4. An angle blade can be angled to what amount of degrees to either side?
  - A. 10°
  - B. 15°
  - C. 20°
  - D. 25°



## 5.0.0 OPERATIONS

The dozer blade is hydraulically controlled by a lever or a joystick inside the operator's cab. Before starting, raise and lower the blade several times to get a feel for the hydraulic control. Start all jobs, if possible, from relatively level ground. If necessary, level an area large enough to provide sufficient working space for the dozer. This prevents back-and-forth pitching of the dozer and results in better blade control.

Avoid track spinning whenever possible; this wastes effort and only converts a relatively smooth working area into ruts and piles of material that pitch and tilt the dozer. In cold weather, ruts and piles freeze and cause additional difficulty the following workday. If it rains, the ruts hold the water, resulting in wet, muddy material.

Ditches, ridges, rocks, or logs should be crossed slowly and, if possible, at an angle. This procedure slows the fall, lessens the danger of upsetting the dozer, and reduces the jolt of the fall, which can harm both operator and dozer.

When dozing, shift the dozer into low gear and lower the blade into the ground gradually until obtaining the desired depth of the cut. When you feel an increase in resistance as the load culminates, start raising the blade in small increments, about one-quarter inch at a time. If you raise and lower the blade as much as 2 or 3 inches at a time while operating, the blade will cut an uneven surface, which the dozer must travel over. The uneven surface will cause the dozer to nose up and down, resulting in a greater uneven cut and up-and-down movement of the dozer.

To push the load with the blade, you must anticipate and compensate for the up-and-down movement of the front of the dozer. When the front of the dozer starts to nose up, move the control lever in the direction that will lower the blade. When the dozer starts to nose down, raise the blade high enough to compensate for the lowering of the front of the dozer. Do not over control. Raise and lower the blade only enough to compensate for the raising and lowering of the front of the tractor. Through experience, you will be able to raise and lower the blade automatically without giving it much thought or special attention.

## 5.1.0 Clearing

Clearing consists of removing brush, trees, and rubbish from a designated area. Also remove surface boulders and other material that may be embedded into the ground, as well as any material that may interfere with the construction project.

### 5.1.1 Brush and Trees

To clear brush and small trees with a dozer, travel forward at a slow speed with the blade lowered several inches below grade, as shown in *Figure 19-17*. To clear in this manner, make one pass to knock over small trees and brush, and then make another pass to clear them away.



Figure 19-17 – Clearing brush and small trees.

### 5.1.2 Medium Trees

Medium trees are 4 to 10 inches in diameter. To push trees of this size, raise the blade as high as possible to gain added leverage and push the tree over slowly, as shown in *Figure 19-18*. As the tree falls, back up quickly to clear the rising root mass. Lower the blade, travel forward, and dig the roots free with a lifting and pushing action. The **felled** trees are then ready to be pushed to a dismissal area.

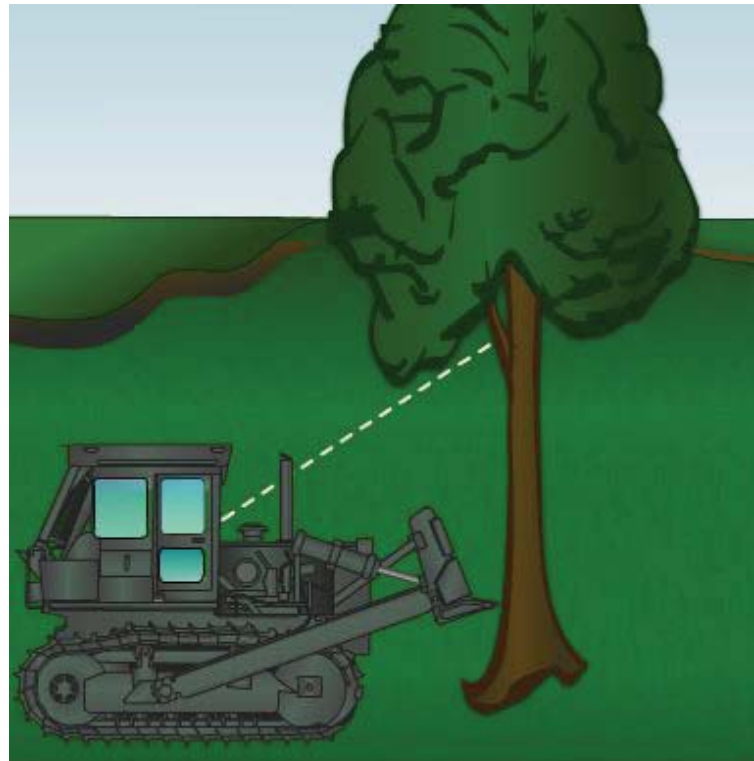


Figure 19-18 – Pushing over a medium-size tree.

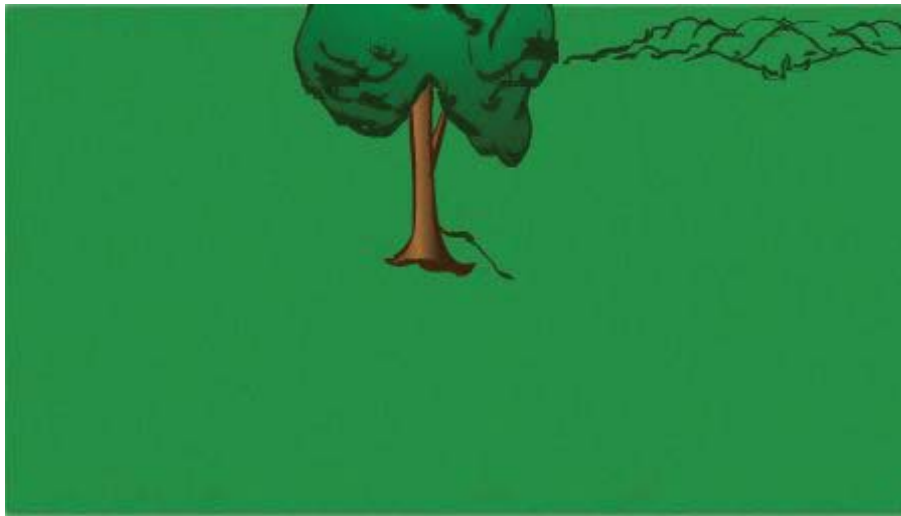
### 5.1.3 Large Trees

Large trees are over 10 inches in diameter. The removal of large trees is more difficult and takes more time. Approach the tree on foot and inspect it for dead limbs that can break off and fall onto the dozer, possibly hitting the operator. Then make sure the dozer blade contacts the tree high and centered for the most leverage. Before pushing over a large tree, determine the direction of the fall, usually the direction of its lean. If the tree can be pushed over in the manner described for medium trees, do so.

If the tree has a large root system, use the following method:

- Make a cut on the opposite side of the proposed direction of fall. The cut should be deep enough to sever some of the larger roots.
- Make a cut on both adjacent sides in the same manner.
- Build an earth ramp on the same side of the original cut to obtain a greater pushing leverage.
- As the tree starts to fall, backup quickly to clear the rising root mass.
- After the tree has fallen fill the stump hole so that water cannot collect.

These steps are shown in *Figure 19-19*.



**Figure 19-19 – Removing a large tree.**

To remove large-or well rooted trees, it may be necessary to cut the roots on the fourth side. The cut around the tree should have a “V” ditch shape, made with the blade angled downward laterally toward the tree to cut the roots.



When removing trees, be careful not to injure personnel or damage equipment. Ensure that the dozer had side covers around its engine. These covers help prevent limbs, sticks, and other debris from entering the engine area.

When clearing trees, dozers should never work closely together because one dozer could push a tree over on the other.

Do not follow too closely when the tree starts to fall because the stump can get caught under the front of the dozer, resulting in difficulty backing up and damage to the bottom of the dozer.

As the operator, you should have a plan for clearing trees so that they do not become entangled with one another when they fall.

You will probably be clearing green trees. When free, green trees bend and snap back, potentially damaging equipment and injuring personnel. When making contact or releasing pressure, do it slowly so that the top of the tree does not sway or shake causing dead limbs to break off and fall on the dozer and possibility hit you.

Know the ground on which you are working. Do not high center the dozer on stumps or trees. This problem is tougher when you are working in a wooded area and need help from another dozer. Existing trees could interfere. When you are clearing brush and trees, remember that the most common cause of damage to a machine is a stick or limb puncturing the radiator, breaking a hydraulic line, or damaging the exhaust stack. Pay attention. Know the capabilities of your dozer and what you need to do from start to finish.

### **5.2.0 Stumping**

Pushing down a whole tree with a dozer is easier than removing a tree by cutting it down and then removing its stump. The stump is usually too short to gain any pushing leverage or provide a good sway action for breaking out the roots.

For a stump that will not yield to dozing, one option is to haul it out with chains and grab hooks pulled by several dozers. Another option is to haul the stump out by a wire leading to the winch on a winch-equipped dozer. If the ground around the stump is not to be disturbed, rather than removing it entirely, you may only need to saw the stump level with the surface grade.

### **5.3.0 Removing Rocks and Boulders**

A dozer with a tilted blade is the most effective piece of equipment for removing rocks and boulders. With the left lower corner of the blade hooked well under the boulder, the best way to exert maximum uprooting pressure is to combine raising the blade with a right turn of the dozer. With the right lower corner of the blade hooked well under the boulder, the best way to exert maximum uprooting pressure is to combine raising the blade with a left turn of the dozer. A boulder that is deeply embedded should be side cut, like stump. Like some stumps, some boulders must be broken up other way before removal.

If the dozer is not equipped with a hydraulic tilt control, the blade can be tilted by adjusting the pitch braces to lower either corner. To increase the digging action of a straight-blade dozer working in hard ground, pitch the top of the blade forward.

## 5.4.0 Working in Wet Material

Wet material is quite difficult to move with a dozer. When the material is too soft to hold up the weight of the dozer, each successive pass should be the full depth of the wet material. This places the dozer on a firmer footing. Push the mud far enough so it will not flow back into the cut. Arrange for rescue in case the dozer becomes stuck.

### NOTE

When rescuing a dozer, never hook onto the blade to pull the dozer forward. The blade is made for pushing, not pulling. Instead, hook the towing wire rope to the hook located under the front of the dozer or to the drawbar on the rear of the dozer.

Some dozers are equipped with wider track shoes for better flotation when working in mud or soft materials. These tractors with wide track shoes are called low ground pressure (LGP) tractors.

Extremely low ground bearing pressure is one of many reasons the dozer is highly recommended for working in wet material.

## 5.5.0 Bulldozing

Bulldozing (drifting) is the process of pushing materials straight ahead in front of the dozer blade. Bulldozing is most efficient when the blade pushes as much material as possible, as shown in *Figure 19-20*. The maximum working distance depends on the dozer's speed and blade's capacity; however, the maximum distance is usually 200 to 500 feet with 300 feet being normal for a medium-sized dozer.



**Figure 19-20 – Bulldozing.**



To maximize the amount of material pushed, push downhill whenever possible. With the assistance of gravity, a dozer can push a far greater load downhill than on a level grade. When bulldozing down a steep hill, a separate full-length pass with each load is unnecessary; instead, push and pile several loads at the brink of the hill and push them all to the bottom in a single pass.

Side-by-side and slot dozing are two techniques that maximize the amount of earth drifted by reducing and preventing spillage around the outer edges of the blade.

### **5.5.1 Side-By-Side**

Side-by-side dozing, as shown in *Figure 19-21*, consists of two dozers working next to each other with blade edges as close together as possible. This technique prevents spillage around one blade edge on each dozer. Side-by-side dozing is time-consuming; therefore, it is impractical for hauls that are less than 50 feet and more than 300 feet.



**Figure 19-21 –Side-by-side dozing.**

### 5.5.2 Slot Dozing

Slot dozing is done by first building a pair of windrows with the spillage of several passes. As shown in *Figure 19-22*, the windrows serve as barriers to prevent spillage around the dozer blade ends. Under favorable conditions, slot dozing can increase production up to 50 percent.



**Figure 19-22 – Slot dozing.**

### 5.6.0 Spreading

As shown in *Figure 19-23*, dozers are ideal for spreading fill material brought in by haul units. Position the blade in a straight position, so the material is drifted directly under the cutting edge.

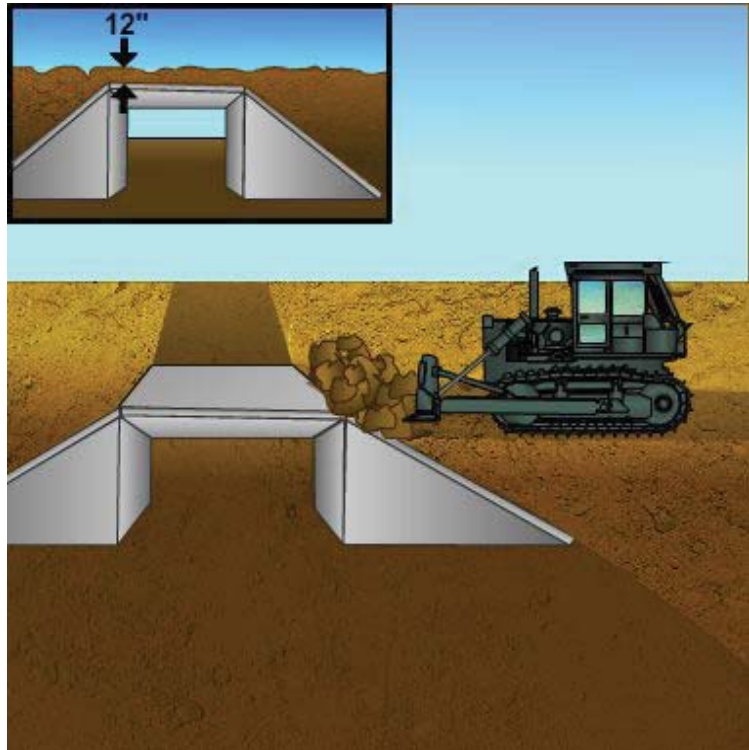


**Figure 19-23 – Spreading.**

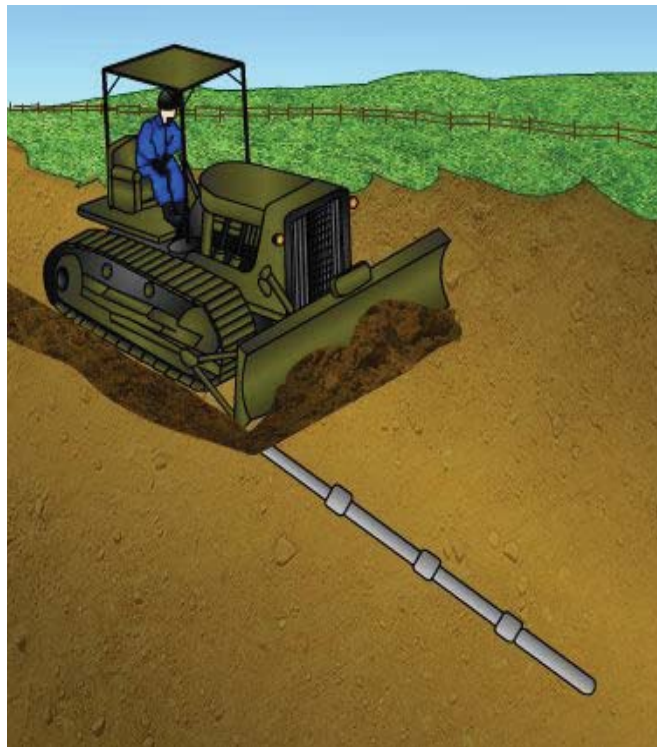
### 5.7.0 Backfilling

When backfilling a culvert, do not cross the culvert with the dozer unless there is at least 12 inches of compacted material on top of the culvert, as shown in *Figure 19-24*. If you use a bulldozer to backfill a culvert, the best method is to make diagonal passes over the material, ending each pass with a swing that brings the blade in line with the culvert.

The angle blade is preferred for backfilling a trench, because it can side cast material into the trench while maintaining a steady forward motion, as shown in *Figure 19-25*.



**Figure 19-24 – Culvert backfilling.**



**Figure 19-25 – Trench backfilling.**



When a pipe trench is backfilled, fine material is placed around the pipe and coarse material above it, so the pipe is supported by well-compacted material. However, covering the pipe to full depth in short lengths may concentrate weight and break pipe joints; therefore, cover the pipe in successive layers, rather than all at once.

#### NOTE

Be careful in pipe trench backfilling to avoid dropping large rocks directly on the pipe.

### 5.8.0 Finishing

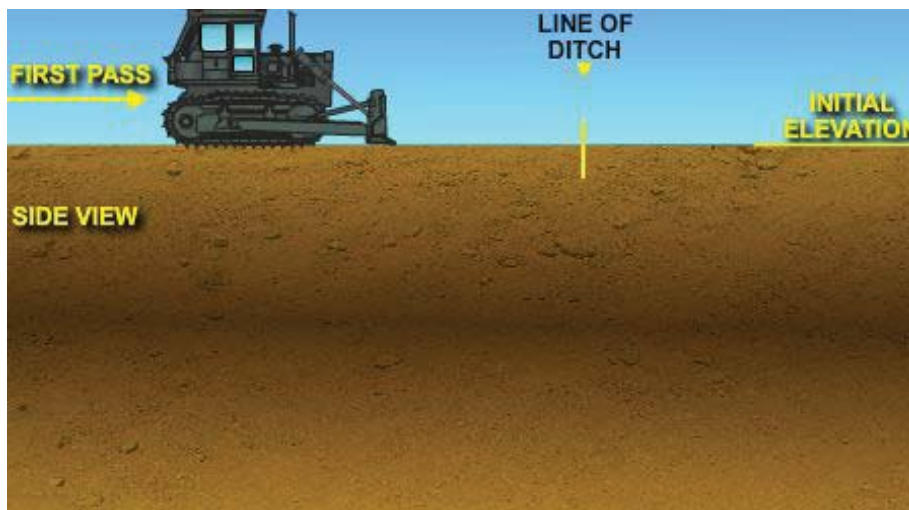
Whether clearing or spreading material on a roadbed, no job is completed until it has been smoothed and drainage is established. This is called finishing and should be done at the end of each shift.

Lightly blade over the surface with about a half a blade of dirt. This fills in any low spots or holes. Leave a windrow on the side that you are working toward. At the start of the next pass, cover half the blade width. Continue in this fashion over the project or section of the project you have worked that day before you shut down for the day. Finishing the project in this manner supports drainage and prevents having to walk over piles of dirt or through mudholes.

### 5.8.0 Ditching

Rough ditching can be done using a dozer by making a series of overlapping passes at right angles to the line of the ditch.

*Figure 19-26* shows the construction of a V-type ditch. First, build a windrow along the edge of the ditch. Then, position the machine parallel to the ditch with the outside track on the windrow. Make a pass along the windrow. With the track elevated by the windrow, the blade cuts one side of the ditch. Cut the other side the same way.



**Figure 19-26 – Constructing a V-type ditch.**

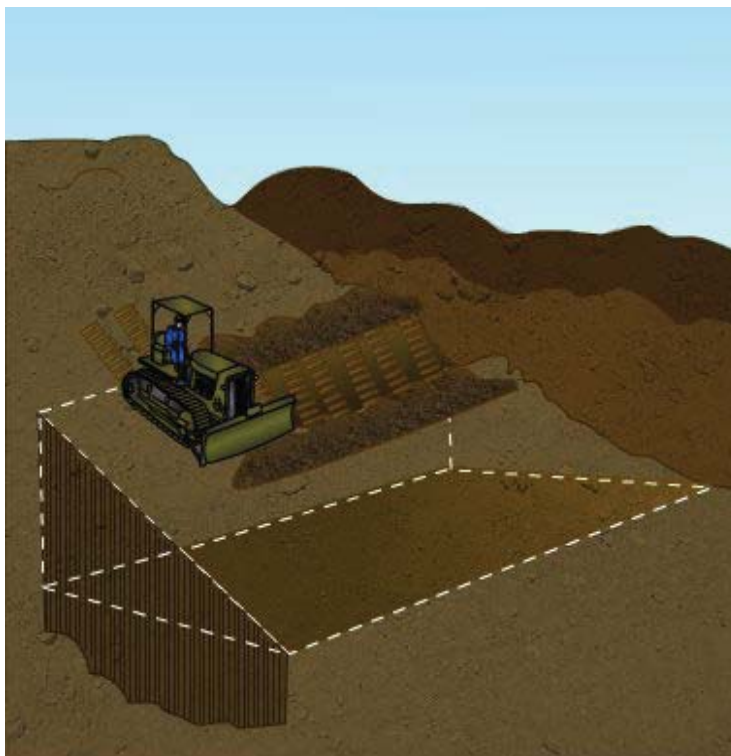
An angled blade is preferable for digging a V-type of ditch for two reasons. You can side cast the windrow in a single pass and the angled blade will side cast the material to the sides of the ditch as you travel along the windrow, as shown in *Figure 19-27*.



**Figure 19-27 – Angle blade ditch cut.**

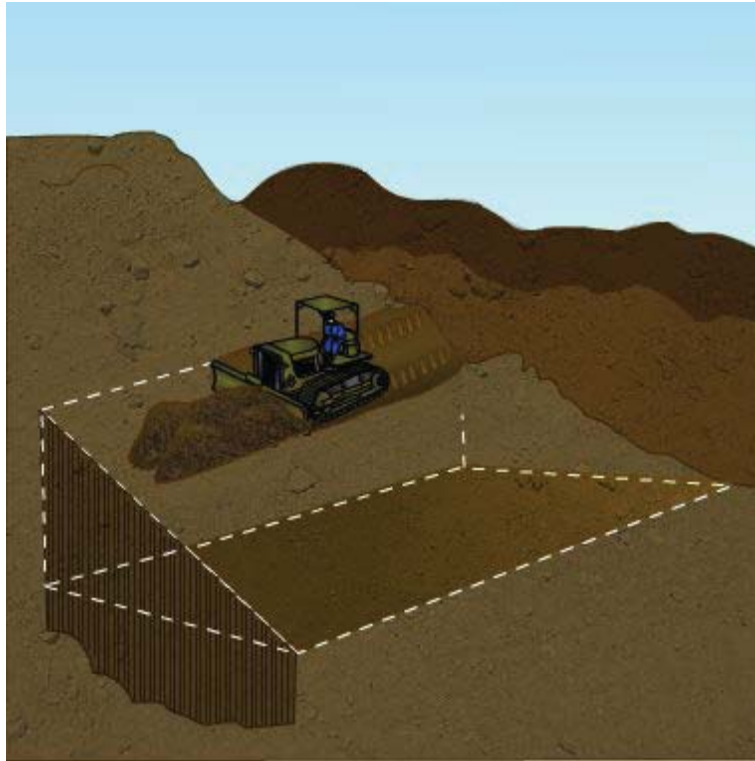
### **5.9.0 Sidehill Excavation**

A sidehill excavation can be started more easily if a small bench cut is made first, as shown in *Figure 19-28* a windrow will be created with the material removed from the bench cut. When digging the sidehill, keep the inside (uphill) surface slightly lower to gain greater tractor stability (*Figure 19-29*). Tilting the blade produces this type of cut.



**Figure 19-28 – Bench cut.**

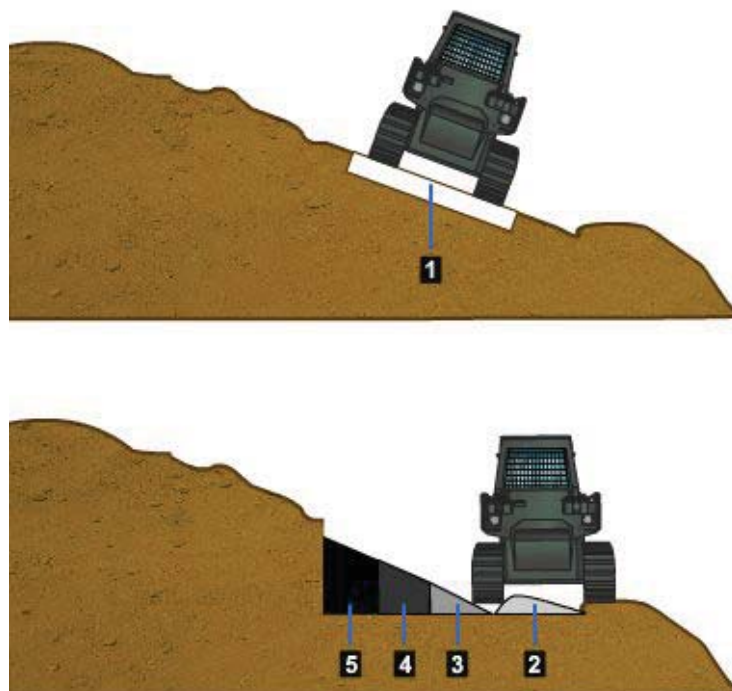




**Figure 19-29 – Sidehill excavation.**

Always cut the shelf wide enough to provide solid support for equipment that will be used later. If possible, move the material downhill to gain the advantage of gravity, reduce effort, and increase the stability of the dozer.

On shallow slopes or in soft soil, the sidehill cut can be made, as shown in *Figure 19-30*, cuts 1 and 2.

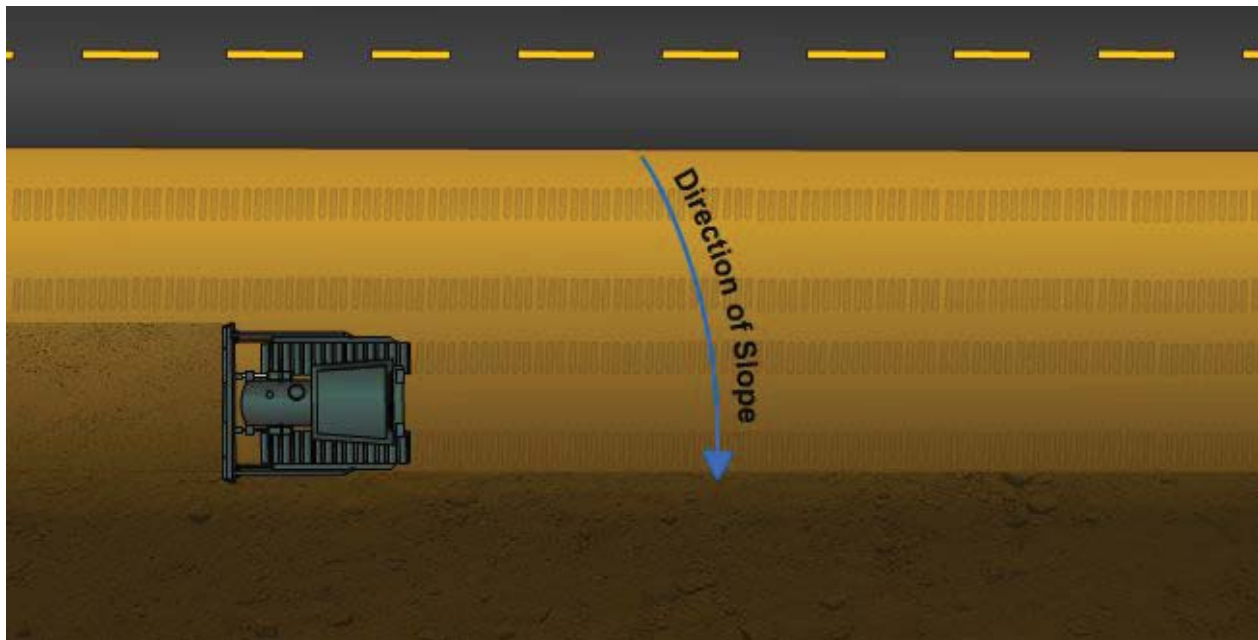


**Figure 19-30 – Shallow slope sidehill excavation.**

Running the uphill track inside the ridge left by the first cut increases stability. Pushing the loosened material to the lower side of the slope normally reduces the time required to complete the cut. In *Figure 19-30*, cuts 3, 4, and 5 show the completion of the shelf. Pushing the loosened material to the lower side of the slope normally reduces the time required to complete the cut. Do not push the material beyond the point required to retain firm track support. When you are backing up, do not raise the blade, as this puts extra weight on the front idlers, causing greater track penetration. Let the blade float as you back away from the edge of soft fills.

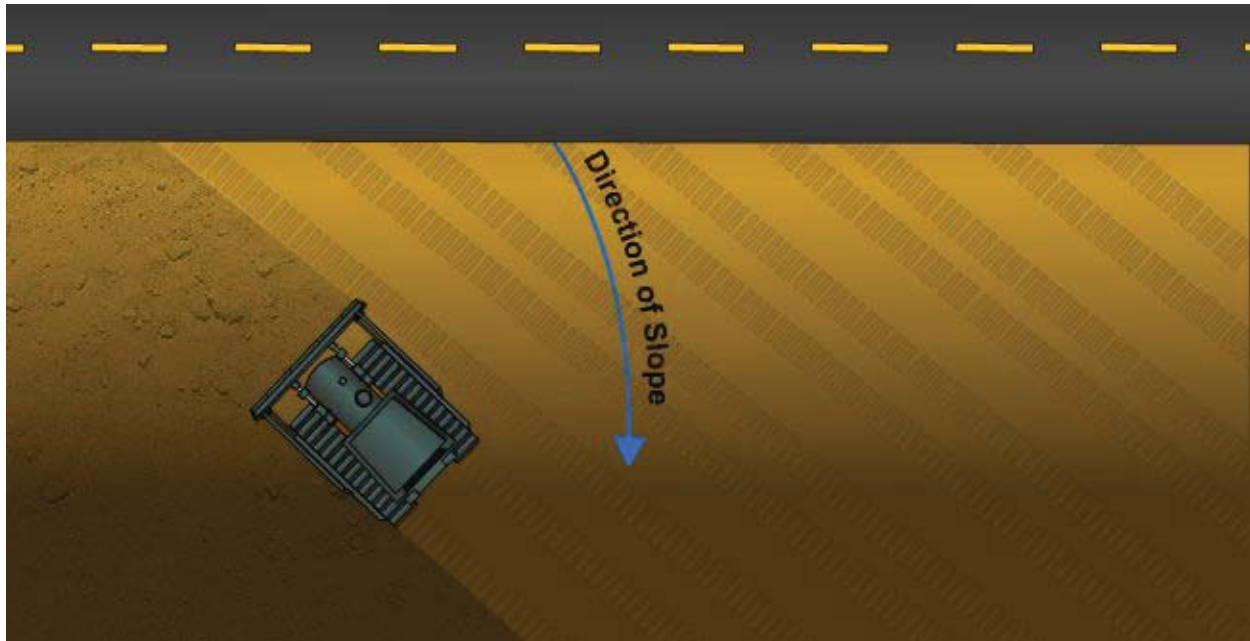
### 5.10.0 Finishing Side Slopes

There are two methods for finishing side slopes with dozer. One is to start at the top of the slope and work parallel to the right-of-way, as shown in *Figure 19-31*. Doing so will cause the material from each pass to fall to the lower side of the blade and form a windrow that can be picked up on the succeeding passes, filling irregularities in the terrain. When performing this method, do not allow the blade corner to dig, since this steepens the slope beyond job specifications.



**Figure 19-31 – Finishing a side slope by working parallel to the right-of-way.**

The other method is to start at the bottom of the slope and work diagonally up (*Figure 19-32*). This method will form a windrow that is continually drifted to one side, filling low spots or irregularities.



**Figure 19-32 – Finishing a side slope by working diagonally.**

**NOTE**

Diagonally finishing a side slope is one of few instances when a dozer may be used efficiently in cutting upgrade.

### **5.11.0 Pushing Dozer**

The push dozer in *Figure 19-33* is equipped with a push blade. However, in most cases, a straight-blade dozer with a reinforced block in the center of the blade is used. Ensure the center lines of the pusher and scraper are aligned. If the alignment is not centered, it is hard to keep the pusher straight without extensive use of the steering clutch. When you are using the steering clutch, power is taken away from one track, and the other track is doing all the work. If the scraper starts to jackknife, stop pushing; back up, and get repositioned straight with the scraper. Be sure the blade of the dozer does not cut the rear tires of the scraper, resulting in downtime and costly tire replacement.



**Figure 19-33 – Push dozer.**

### **Test your Knowledge (Select the Correct Response)**

5. What term is used to describe the operation of removing brush, trees, and rubbish from a designated area?
  - A. Bulldozing
  - B. Stumping
  - C. Clearing
  - D. Ditching
  
6. What is the most effective piece of equipment for removing rocks and boulders?
  - A. A dozer with a tilted blade
  - B. A rock drill
  - C. A forklift
  - D. A jackhammer

## **6.0.0 SAFETY**

Standard safety precautions that apply to dozer operations are as follows:

- Only operate the dozer at speeds at which you can maintain control of the dozer at all times.
- Navy safety regulations require that all dozers be equipped with ROPS, crankcase guards, and radiator protectors. All dozers purchased by the Navy are equipped with these devices. Never use dozers without these devices.
- Always wear a seat belt when dozing. A sudden jolt from working on uneven terrain can possibly throw you off the machine or against the control levers, causing serious injury or death.
- Obtain a digging permit before performing excavation operations with a dozer.

- When using a dozer for demolition, take care to prevent falling objects from striking the operator or other personnel.
- When felling trees with a dozer, take care to avoid being struck by falling branches or by the backlash of a branch or trunk.
- Never use a dozer for clearing trees unless it is equipped with an operator's protective cage (brush cage).
- Personnel must never ride the dozer drawbar. This dangerous practice has been the cause of numerous accidents.
- Operators of dozer equipped with rippers should make every effort to learn the locations of any underground high-voltage electric lines or gas lines.
- Operate the dozer from the sitting position, never from a standing position.
- Operate a dozer with extreme care when near the edge of a cut; the edge may give way, overturning the machine.
- Climb a steep incline slowly. "Gunning" up a steep slope has often caused dozers to overturn.
- Do NOT attempt a turn on a steep slope. Sliding sideways may not appear to be dangerous, but it can easily become so if the low side of the dozer hits a solid rock or a stump.
- Coupling trailing equipment to a dozer is hazardous; be especially alert while this is being done. Whenever possible, couple equipment with the dozer stopped and the clutch, if so equipped, disengaged. Additionally, set the brake, and lower the blade.
- When towing a heavy load downgrade, keep the dozer in low gear. Coasting is dangerous. A coasting dozer with a towed load is likely to jackknife.
- Before dismounting a dozer and at the end of a workday, secure the dozer blade by lowering it to the ground. Lowering the blade prevents the dozer from rolling; most importantly, it eliminates the possibility of the blade falling on someone. Whenever it is necessary to work on the dozer with the blade up, especially when changing cutting edges, always securely block the blade to prevent it from falling accidentally.
- Wear required personal protective equipment such as steel-toed safety shoes and hard hats.

### **Test your Knowledge (Select the Correct Response)**

7. **(True or False)** Before operating a dozer equipped with a ripper, it is a safe practice to learn the locations of any underground high-voltage electric lines or gas lines.
- A. True  
B. False



## Summary

This chapter introduced you to the low and high track dozers. You were introduced to their major components, which include a track assembly and frame, as well as their controls for operating the blade and rear-mounted ripper. You were introduced to various blades used with dozers for specific applications. In addition, you were introduced to operations such as clearing brush and small to large trees. You were introduced to side-by-side and slot dozing, two techniques that increase production by reducing and preventing spillage around blade. Lastly, you were introduced to safety practices to adhere to when operating a dozer.

## Review Questions (Select the Correct Response)

1. Dozers are usually rated by size and what other item?
  - A. Engine size
  - B. Power
  - C. Track length
  - D. Blade width
  
2. **(True or False)** Dozer drawbar pull is greatest in the highest transmission gear range.
  - A. True
  - B. False
  
3. What action should an operator perform when operating a dozer in water deep enough to reach the radiator?
  - A. Tape off the air cleaner
  - B. Tape off the exhaust stack
  - C. Disconnect the fan belt
  - D. Disconnect the batteries
  
4. What component of the dozer contacts the track pin bushings and propels the dozer along the track assembly?
  - A. Drive sprocket teeth
  - B. Front idler
  - C. Carrier rollers
  - D. Track rollers
  
5. What components, as they wear, will cause the track assembly to lengthen?
  - A. Grouser shoes and pins
  - B. Sprocket teeth and bushings
  - C. Pins and bushings
  - D. Recoil spring and front idler
  
6. What term is used to describe the most common dozer track shoe?
  - A. Grouser
  - B. Cleat
  - C. Spikes
  - D. Pads

7. What component keeps the track chain in alignment between the drive sprocket and the front idler?
  - A. Track rollers
  - B. Lift sheaves
  - C. Support bearings
  - D. Carrier rollers
  
8. What component serves as a guiding support for the track chain?
  - A. Recoil spring
  - B. Front idler
  - C. Pitch arm
  - D. Trunnion roller
  
9. **(True or False)** The track adjuster fitting should be lubricated every time daily operator's maintenance is performed.
  - A. True
  - B. False
  
10. Which of the following personnel are responsible for checking cutting edges and corner bits for wear?
  - A. The Operations Officer
  - B. The Dispatcher
  - C. The Operator
  - D. The Field Crew Mechanic
  
11. Most push arms are attached to what location on a blade?
  - A. The top
  - B. The center
  - C. The front
  - D. The bottom
  
12. A forward blade pitch adjustment is for dozing what type of material?
  - A. Hard
  - B. Sandy
  - C. Salty
  - D. Loose
  
13. Which of the following dozer attachments is used to break up compacted materials, uproot boulders and stumps, and rip up concrete slabs?
  - A. Jackhammer
  - B. Boulder buster
  - C. Ripper
  - D. Blade

14. On the Caterpillar D7G, how would an operator lower the right side of the blade?
- A. Push the blade lift and tilt control forward.
  - B. Pull the blade lift and tilt control back.
  - C. Move the blade lift and tilt control left.
  - D. Move the blade lift and tilt control right.
15. On the Caterpillar D7G, how would an operator raise the ripper?
- A. Move the ripper height control forward.
  - B. Move the ripper height control back.
  - C. Move the ripper height control left.
  - D. Move the ripper height control right.
16. Which of the following types of blades drift large volume loads efficiently over long distances?
- A. Angle
  - B. "U"
  - C. Straight
  - D. Push
17. The winch line pull is what percentage greater than a straight dozer pull?
- A. 10% to 20%
  - B. 30% to 40%
  - C. 50% to 100%
  - D. 60% to 100%
18. When rewinding the wire rope back onto the winch drum, the rigger's hands should stay clear of the winch drum by at least how many feet?
- A. 3
  - B. 6
  - C. 9
  - D. 12
19. Crossing ditches, ridges, rocks, or logs at an angle with a dozer produces which of the following results?
- A. Slows the fall
  - B. Lessens the danger of upsetting the dozer
  - C. Reduces the jolt of the fall
  - D. All of the above
20. What size diameter tree is considered a large tree?
- A. 4 inches
  - B. 6 inches
  - C. 8 inches
  - D. 10 inches

21. **(True or False)** Making contact or releasing pressure on a tree with a dozer should be performed quickly and smoothly to avoid any shock to the tree.
- A. True
  - B. False
22. **(True or False)** Punctured radiators, broken hydraulic lines, and damaged exhaust stacks are common types of equipment damage that occurs when clearing brush and trees?
- A. True
  - B. False
23. What action should an operator perform to increase the digging action of a straight-blade dozer working in hard ground?
- A. Tilt the top of the blade rearward
  - B. Tilt the top of the blade forward
  - C. Angle the blade to the left
  - D. Angle the blade to the right
24. What is the maximum working distance for a medium-size dozer?
- A. 100 feet
  - B. 200 feet
  - C. 300 feet
  - D. 400 feet
25. Side-by-side dozing is impractical for hauls of less than what distance?
- A. 50 feet
  - B. 40 feet
  - C. 30 feet
  - D. 20 feet
26. Slot dozing can increase production up to what percentage?
- A. 50%
  - B. 40%
  - C. 30%
  - D. 20%
27. A sidehill excavation can be started more easily if what type of cut is made first?
- A. Ditch
  - B. Bench
  - C. Slope
  - D. Slot



28. What position should the dozer blade be in when backing away from the edge of soft fills?
- A. As high as possible
  - B. As low as possible
  - C. In the float position
  - D. Angled
29. A blade on a straight-blade dozer must have what type of accessory before it can be used as a push dozer?
- A. A cutting edge
  - B. A hard facing
  - C. A reinforced block
  - D. A rubber bumper
30. **(True or False)** An operator of a dozer should always wear a seat belt when dozing.
- A. True
  - B. False
31. **(True or False)** When towing a heavy load downgrade, the dozer should be in the highest gear.
- A. True
  - B. False
32. **(True or False)** When changing a blade's cutting edge, the blade must be securely blocked.
- A. True
  - B. False

## Terms Introduced in this Chapter

<b>Drift</b>	The process of pushing materials straight ahead in front of the dozer blade.
<b>Drawbar</b>	A fixed or hinged bar, extending to the rear of a tractor and used as a fastening for lines and towed machines or loads.
<b>Draw horsepower</b>	A tractor's flywheel horsepower minus friction and slippage losses in the drive mechanism and the tracks or tires.
<b>Draw pull</b>	The pull that a tractor can exert on a load attached to the drawbar. Depends on power, weight and traction
<b>Felled</b>	A term used in forestry to refer to a chopped or knocked down tree.
<b>Ground pressure</b>	The weight of a machine divided by the area in square inches of the ground directly supporting it.

## **Additional Resources and References**

This chapter is intended to present thorough resources for task training. The following reference works are suggested for further study. This is optional material for continued education rather than for task training.

*Apprentice Construction Equipment Operator, Volume 1* CDC 131, General Subjects and Contingency Responsibilities, Extension Course Institute, Gunter Air Force Base, Montgomery, AL, 1984.

*Construction Equipment Operator, Volume 2*, CDC 55151, "Earth Moving and Compaction," Extension Course Institute, Gunter Air Force Base, Montgomery, AL, 1985.

*Construction Mechanic 3 & 2*, NAVEDTRA 10644-G1, Naval Education and Training Program Management Support Activity, Pensacola, FL, 1988.

*Earthmoving Operations*, FM 5-434, Headquarters Department of the Army, Washington, DC, 2000.

*Equipment Utilization*, U.S. Army Subcourse EN5468, U.S. Army Engineer School, Fort Belvoir, VA, 1988.

*Heavy Equipment Operations: Level Three*, 2nd ed., National Center for Construction Education and Research, Gainesville, FL and Pearson Education, Inc., Upper Saddle River, NJ, 2006.

*Operation: D7G, D8K & D9H Track-Type Tractors*, Caterpillar.

## CSFE Nonresident Training Course – User Update

CSFE makes every effort to keep their manuals up-to-date and free of technical errors. We appreciate your help in this process. If you have an idea for improving this manual, or if you find an error, a typographical mistake, or an inaccuracy in CSFE manuals, please write or email us, using this form or a photocopy. Be sure to include the exact chapter number, topic, detailed description, and correction, if applicable. Your input will be brought to the attention of the Technical Review Committee. Thank you for your assistance.

Write: CSFE N7A  
3502 Goodspeed St.  
Port Hueneme, CA 93130

FAX: 805/982-5508

E-mail: [CSFE\\_NRTC@navy.mil](mailto:CSFE_NRTC@navy.mil)

Rate \_\_\_\_\_ Course Name \_\_\_\_\_

Revision Date \_\_\_\_\_ Chapter Number \_\_\_\_\_ Page Number(s) \_\_\_\_\_

Description

---

---

---

(Optional) Correction

---

---

---

(Optional) Your Name and Address

---

---

---