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HEAVY MACHINE OPERATOR

LEARNER GUIDE

National Vocational Certificate Level 3

Version 1 - November, 2019

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Introduction
Welcome to Learner's Guide for the *Heavy Machine Operator* Programme. It will help Learner's to complete the Programme and to go on to complete further study or go straight into employment.

The *Heavy Machine Operator* programme is to engage young people with a programme of development that will provide them with the knowledge, skills and understanding to start this career in Pakistan. The programme has been developed to address specific issues, such as the national, regional and local cultures, the manpower availability within the country, and meeting and exceeding the needs and expectations of their companys.
The main elements of learner's guide are:

- **Introduction:**
  - This includes a brief description of guide and guidelines for Learner's to use it effectively
- **Modules:**
  - The modules form the sections in learner's guide
- **Learning Units:**
  - Learning Units are the main sections within each module
- **Learning outcomes**:
  - Learning outcomes of each learning units are taken from the curriculum document
- **Learning Elements:**
  - This is the main content of learner's guide with detail of the knowledge and skills (practical activities, projects, assignments, practices etc.) learners will require to achieve learning outcomes stated in the curriculum
  - This section will include examples, photographs and illustrations relating to each learning outcome
- **Summary of modules**:
  - This contains the summary of the modules that make up learner's guide
- **Frequently asked questions**:
  - These have been added to provide further explanation and clarity on some of the difficult concepts and areas. This further helps Learners in preparing for the assessment.
- **Multiple choice questions for self-test**:
  - These are provided as an exercise at the end of your learner's guide to help Learner's in preparing for the assessment.

Overview of the Curriculum for Heavy Machine Operator:

Module Title and Aim	Learning Units	Theory Days/hours	Workplace Days/hours	Timeframe of Modules
Module A: **Apply Work Health and Safety Practices (WHS)** **Aim:** This unit describes the skills to work with safety and participate in hazard assessment activities, follow emergency procedures and participate OHS practices in process	**LU1.** Implement safe work practices at work place **LU2.** Participate in hazard assessment activities at a work place **LU3.** Follow emergency procedures at workplace **LU4.** Participate in OHS consultative processes	**04**	**16**	**20**
Module B: **Identify and Implement Workplace Policy and Procedures** **Aim:** This unit describes the skills and knowledge required to develop and implement a workplace policy & procedures and to modify the policy to suit changed circumstances. It applies to individuals with managerial responsibilities who undertake work developing approaches to create, monitor and improve strategies and policies within workplaces and engage with a range of relevant stakeholders and specialists.	**LU1.** Identify workplace policy & procedures **LU2.** Implement workplace policy & procedures **LU3.** Communicate workplace policy & procedures **LU4.** Review the implementation of workplace policy & procedures	**02**	**08**	**10**
Module C: **Communicate at Workplace** **Aim:** This unit describes the performance outcomes, skills and knowledge required to develop communication skills at workplace. It covers gathering, conveying and receiving information, along with completing assigned written information under direct supervision.	**LU-1:** Communicate within the organization **LU-2:** Communicate outside the organization **LU-3:** Communicate effectively in workgroup **LU-4:** Communicate in writing	**02**	**08**	**10**

Module D: **Perform Computer Application Skills** **Aim:** This unit describes the skills and knowledge required to use spreadsheet applications, prepare in page documents, develop familiarity with Word, Excel, Access, PowerPoint, email, and computer graphics basics. It applies to individuals who perform a range of routine tasks in the workplace using a fundamental knowledge of spreadsheets, Microsoft office and computer graphics in under direct supervision or with limited responsibility.	**LU1.** Prepare In-page documents as per required information **LU2.** Prepare Spreadsheets as per required information **LU3.** Use MS Office as per required information **LU4.** Perform computer graphics in basic applications **LU5.** Create Email account for communications	**02**	**08**	**10**
Module E: Manage Personal Finances **Aim:** This unit of competency describes the outcomes required to manage develop, implement and monitor a personal budget in order to plan regular savings and manage debt effectively.	**LU1.** Develop a personal budget **LU2.** Develop long term personal budget **LU3.** Identify ways to maximize future finances	**02**	**08**	**10**
Module F: **Transport Machines** **Aim:** This module covers the skills and knowledge required to Prepare to load machine and attachments, Load or assist with loading machine and attachments, Assist with securing machine and attachments, Unload or assist with unloading machine and attachments, Prepare rubber-tired machine for road travel and Drive rubber tired machine on public roads.	**LU-1:** Prepare to load machine and attachments **LU-2:** Loading machine and attachments **LU-3:** Securing machine and attachments **LU-4:** Unload or assist with unloading machine and attachments **LU-5:** Prepare rubber-tired machine for road travel **LU-6:** Drive rubber-tired machine on public roads	**16**	**64**	**80**

Module G: **Operate Bulldozer** **Aim**: This module covers the skills and knowledge required to Operate Controls, Strip and stockpile surface materials, Cut and fill material, create slopes, create ditches, spread ballast, Rip dense materials, Clear land and Push scraper.	**LU-1:** Operate controls **LU-2:** Strip and stockpile surface materials **LU-3:** Cut and fill material **LU-4:** Create slopes **LU-5:** Create ditches **LU-6:** Spread ballast **LU-7:** Rip dense materials **LU-8:** Clear land **LU-9:** Push scraper	**28**	**112**	**140**
Module H: **Operate Wheel Loader** **Aim:** This module covers the skills and knowledge required to Install attachments, Operate controls, Dig, Carry (tram) & Stockpile materials, Place and spread materials, Backfill trenches , excavate and load rucks	**LU-1:** Install attachments **LU-2:** Operate controls **LU-3:** Dig, carry (tram) & stockpile materials **LU-4:** Place and spread materials **LU-5:** Backfill trenches & excavate **LU-6:** Load trucks	**20**	**80**	**100**
	TOTAL	**76**	**304**	**380**

HEAVY MACHINE OPERATOR

Module-G

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Learning Modules

Module G: Operate Bulldozer

Objective: This module covers the skills and knowledge required to Operate Controls, Strip and stockpile surface materials, Cut and fill material, Create slopes, Create ditches, Spread ballast, Rip dense materials, Clear land and Push scraper.

Duration: 126 Hours **Theory: 16 Hours** **Practice: 110 Hours**

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
LU1: Operate Controls	• Operate controls smoothly and safely • Operate different operating controls simultaneously as required • React to changing conditions/situations	• Define basic operating functions. • Describe different operating controls and their functions • Describe different situations which an operator can encounter under different conditions • Describe smooth and safe handling of controls	

Bulldozer

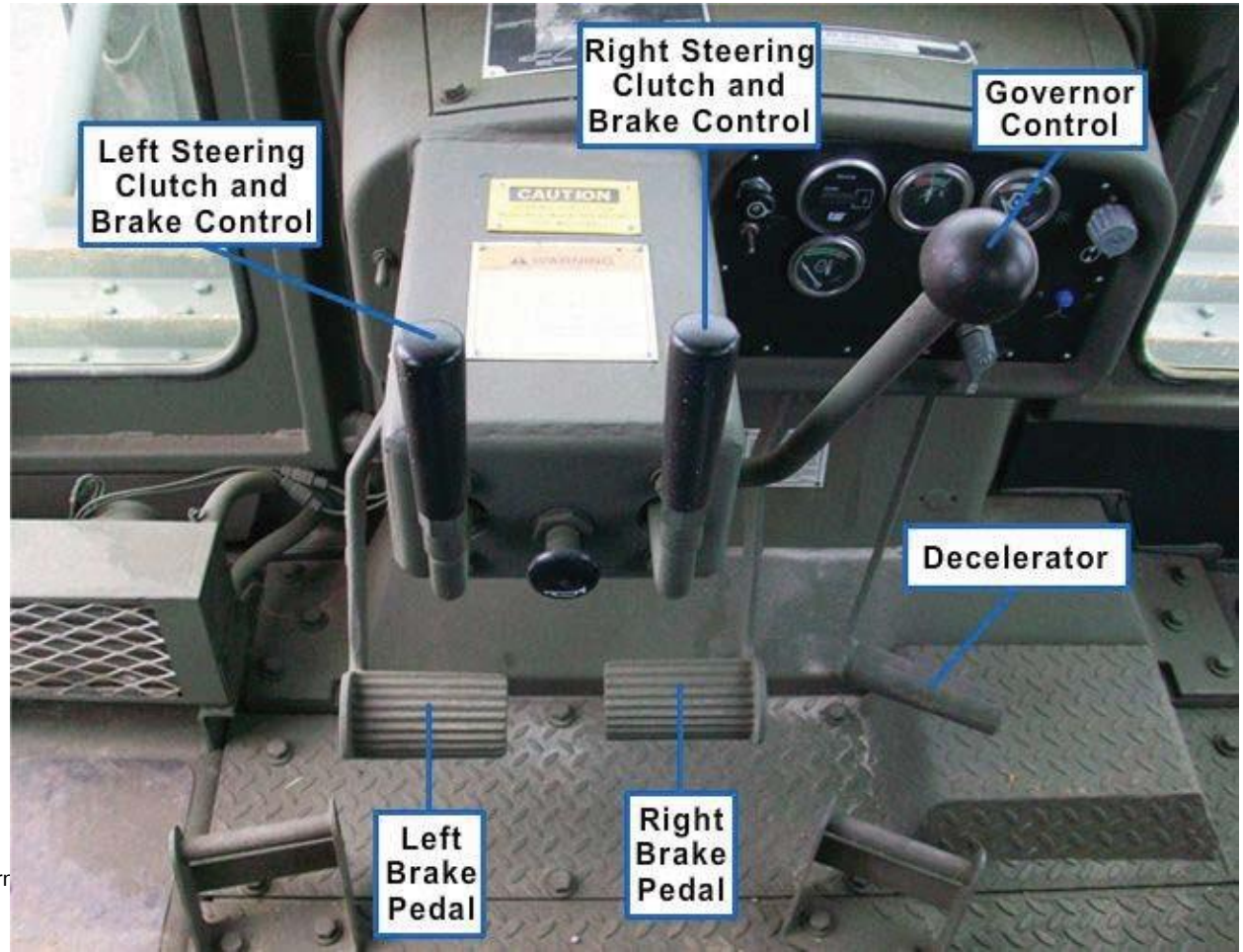
Bulldozers are strong machines that mainly assist with pushing, digging, excavating, and leveling materials like soil and debris at a work site.
Operating Bull-Dozer is a practical tasks and trainee shall follow the instructions and methods explained by the trainer however for reference and understanding following “Operator Manuals” may be referred too for knowledge and understanding.

A Bulldozer Operator will use controls to manoeuvre the bulldozer, to flatten debris, maintain the log yard and pull equipment out of the mud.

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.



Blade Lift and Tilt Control

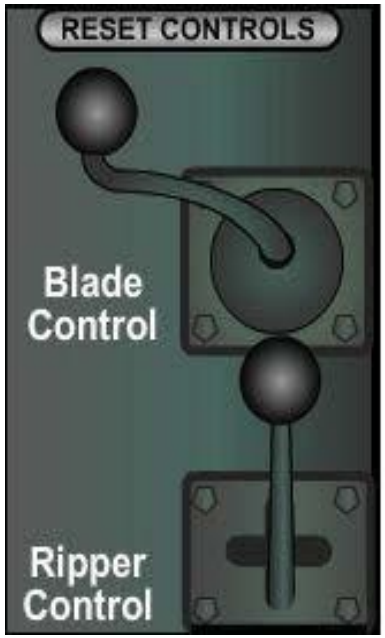
The blade lift and tilt control raises and lowers the blade as well as tilt the blade left or right. It can be moved forward, back or, and side to side. Its vertical positions are as follows: slightly and completely forward, center, and back. Its horizontal positions are left, center, and right.

- 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.

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, centre, 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.



Move the levers on the left to control the movement of the Blade and Ripper on the Dozer

BULL DOZER ATTACHMENTS:

A bulldozer's primarily function, simply put, is clearing ground. However, these machines also come with a wide variety of attachments enabling them to perform a wide variety of tasks. The most common attachment is a blade.

Bulldozer blades push away the objects cleared from the land, including dirt, rock, and sand. The blade is not only the most common attachment, it is also the most important, and getting the right kind of blade for the job is a key component of project's success. Blades are designed to work with different types of ground cover, and Operator need to understand the characteristics of both the land clearing and the blades in order to choose the right one for the job.

The most common blades are the straight, U, SU, and angle. Using the blade specifically designed for conditions leads to higher productivity, less wear and tear on equipment, fuel savings, and optimum results.

Straight or "S" Blade

Sometimes called an S blade, the bulldozer arms attach to the lower back corners of a straight blade, ensuring no angle (hence the name "straight"). Angle braces help stabilize the blade, and these may include a hydraulic tilt cylinder for purposes of adjustment. Operators use the tilt feature to concentrate cutting force and allow the bulldozer to perform operations such as crowning and ditching.
The bulldozer's ability to machinery materials is limited with the S blade, though skilled operators often use a push trough to enhance carrying capabilities.
Where the S blade excels is in working with medium to hard compact materials. This is a rugged blade with substantial weight. Coupled with its straight design, it is ideal for penetrating harder landscapes. Common applications includes Backfilling, Ditching, Shaping, Stripping and Stumping.
Experienced, skilled operators get the most out of straight blade bulldozers.

U Blade

A **U blade** has what it sounds like: a U shape. These blades are popular choices for loading and carrying material, since the U shape more securely holds materials, minimizing spillage. If Learner need to move soil across longer distances, the U blade is the one Learner want.
The U blade also mounts to the bulldozer at the lower back corners of the attachment, with similar stabilizing braces and hydraulic tilt cylinders. These cylinders improve ground penetration, though the blade is still best for soft to medium soils. When working with more compact surfaces, such as soft rock and hardpan, using a ripper attachment helps improve penetration. Common uses include:

- Crowning
- Ditching
- Materials handling
- Moving soil

SU Blade

The **semi-U blade,** commonly referred to as an SU, lives in the world between the straight and U blades. It also attaches to the bulldozer from the lower back portion of the blade, with stabilizing angle braces using either one or two hydraulic tilt cylinders. As with the S blade, these cylinders allow the blade greater penetration force and increase its versatility.

SU blades differ from S blades mainly in the curving sides at either end of the blade, which help reduce spillage. The result is improved load and machinery capabilities for a broader range of applications, though SU blades have reduced penetration ability. For many jobs, however, the gains in materials handling efficiency make up for that loss of penetration. Common applications include:

- Backfilling
- Crowning
- Ditching
- Leveling
- Stripping
- Stumping

Use these blades on soft to medium hard soils. If Learner need to use an SU blade on hardpan (glacially compacted landscapes), Learner want to first loosen the ground with a ripper.

Angle Blade

Unlike the S, U, and SU blades, the angle blade mounts via a center-mounted C frame. This mounting allows the operator to angle the blade to the left and right for enhanced side casting. Older models used manual-screw tilt adjusters but newer units come with the same hydraulic tilts found on S, U, and SU bulldozer blades. Ideal applications for angle blades include:

- Ditching
- Shaping
- Stripping
- Stumping
- Trail pioneering

Use the angle blade on soft to medium hard landscapes. As with the straight blade, the angle blade's design leads to greater spillage. Experienced operators account for this by creating troughs that allow for more efficient materials pushing.

Comprehensive Manual for BULLDOZER JOB:

- http://www.sweethaven02.com/constPDFs/434les02.pdf

- https://www.midwaysales.com.au/assets/yct-356-operation-manual-v2013.02.21.pdf
- http://vanguardequip.com/images/032-08OP-007C.pdf
- http://www.tkgroup.su/pdf/65/rukovodstvo-po-ekspluatacii-na-gusenichnyj-buldozer-liebherr-libherr-pr-764-litronic-operating-manual.pdf
- https://www.youtube.com/watch?v=ky9aMo-RaQo
- https://www.youtube.com/watch?v=rQhWds9Uc0Y
- https://www.youtube.com/watch?v=QrWLqmzmxko
- https://www.youtube.com/watch?v=hyrq0TvhLws
- https://www.youtube.com/watch?v=r9k96Vfo2AI

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
LU2. Strip and stockpile surface materials	• Distinguish waste layer from structural layer • Remove waste layer • Move full blade load with optimum	• Describe types of soils and their characteristics • Describe attachments to be used for different types of soil	

	capacity • Clean up windrows and any remaining waste material • Stockpile waste materials.	• Describe techniques for clearing and scrubbing • Describe methods for spreading / stock pile of materials	

Soil types

Soil is a natural resource that can be categorised into different soil types, each with distinct characteristics that provide growing benefits and limitations.

Soil can be categorised into sand, clay, silt, peat, chalk and loam types of soil based on the dominating size of the particles within a soil.

Here is a break down of the common traits for each soil type:

Sandy soil – are light, warm, dry and tend to be acidic and low in nutrients. Sandy soils are often known as light soils due to their high proportion of sand and little clay (clay weighs more than sand). These soils have quick water drainage and are easy to work with. They are quicker to warm up in spring than clay soils but tend to dry out in summer and suffer from low nutrients that are washed away by rain. The addition of organic matter can help give plants an additional boost of nutrients by improving the nutrient and water holding capacity of the soil.

..

Clay soil – are heavy soils that benefit from high nutrients. Clay soils remain wet and cold in winter and dry out in summer. These soils are made of over 25 percent clay, and because of the spaces found between clay particles, clay soils hold a high amount of water. Because these soils drain slowly and take longer to warm up in summer, combined with drying out and cracking in summer, they can often test gardeners.

..

Silt soil – are light and moisture retentive soils with a high fertility rating. As silt soils compromise of medium sized particles they are well drained and hold moisture well. As the particles are fine, they can be easily compacted and are prone to washing away with rain. By adding organic matter, the silt particles can be bound into more stable clumps.

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Peat soil – are high in organic matter and retain a large amount of moisture. This type of soil is very rarely found in a garden and often imported into a garden to provide an optimum soil base for planting.

..

Chalk soil – can be either light or heavy but always highly alkaline due to the calcium carbonate or lime within its structure. As these soils are alkaline they will not support the growth of ericaceous plants that require acidic soils to grow. If a chalky soil shows signs of visible white lumps then they can't be acidified and gardeners should be resigned to only choose plants that prefer an alkaline soil.

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Loam soil – are a mixture of sand, silt and clay that are combined to avoid the negative effects of each type. These soils are fertile, easy to work with and provide good drainage. Depending on their predominant composition they can be either sandy or clay loam. As the soils are a perfect balance of soil particles, they are considered to be a gardeners best friend, but still benefit from topping up with additional organic matter.

Excavation and Trenching: Understanding Ground Types

During the planning process, and during the excavation process, the trained and competent person will be tasked with classifying soil and rock deposits as:

Stable Rock, Type A Soil, Type B Soil, Type C Soil.

Types of Rock and Soil Classifications

Stable Rock

"Stable rock" means natural solid mineral matter that can be excavated with vertical sides and remain intact while exposed.

Type A Soil

"Type A" means cohesive soils with an unconfined, compressive strength of 1.5 ton per square foot (tsf) (144 kPa) or greater. Examples of cohesive soils are:

- Clay,
- Silty clay
- Sandy clay
- Clay loam and
- In some cases, silty clay loam and sandy clay loam.

Cemented soils such as caliche and hardpan are also considered Type A.

Exceptions

No soil is Type A if it is fissured or has been previously disturbed. Examples

- The soil is fissured
- The soil is subject to vibration from heavy traffic, pile driving, or similar effects

- The soil has been previously disturbed
- The soil is part of a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical (4H:1V) or greater
- The material is subject to other factors that would require it to be classified as a less stable material.

Type B Soil

Type B Soil can be defined as any of the following:

- Cohesive soil with an unconfined compressive strength greater than 0.5 tsf (48 kPa) but less than 1.5 tsf (144 kPa); or
- Granular cohesionless soils including:
- Angular gravel (similar to crushed rock)
- Silt
- Silt loam
- Sandy loam
- In some cases, silty clay loam and sandy clay loam.
- Previously disturbed soils except those which would otherwise be classed as Type C soil.

Disturbed Type A Soils

Furthermore, soils listed in the 'exceptions to type A' due to fissure, vibration, or slope are listed in type B:

- Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subject to vibration; or
- Dry rock that is not stable; or
- Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than four horizontal to one vertical (4H:1V), but only if the material would otherwise be classified as Type B.

Type C Soil

"Type C" means:

- Cohesive soil with an unconfined compressive strength of 0.5 tsf (48 kPa) or less; or
- Granular soils including gravel, sand, and loamy sand; or
- Submerged soil or soil from which water is freely seeping; or

- Submerged rock that is not stable, or
- Material in a sloped, layered system where the layers dip into the excavation or a slope of four horizontal to one vertical (4H:1V) or steeper.

Before work each day, or when any trench conditions change, a competent person must test the soil to ensure the soil is safe and that the safety measures are taken (shoring, sloping, etc.).

- **Visual** (is the soil coming out in clumps, is there water, is the soil fissured, etc.)
- **Unconfined compressive strength** means the load per unit area at which a soil will fail in compression. It can be determined by laboratory testing or estimated in the field using a pocket penetrometer, thumb penetration tests, or other methods.
- Plasticity: Rolling a piece of moist soil to a 1/8”
- Thumb penetration: Push thumb into clump of soil
- Pocket Penetrometer: Provides numerical value (like a tire valve) to the unconfined compressive strength of a sample.

Comprehensive Manual for BULLDOZER JOB:

- http://www.sweethaven02.com/constPDFs/434les02.pdf

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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. 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. 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.

Spreading:

Dozers are ideal for spreading fill material brought in by haul units.

Position the blade in a straight position, so the materials is drifted directly under the cutting edge.

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
LU3. Cut and fill material	• Estimate the height of cuts and fills • Apply grade checking instruments • Cut “humps” and create enough loose material to fill blade before pushing to haulage distance • Push material to fill depressions • Match blade load with available power and traction • Perform rough leveling of ground • Eliminate windrows and clean up.	• Define capacities & capabilities of Machine. • Describe method for estimation of cuts and fill • Describe grade checking instruments • Describe techniques how to cut humps and fill depressions • Describe method of rough leveling of ground	

Cutting

Cutting is the process of excavating earth material from a work location to achieve the desired topography.

Filling

Filling is the process of moving the excavated material or additional earth material to a work location to achieve the desired topography.

Estimation of Cuts and Fills:

Average method:

In this method Levels at each grid point is found out. Difference between the Average of Two Sets of Levels multiplied by Area gives the Result. This is a very simple and straight forward method. But this can be used only when there is cutting or filling. When Leveling of surface includes both cutting and filling, Average method gives wrong result as cutting and filling values nullify each other while averaging.

Block Method (Division of Square Method):

In this method, volume of cutting or filling is found out for each block and added together to get the final volume. This is mathematically simpler then Section Method, but more accurate than Average method. The problem of nullification is also encountered here when in the same block there is both cutting and filling. But here the margin of error is very small when compared to Average method for whole area

Section Method:

In this method Sections are drawn for Each Line of Value. Area of Cutting and Filling is found out for each Section with Trapezoidal Method or Nett Area Calculation Method. Then volume is determined by multiplying Average Area with Distance between Sections. This method is more accurate, but for larger area, finding the area becomes difficult as we need to find intersection of points where lines representing Surfaces meet

Comprehensive Manual for BULLDOZER JOB:

- http://www.sweethaven02.com/constPDFs/434les02.pdf

Rough Leveling of Ground:

- https://www.youtube.com/watch?v=f4fIbS_IM6c
- https://www.youtube.com/watch?v=fmkPabJCe-k

Filling of depressions:

- https://www.youtube.com/watch?v=D9VJwTRU-uU
- https://www.youtube.com/watch?v=Xdt3TZgja5U
- https://www.youtube.com/watch?v=KaRqqbSmRCw

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
LU4. Create slopes	• Interpret stakes/specifications • Apply grade checking instruments • Cut the slope next to each row of stakes • Perform heavy cuts down hill • Match blade load with available power and traction • Apply safe practices regarding stability issues • Grade area to a given slope and eliminate windrows and clean up.	• Describe stakes/specifications • Describe grade checking instruments • Describe methods of making slope in different conditions • Describe safety measures to be kept in consideration while working on slopes • Describe problems faced while making slope	

Comprehensive Manual for BULLDOZER JOB:

- http://www.sweethaven02.com/constPDFs/434les02.pdf

Precautions for working on slopes:

1. There are too many variables to give you a set answer. A lot depends on the condition of the soil you are working on. Working on banks or dams, you have to be careful that the embankment does not shear off from the weight of your machine. Several experienced operators have been killed from banks shearing off. Never work a slope crossways, always work it head on. If your inner voice is saying don't do it, pay attention. Some soils will pack well and some won't, especially sandy soils. This will impact the amount of slope your machine can safely handle. I know this doesn't answer your question, but every job is a different situation and there is no set limit on slopes.
2. If working a dozer on slopes It's best to watch someone with lots of seat time do the work. Proper ROPS and seat belt too. If the ground is frozen it could get real touchy. The condition of the growsers is also a factor.
   I've seen a few go down a slope while the operators were making the initial road backslope cut on a side hill. The operator was very skilled and always ended up going blade first down hill. Another 9 with winch was required to get him back up as going down and around was not an option.
3. max working angle is 100% grade or 45 degrees. As Dozernut has already pointed out, ideal conditions rarely exist in the real world. Soil type, compaction, and ground debris can alter the safe working angle.
4. Injuries from crawler-wheel loader operation are usually serious, often fatal. Practice defensive operation at all times. This means:

    - Understand the equipment and its limitations. Accept competent advice.

- Always keep accident prevention in mind.
- Avoid doubtful or spectacular operations.
- Allow apprentices to operate a crawler-wheel loader only under the immediate supervision of a skilled operator.

5. Do not operate a crawler-wheel loader if any part of the control, hoist, or hydraulic system, including the steering and brakes, is not in safe operating condition. Notify the supervisor or mechanic if a bull dozer is unsafe.

6. Before starting the engine of a direct-drive crawler bull dozer, put the transmission in *neutral*, disengage the master clutch, and keep the blade down. For a power-shift transmission, place the transmission gearshift lever in *neutral* and lock it by placing the safety control in the on position.

7. Keep clear of a crawler-bull dozer that is moving. To stop the operator, signal from a safe distance.

8. When stopped and the engine of a direct-drive crawler-bull dozer is idling, put the transmission in neutral and engage the master clutch so the wheel loader cannot be jarred into gear. When motion is stopped and the engine of a power-shift type bull dozer is idling, apply the foot brake and lock in the safety control lever.

9. On a direct-drive crawler- Bull Dozer, gently engage the master clutch, especially when going up a hill or pulling out of a ditch. On a power-shift crawler Bull dozer, select the proper gear and adjust the speed control lever for additional power.

10. Always study the ground to be traveled and the job to be done. If you cannot see the ground clearly from the driver's seat, dismount and examine it before proceeding, unless a spotter is available for guidance. Avoid setups for upsets.

11. Always be especially careful around overhanging rocks, on rock slides, and near dead trees.

12. Only a trainee or mechanic engaged in actual repair is permitted to ride on the seat with the operator, and then only if the slope is less than 30 percent. Exceptions may be made only during fire emergencies.

13. Handholds to assist the operator when mounting and dismounting should be installed and maintained as necessary.

14. A heavy mesh screen should be installed on the rear of the cab protector between the operator and the rear-mounted towing winch, to protect the operator's back.

15. Know the location of all persons nearby.

16. Use extreme caution while going over obstacles when headed downhill. Be sure the slope is safe. Use caution when steering downgrade on steep slopes.

17. Observe the safe limits of crawler-Bull Dozer operation on side slopes. Small narrow-gauge crawler-bull dozers are more dangerous than wide-gauge equipment.

18. Reduce speed before making any turn or applying the brakes. When the speed of a crawler bull dozer is doubled, the danger of overturning is increased four times.

19. When on steep side slopes, take the following precautions:

    - Do not run over obstacles with the upper track or wheels.
    - Keep off solid rock faces.
    - Have the transmission in gear when the crawler-wheel loader is going down steep grades; use the blade as a brake.
    - Usually, lock the uphill track and immediately turn the machine if the crawler-wheel loader slides sideways.
    - Make turns so that the operator is on the uphill side if possible.

20. Lower the dozer blade whenever the operator dismounts.

21. Do not get under an unblocked, raised blade for any purpose.

22. When dozing downhill or over embankments, it is best to doze several loads to the edge of the hill and push the loads in one pass.

- https://www.youtube.com/watch?v=cH7JXmky5vY
- https://www.youtube.com/watch?v=Xdt3TZgja5U
- https://www.youtube.com/watch?v=mbQZ4eO-x-E
- https://www.youtube.com/watch?v=G_NxSEOrQ7k

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
LU5. Create ditches	• Identify the required profile using grade checking instrument • Create ditch of specified dimensions • Stockpile or blend in material • Level the ground roughly, eliminate windrows and clean up.	• Describe types/shapes of ditches • Describe special attachments to be used for making ditch • Describe problems faced while making ditch • Describe ditches to be made under different environment/conditions • Describe safety measures to be kept in mind while making ditch	Dozer

Comprehensive Manual for BULLDOZER JOB:

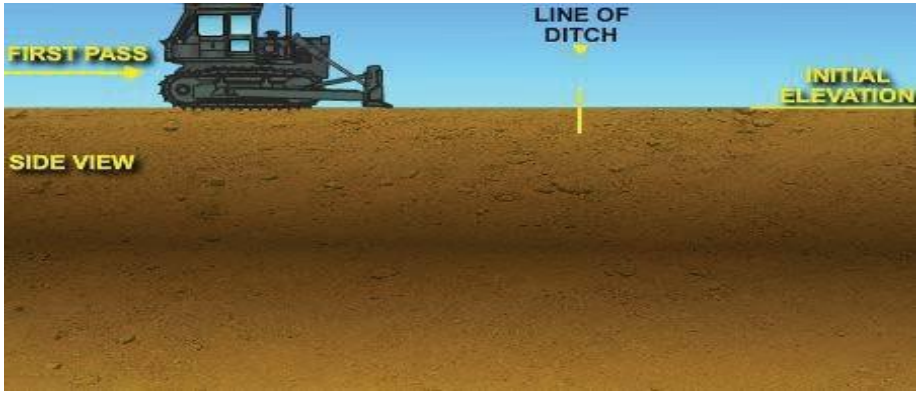
http://www.sweethaven02.com/constPDFs/434les02.pdf
https://www.youtube.com/watch?v=ae-zBczG_jw
https://www.youtube.com/watch?v=MdpammwF1ow

Ditching

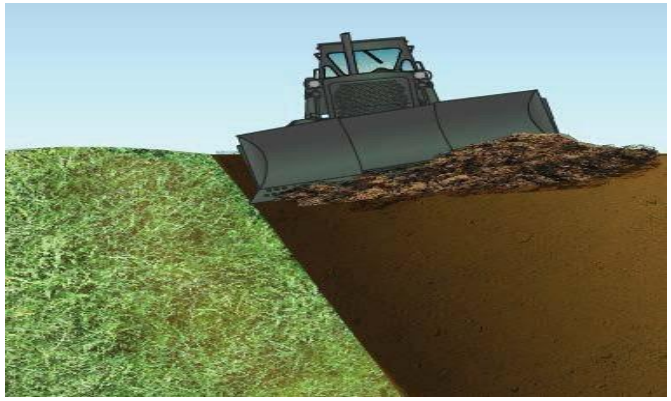
Rough ditching can be done using a dozer by making a series of overlapping passes at right angles to the line of the ditch.

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.

Constructing a V-type ditch.



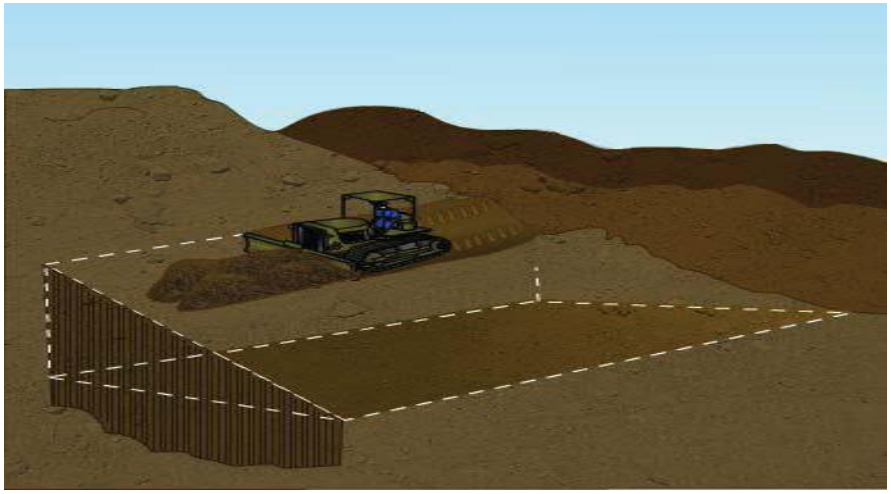
An angled blade is preferable for digging a V-type of ditch for two reasons. You can side cast the windrow in a single pass and the angled blade will side cast the material to the sides of the ditch as you travel along the windrow, as shown below



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.

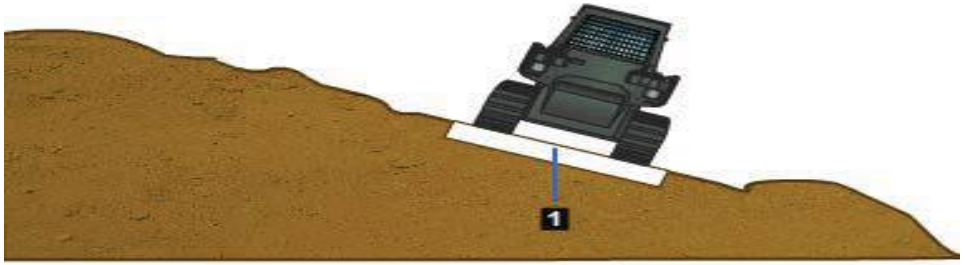
Bench cut.

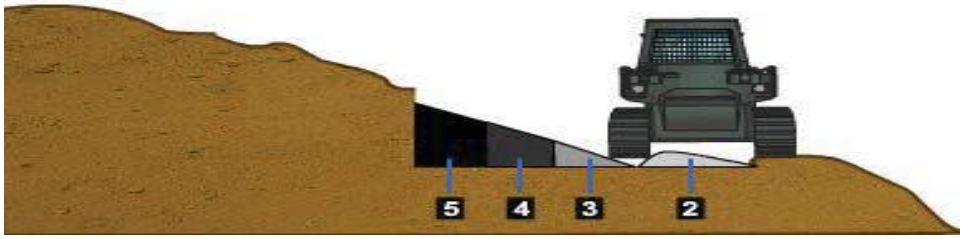


Sidehill excavation.

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 below.





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.

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
LU6. Spread ballast	• Identify dumping location and pattern • Match blade load with available power and traction • Spread material • Grade to requisite level	• Describe types of ballast • Describe methods of spreading of ballast • Describe blade load versus power and traction in different soils conditions • Describe different levels to be maintained during spreading of ballast	

Comprehensive Manual for BULLDOZER JOB:

- http://www.sweethaven02.com/constPDFs/434les02.pdf

Spread Ballast:

- https://www.youtube.com/watch?v=Y6dxbKU_ydM
- https://www.youtube.com/watch?v=bwheD7re65o

Ballast

Ballast is a granular material which is placed and packed below and around the railway sleepers. Different types of ballast materials used are broken stone, sand, gravel, moorum, brickbats etc. The main purpose of ballast is to transmit the load from sleepers to the formation(consolidated track bed) and to provide drainage facilities to the track.

Types of Ballast

1. Broken stone Ballast

Broken stone is a widely used ballast in railways. It is obtained by crushing hard stones like granite, hard trap, quartzite etc. In lieu of broken stones, limestone and sandstone can also be used. It is suitable for high-speed railway tracks. The broken stone selected as ballast should be hard, tough and non-porous. It should stay strong against inclement weather conditions.

2. Sand Ballast

Sand can also be used as a ballast material. It is well suitable under cast iron sleepers and can be seen in desert railway tracks where plenty of sand gets accrued on the track. Coarse sand is best suitable as ballast than fine sand

3. Gravel Ballast

Gravel is a naturally occurring material formed by the erosion of rocks. They are suitable for all types of sleepers and are usually round and smooth and can be obtained from river beds, gravel pits etc.

4. Moorum Ballast

Moorum is formed by the decomposition of laterite. It is available mostly in red color and, sometimes, in yellow. If the track is to be laid on black cotton soil, moorum can be used as a blanketing material or sub-ballast since it prevents permeability of water into the subgrade or formation.

5. Coal Ash or Cinder Ballast

Coal ash also called cinder is the by-product of coal-fired power plants and railway locomotives. It can be used as a ballast material since it is cheaply available and also possesses good drainage properties. It is used as a ballast especially for station yards and as initial ballast for newly constructed tracks.

Spreading of Ballast

Operators attach the rake to the outward portion of the dozer's blade and the system is ready to work. Track rail liners lift a stretch of track so the dozer can quickly run the rake blade beneath it to level the ballast underneath. While the track is lifted, work crews can easily inspect the elevated ties and replace any that are worn as well.

Once the ballast is leveled, the track rail liners lower the track back into place and move forward to repeat the process. The end result is a smooth and level stretch of track.

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
LU7. Rip dense materials	• Rip hard strata • Balance ripper load depth & load to available power and traction	• Describe ripper and its functions • Describe techniques/methods to rip dense materials or hard strata	

Comprehensive Manual for BULLDOZER JOB:

- http://www.sweethaven02.com/constPDFs/434les02.pdf

Ripping of Dense Material:

- https://www.youtube.com/watch?v=b7YkVpM0Rfs
- https://www.youtube.com/watch?v=pxUAfdIyLyE

Ripping:

Ripping is a technique of loosening a soil or rock before the final excavation. Bulldozer also comes with single shank ripper and three shank ripper attachment. Ripper shanks are introduced entirely regular to the longitudinal axis of the bulldozer. Most of the mining-class bulldozers are equipped with single or multiple rippers. On the crawler dozers single – and triple-tooth rippers can be mounted, which are intended to rip soil, rock, cemented gravel, sandstone and tearing of the old asphalt isolating them from the general mass as hunks of different sizes and pieces.

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.

Ripper with a dozer has become a popular method to loosen soil when blasting can be avoided as extremely expensive. In addition, neighborhood experts put increasingly tight confinement on impacting activity excessively close from towns or cities. Inability to do as such causes critical sidelong powers and the heap on the ripper, which diminishes the effectiveness of the machine, as well as prompts its untimely wear.

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
LU8. Clear land	• Work around obstructions and hazards • Clear land in accordance with job specifications.	• Describe types of obstructions and hazards • Describe how to work around obstructions and hazards • Describe precautions to be ensured while working around obstructions and hazards	

Comprehensive Manual for BULLDOZER JOB:

- http://www.sweethaven02.com/constPDFs/434les02.pdf

Clear Land:

- https://www.youtube.com/watch?v=b7YkVpM0Rfs
- https://www.youtube.com/watch?v=5h7RtN20COc

Safe operation of Dozer

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

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
LU9. Push scraper	• Balance engine power to load and traction • Minimize wear & tear impact, track spinning • Assess grade and level. • Remove obstacles and rocks.	• Describe scrapper and techniques to push it • Describe problems faced during pushing of scrapper • Describe selection of engine power rating to the desired load and traction	Bulldozer

Comprehensive Manual for BULLDOZER JOB:

- http://www.sweethaven02.com/constPDFs/434les02.pdf
- https://www.youtube.com/watch?v=b7YkVpM0Rfs

Pushing Dozer

The push dozer 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.

Push Dozer

Question	**6**	Which machine your should use for ripping soil	Xx	A	Bull Dozer
				B	Wheel Loader
				C	Excavator
				D	Grader
Question	**7**	Which of the following is a part of Bull Dozer?		A	Boom
				B	Stick
				C	Bucket
			Xx	D	Blade
Question	**8**	Which of the following machines can be used for rough grading of the surface?		A	Grader
				B	Wheel Loader
				C	Excavator
			Xx	D	Bull Dozer
Question	**9**	Which are the bull dozer functions?		A	Strip and stockpile surface materials
				B	Cut and fill material

	C	Create slopes
Xx	D	All of the above

Question 10 Which is not the function of the bull dozer?

Xx	A	Load Trucks
	B	Push scraper
	C	Clear land
	D	Rip dense materials

HEAVY MACHINE OPERATOR

Module-H

LEARNER GUIDE

National Vocational Certificate Level 3

Version 1 - November, 2019

Module H: Operate wheel Loader

Objective: This module covers the skills and knowledge required to Install Attachments, Operate Controls, Dig, Carry (tram) & Stockpile Materials, Place and Spread materials, Backfill trenches & Excavate and Load Trucks

Duration: 100 Hours **Theory: 20 Hours** **Practice: 80 Hours**

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
LU1. Install Attachments	• Select appropriate tools • Position equipment and attachment for installation • Respond to hand signals • Install attachments safely	• Describe attachments of Wheel loader and purposes. • Describe tools for installation of attachments • Describe procedure for installation of attachments	

WHEEL LOADER ATTACHMENTS

Pin-on Tooth type
is for General Excavating and Loading, of Natural ground and Construction materials

Feature & Benefits of Shape
Prevent bucket upper part damage caused by loaded material, leading backward falling object to sideway to protect link & Lever · Enforced structure without losing visibility · Hole prevent soil from solidifying on the bucket · High Intensity Carbon Steel on lower part · Optimal structure to protect bucket body · Reinforced carbon steel plate applied to bottom · Optimize angle between tooth & Ground surface· Economical (long lifetime of adopter just switch pin worn out)

2 piece type: easy & economical for blade change · Blade pieces are compatible with each other
Spill Guard Ribs - Prevent bucket upper part damage caused by loaded material, leading backward falling object to sideway to protect link & Lever - Enforced structure without losing visibility - Hole prevent soil from solidifying on the bucket.

Blade type: Blade type is for Loading and Stockpiling, of low density materials like Livestock Feed, Fertilizer, Snow, Sawdust.
Mono Tooth type: Mono Tooth type is One piece structure to prevent tooth tip from being separated and falling into crusher which may cause damage to crusher.

Light Material Bucket
Specially designed for efficiency in loading light, loosely packed materials, such as coal, mulch, hay, fertilizer and snow.

Feature & Benefits of Shape
Sloped-bottom design allows for maximum fill capabilities and material retention –
Thick bottoms for wear resistance
Bolt-on edge as standard

V-Shape Rock Bucket
Designed for face or bank loading in mining or quarry applications. The spade-edge rock bucket offers increased penetration in certain applications.

Feature & Benefits of Shape Increase number of ribs to reinforce bucket body · Sole solidifying preventative hole for every ribs · Used High intensity carbon steel · 2 layer high intensity carbon steel on the front-bottom part · Wide V shape structure is optimized for penetration and increase durability · Highly extended structure maximize bucket capacity particularly quarry work · Many holes to guarantee the visibility · Enforced structure to protect bucket body · Welded adapter to provide more durability

Pallet Fork
Commonly used on job sites to move pallets and to perform other material handling duties such as pipes, steel frames, concrete blocks. Operator visibility was tested and optimized to ensure safe, precise and fast control at ground level and up to truck bed height.

Feature & Benefits Heavy Duty Construction: Designed for construction use with tine static load ratings beyond loader lift capacities · Open frame design and offset tines : Provides maximum visibility for picking up and placing materials · Manual Adjustable Tines: Allows forks to be adjusted to required width depending on material to be moved or placed

Wheel Loader Controls and Operation Guide:

- https://www.youtube.com/watch?v=eLYVCQ1_aGY
- https://www.youtube.com/watch?v=a55VzpybLjQ
- https://www.youtube.com/watch?v=WIgmjFtJ__4
- https://www.youtube.com/watch?v=7wnvaEDPTR4

Changing Out Attachments

Using the front-end loader quick-disconnect system makes changing out attachments easy. However, ground safety must be established first. Always have a ground guide to direct the operation. When working with quick-disconnect fittings there is the potential of hydraulic fluid spillage. The ground guide should wear personal protection equipment (PPE) such as gloves to protect hands from sharp edges and skin from coming into contact with the hydraulic fluid. The ground guide should also wear safety goggles to protect the eyes from squirting hydraulic fluid. It is also recommended to have a drip pan and rags ready to prevent the fluid from leaking onto the ground.

When you change out an attachment, it should be unloaded, away from traffic, and on a leveled surface.

The following are the steps to change out attachments:

Step 1. Remove attachment by shutting off the front-end loader and relieving hydraulic pressure.

Step 2. Move the hydraulic controls back and forth.

Step 3. Disconnect the hydraulic lines to clam cylinders and reconnect to locking pin lines.

Step 4. Cap unused lines to prevent dirt from entering them.

Step 5. Release locking pins and remove the attachment by starting the front-end loader and pulling the clam lever to release the locking pins.

Step 6. Use the tilt levers to tilt the backing plate all the way forward.

Step 7. Lower the lift arms until the bracket is clear, and back away from attachment.

Step 8. Pick up the attachment by maneuvering the loader to center on the new attachment.

Step 9. Tilt the backing plate all the way forward and lower the boom until the backing plate clears the attachment bracket, and ease up to the attachment.

Step 10. Use tilt lever to roll the backing plate back and pick up the attachment. Step 11. Push the clam lever to reset the locking pin.

Step 12. Reconnect the attachment by shutting off the front-end loader and releasing the hydraulic pressure.

Step 13. Remove caps or disconnect the clam lines from the locking pins. Step 14. Reconnect the clam lines to the attachment.

Step 15. Start the front-end loader and charge the attachment hydraulic system. Step 16. Test the attachment for proper operation.

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
LU2. Operate Controls	• Operate controls smoothly and safely • Operate different operating controls simultaneously as required • React changing conditions/situations	• Define basic operating functions. • Describe different operating controls and their functions of a wheel loader. • Describe different situations which an operator can encounter under different conditions • Describe smooth and safe handling of controls • Describe adjustment technique of bucket	.

Wheel Loader Basic Operations Guide lines:

- http://constructionsupport.terex.com/_library/technical_assistance/terex_schaeff/operating%20manuals/om_tl/tl160_0101-0198_5780200363_ba_en_2006_10.pdf
- https://www.deltaegyptsem.com/wp-content/uploads/2018/04/pdf_636d_eng.pdf

SAFE WORKING PROCEDURES FOR WHEEL LOADER:

- http://www.marsonhire.com.au/images/uploads/downloads/SWP_Front_End_Loader.pdf

PERFORM SITE PLANNING AND SET UP

Performance Objective Plan and organize loading pattern, using maps, photographs, and established road/pit boundaries, in order to facilitate material extraction and communicate with others to ensure safe loading procedures and minimize ground disturbances. Evaluate and recognize ground conditions by observing changes in terrain and weather conditions, in order to prevent equipment and environmental damage and to protect self and others. Observe road/pit boundaries, according to pre-established prescriptions and legislative requirements in order to prevent entry into protected and non-allocated areas.

Guidelines for Performance Objective:

1. Identify loading pattern: Check with your immediate supervisor to determine any environmental or other potential hazards in the immediate area utilizing maps, photographs and established road/pit boundaries to assist you. (i.e. chicots, hang-ups, terrain, traffic or other equipment, power lines).
2. Identify travel route: Check with your immediate supervisor and/or cross-shift operator regarding hazardous terrain that must be taken into consideration (i.e. Rough terrain, wet areas).

3. Minimize rutting and ground disturbances: Be aware of ground disturbance guidelines for your operation and if unsure check with your immediate supervisor. RUTS CAN POSE UNSAFE CONDITION FOR MACHINE OPERATION
4. Maintain a safe operating distance between neighbouring equipment: Be aware of other equipment working in your work area. Check with your immediate supervisor and co-workers to identify appropriate danger zones for your operation. Follow the danger zone communication rules for your operation.
5. Communicate with others: Communicate with others to ensure safe loading procedures utilizing radio, hand signals or other means.
6. Working on hills: When possible, working on inclines should be conducted in direction of slope to reduce potential of roll over. Working should be conducted straight up and down steep hills. Avoid travelling over high stumps, rocks and windfalls. Discuss ground condition concerns with your immediate supervisor or the previous shift co-worker at beginning of each shift.
7. Seasonal concerns (winter, summer) requires extra caution to be exercised due to poor visibility and hidden hazards. Be aware of these hidden hazards due to seasonal conditions (i.e. culverts hidden, hidden areas of concerns such as recently planted areas, hidden rock outcrops/cliffs) . WHEEL LOADER LOADER OPERATOR 12
8. Operate equipment within identified boundaries: Check with your immediate supervisor in relation to boundary identification rules. (i.e. colour of ribbon used to identify concerns and boundaries). Observe established rules and if unsure confirm with your immediate supervisor.
Component Checklist: ‰ Identify loading pattern ‰ Identify travel route ‰ Minimize rutting and ground disturbance ‰ Maintain a safe operating distance between neighbouring equipment ‰ Communicate with others ‰ Operate equipment within identified road/pit boundaries ‰ Working on hills should be conducted in direction of slope to reduce potential of roll over ‰ Seasonal concerns (winter, summer) require extra caution due to poor visibility, hidden hazards and slippery surfaces

TRAVEL WITH WHEEL LOADER LOADER

Performance Objective Travel with wheel loader loader by selecting appropriate speed, placing attachments in the travel position according to manufacturer's specifications, in order to protect self and others and to prevent equipment damage.
Guidelines for Performance Objective:
1. Place bucket in the travel position: The bucket should be maintained in a position not to impede visibility. Ensure that the bucket is elevated to an appropriate height when in the travel position.
2. Select a speed appropriate to ground conditions while maintaining control of the machine. Maintain a speed and engine RPM that allows the operator to maintain full control of the machine at all times taking into consideration ground conditions, weather.
3. Maintain control, travel at a safe speed and keep right while travelling on roadways or on route to landing to ensure public safety. Be aware of local traffic and observe traffic and warning signs posted within your work area. Keep speed appropriate to road conditions, weather, volume of traffic, seasonal conditions (dust). Be aware of soft shoulders
4. Maintain communication with other equipment operators: Check to ensure your radio is in good working order and proper channel is used. Monitor the local channel for traffic (if applicable). Check with your immediate supervisor for communication protocol within your work area
5. Activate warning devices: Engage all warning lights
6. Passing Protocol Park machine with attachment on the ground and throttle at idle with parking brake engaged and/or transmission/hydraulic interlock engaged when allowing traffic to pass when roading.
Component Checklist: ‰ Place bucket in travel position ‰ Select a speed appropriate to ground conditions while maintaining control of the machine ‰ Maintain control, travel at a safe speed and keep right while traveling on the roadway or on route to and from the work site while maintaining radio communication to ensure public safety ‰ Maintain communication with other equipment operators/personnel ‰ Activate warning devices (use of slow moving vehicle sign)

OBSERVE MACHINE LIMITATIONS

Performance Objective Observe machine limitations according to manufacturer's specifications by identifying equipment load chart, recognizing conditions that affect machine capabilities such as steep terrain and lifting capacity, in order to protect self and others and prevent equipment damage.

Guidelines for Performance Objective:

1. Apply the manufacturer's standards for machine capacity and limitations in determining the size of load keeping in mind ground conditions and slope
2. Maintaining the load position as close to the machine and as low to the ground as appropriate given terrain and ground conditions. This will avoid damage to the machine or prevent possible roll over.
3. While turning with load be aware of obstacles that may cause roll over. Also when turning, be aware of load height, other personnel and nearby machines.

Component Checklist: ‰ Understand the load limitations of the machine according to ground conditions. Maintain ground contact with four wheels at all times ‰ Keep load as close to the machine and as low to the ground as possible, while observing obstructions, when placing the load in the travel position ‰ While turning with load be aware of obstacles and bucket height, which may cause machine, roll over

OBSERVE DANGER ZONE

Performance Objective Observe danger zone by keeping a safe distance between self, others and equipment, taking into consideration limited visibility and blind spots, according to legislative requirements and manufacturer's specifications and established procedures, in order to protect self and others and prevent damage to equipment.

Guidelines for Performance Objective: 1. Review danger zone requirements and identify site-specific hazards. Know the danger zone as it applies to other equipment and operating equipment near other workers. Consult operator's manual for recommended danger zone for this equipment**.**

Component Checklist: ‰ Review dangers zones requirements and identify site-specific hazards

FRONT-END LOADER SAFETY TIPS

• Never walk or work under a raised loader.

• Raise and lower loader arms slowly and steadily. • Allow for the extra length of the loader when making turns. • Take extra precaution when handling loose loads. • Never move or swing a load while people are in the work area. • Stay away from the outer edge when working along high banks and slopes. • Watch for overhead wires and obstacles when you raise the loader. • Travel with the load low to the ground and watch for obstructions on the ground. • Operate the loader from the operator's seat only. • Do not lift or carry anyone on the loader, bucket or attachments. • Lower the loader when parking or servicing. • Assure all parked loaders are on a firm, level surface and all safety devices are engaged. • Visually check for hydraulic leaks and broken, missing or malfunctioning parts, then make necessary repairs. • Under pressure, escaping hydraulic oil can have sufficient force to penetrate the skin, causing serious personal injury. Injuries resulting from oil penetrating the skin are very difficult to treat. Use a piece of cardboard or paper to check for pinhole leaks.

• Before disconnecting hydraulic lines, relieve all hydraulic pressure. • Be certain anyone operating the loader is aware of safe operating practices and potential hazards. • Extending the tines of a loader may look like a good way to solve the loading problem, but when this is done, the wheel loader's center of gravity is moved forward. Extra stress is placed on the loader, the hydraulic system and wheel loader wheel loader.

• All loaders should have roll-over protective structures (ROPS). ROPS can either be a protective enclosed cab or a roll bar with a canopy.

• Loader operators should wear the seat belt at all times, regardless of the task that is being done

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
LU3. Dig, Carry (tram) & Stockpile Materials	• Fill bucket in loose material • Carry loose material to a short distance • Place material in a stockpile • Maintain smooth pit floor/running surface	• Describe types of materials • Describe technique to dig, carry and stockpile materials • Describe balancing of back load with bucket load under different conditions • Describe techniques of safe carrying and dumping of materials • Describe economical use of machine (with respect to haul distance) • Describe capacities & capabilities of machine.	

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.

Practical simulations to perform "Dig, Carry and Stockpile" using Wheel Loader:

https://www.google.com/search?biw=1280&bih=913&q=front+end+loader+operating+techniques&sa=X&ved=2ahUKEwifzfqMxZXjAhVKA2MBHe-rAfEQ1QIoA3oECAoQBA#kpvalbx=1
https://www.youtube.com/watch?v=i8m3euwQIa0
https://www.youtube.com/watch?v=rrm3n2v3xIk
https://www.youtube.com/watch?v=eXdHTS6yfI4
https://www.youtube.com/watch?v=ohI1Kej1gfQ

Standard Stockpile

Standard stockpiles, like the one shown , are constructed by performing basic bucket loading and dumping techniques.

The steps to construct a standard stockpile are as follows:

Step 1. Move the front-end loader forward until the front tires contact the bank.

Step 2. Move the lift control lever to raise the bucket all the way.

Step 3. Move the tilt control lever to slowly tilt the bucket to the dump position.

Step 4. Pull the tilt control lever to tilt the bucket back to the standard bucket position.

Step 5. Back the front-end loader from the stockpile and lower the bucket to about 10-14 inches off the ground.

Step 6. Back the front-end loader to the start of the work area.

Step 7. Repeat the above steps until all the material is stockpiled.

Ramp Stockpile

Ramp stockpiles, like the one shown , are constructed to be with a narrow ramp. This type of stockpile is best for storing large amount of material in a relatively small area.

Bin Stockpile

Bin stockpiles, like the one shown , are constructed within a three-sided enclosure. This enclosure, or bin, usually has a hard floor and walls made of concrete or wood. This type of stockpile is best for keeping various types of material separated.

Backfilling

The front-end loader can also be used to backfill trenches, as shown below. To perform this task, the bucket should be just as wide, or wider, than the loader's wheels or tracks. Narrow buckets can cause the loader to ride up onto the stockpile. This will cause a raise of one corner of the bucket and later require more passes.

Backfilling a trench

Before backfilling a trench, check the bucket cutting edges for wear. Someone should also direct the operation so that you do come too close to the edge of the trench.

The steps to backfill a trench are as follows (Please note this technique will not work when pushing a large stockpile. For large stockpiles, work from the edges.):

Step 1. Align the front-end loader with the stockpile (either to the left or the right) while approaching at a 45-degree angle so that one-third of the bucket will contact the stockpile.

Step 2. Adjust the bucket by moving the lift control lever to lower the bucket to just off of the natural ground. If using a multi-purpose bucket, move the bucket control lever to open the bucket to the clam position.

Step 3. Move the front-end loader forward and gradually move the material. Keep the loader in as high a gear as possible without causing the tires to spin excessively.

Step 4. Move the lift control lever to lower or raise the bucket to cut and spread the material the length of the trench.

Step 5. Move the lift control lever to raise the bucket 10 to 14 inches off the ground before reversing direction.

Step 6. Reverse the front-end loader and return to the stockpile.

Step 7. Repeat the above steps until the operation is complete.

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
LU4. Place and Spread materials	• Load bucket quickly and fully in loose material • Carry loose material to a short distance • Spread material • Maintain smooth pit floor/running surface	• Describe load carrying capacity of the bucket • Describe procedure of loading the bucket efficiently • Describe safety precautions while carrying materials to a short distance	

Practical simulations to perform "Loading Bucket safely" using Wheel Loader:
https://www.youtube.com/watch?v=OCaX_8M7muM
https://www.youtube.com/watch?v=cLPsiUFWrfw
https://www.youtube.com/watch?v=RMsP4GvwWjw

Wheel Loader Safety Rules

A front-end loader is a versatile and valuable tool on any wheel loader. However, improper operation of the wheel loader-loader combination can be hazardous. The center of gravity rises as the loader is raised and the stability of the wheel loader is affected. If not used according to the guidelines stated in the operator's manual, this can result in a potential tipping hazard for the wheel loader.

Remember to always refer to the operator's and safety manuals for advice on proper use of your equipment. Adopt and follow the motto "low and slow" when it comes to loader use.

Before Using Loader

- Install only loaders designed and approved by the wheel loader manufacturer.
- Never use a loader for removing fence-posts, towing or as a demolition tool.
- Check for underground utilities before digging below ground level.
- Use ballast or wheel weights to correctly balance the wheel loader and loader.
- Move wheels to the widest practical setting for more stability.
- Be familiar with operator's manuals for both the wheel loader and loader.
- Use loaders only for the jobs they're built to handle.
- Use a ROPS and wear a seatbelt.

While Using Loaders

- Don't exceed recommended load limits. Load the bucket evenly to prevent upsets, and make sure contents fit in bucket.
- Carry loads at a low height and slow speed, and never move or swing a load over people in the work area.
- Operate loaders only from the driver's seat, and never walk or work under a raised loader unless it is securely blocked or held in position.
- When working on inclines with a load, drive forward when going uphill. Back downhill with loads.
- After completing loader work, remove the bucket before using the wheel loader for other jobs, such as tillage operations.

After Using Loaders

- Lower loaders to ground when parked.
- Shut off engine and relieve hydraulic pressure when performing maintenance.
- Check to see that loaders are balanced and stable when detached, and park on a hard, level surface.

The wheel loader loader is a valuable piece of equipment in construction industry, thanks to its versatility. The wheel loader loader (view more) is used at construction sites for loading, unloading and transporting different kinds of materials and items, from one place to another. The very first wheel loader loader was designed and invented by Abram Dietrich Thiessen in the distant 1940. Today, there are many different models offered by well-known loader manufacturers, and every model comes with different specifications and configurations. The wheel loader loaders can be extremely dangerous machines if not operated the right way. Before you enter the cabin of your wheel loader loader, there are few safety tips you should always keep in mind.

- the wheel loader loaders should only be used for their designed functions. Never use them to ride children in the loader bucket or to knock down trees or to haul a stuck truck or other vehicle.
- The bucket of a wheel loader loader should always be positioned low when the machine is traveling loaded, or when traveling uphill. By keeping a low center of gravity, the chances of rolling over are minimal. If you need to raise the bucket, make sure to check twice for clearance.
- Make sure the tires of a wheel loader loader are safely blocked when the loader is not in function. Periodical inspection and regular maintenance is a must. With proper and regular maintenance, the risks of accidents, injuries or even death can be minimized.
- Wheel loader loaders should be driven very slowly and an operator must be extra cautious when making turns with a loaded machine. This is very important to know when the wheel loader loader carries loads prone to sliding or shifting. Add some extra weight on the rear end of your wheel loader loader to counter-balance the weight of the loader.
- Never exceed the suggested limit of the loads and load the wheel loader loader evenly to prevent upsets. Make sure that load can be carried in the bucket without any problems.
- When the primary job of loading and unloading is completed, remove the bucket carefully before using the wheel loader loader for other applications.
- Always drive the wheel loader loader on clear ground surfaces. Avoid driving the loader on rocks, holes, loose fills or other kind of obstacles since you may lose control over the loader.
- Do not attempt to operate the controls from behind, and operate your loader only from the cabin, from where you have full control and great visibility.

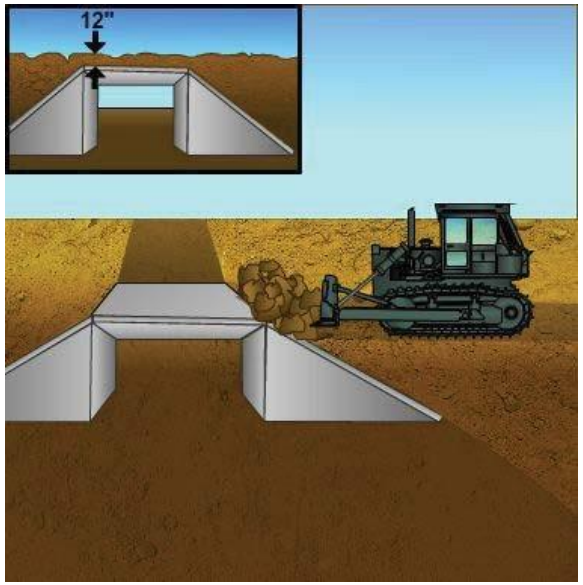
- And the last safety tip when working with a wheel loader loader, is to take extra precautions by following the instruction manual provided by the loader manufacturer.
- Use a front–end loader only for its specific purpose. Never use it for such things as removing fence posts, towing or to knock something down. Never allow people to ride in the bucket. Never walk or work under a raised loader. Raise and lower the loader arms slowly and steadily. Never move or swing a load with people in the work area. If the wheel loader is to be used in tillage operations, remove the bucket first.
- Load the bucket evenly, and avoid overloading to prevent upsets. Do not exceed the load limits listed in the operator's manual. Keep the bucket low while carrying loads and operating on hills. A hole or sudden bump can easily upset the wheel loader if the bucket is carried and the rougher the terrain, the greater the danger of an upset.
- Unsecured loads such as large, round bales carried without a bale fork or grapple can roll back and crush the operator. With loaded buckets, drive forward when going uphill. Back downhill with loads. Allow extra room to turn and maneuver because of the extension of the bucket.
- Travel slowly with front–end loaders filled. Carry the load low, to maintain stability and visibility. However, make sure the load is high enough to avoid contact with the pavement. Be careful when turning with loads, especially those that may shift or slide. Add extra weight on the rear of the wheel loader to counter-balance the weight of the load of the wheel loader loader. Check the operator's manual for specific recommendations.
- Keep the wheel loader wheels spread as widely as possible. Avoid using loaders on tricycle-type wheel loaders, because the chances of a sideways upset will increase.
- When operating a front–end loader, watch the road or field. Avoid holes, rocks, loose fill or any other obstacle that could upset the wheel loader. Watch for overhead wire and obstacles when the loader is raised. If working inside buildings, watch for low ceiling beams and doorways to prevent being pinned or crushed between them and the wheel loader. Also, be sure there is enough ventilation so carbon monoxide from the wheel loader engine will not build up.
- Be very careful when back filling. The weight of the fill material plus the weight of the wheel loader and loader could cause the new construction of collapse. Avoid undercutting high banks. Watch for falling rocks and cave-ins if a high bank must be undercut. Stay away from the outer edge when working along high banks and slopes.
- Keep the bucket low while carrying loads and when operating on hills. A hole or bump can easily upset the wheel loader if the bucket is carried too high. The higher the bucket is carried, the greater the danger of an upset. With loaded buckets, drive forward when going uphill. Back downhill with loads.
- Travel Slowly. Be careful when turning with loads, especially those that may shift or slide.
- Add extra weight on the rear of the wheel loader to counter-balance the weight of the load on the front. Check the operator's manual for specific instructions.
- Keep the wheel loader wheels spread as wide as possible. Avoid using wheel loaders that have a tricycle front suspension. The chances of a side upset are greatly increased.
- Load the bucket evenly and avoid overloading to prevent upsets. The capacity of the loader is specified in the operator's manual.
- Watch where you are going. Avoid holes, rocks, loose fill, or any other obstacles which may cause you to upset the wheel loader. If you are working inside buildings, watch for low ceiling beams or doorways that could cause you to get pinned or crushed between them and the wheel loader. Also, be sure that there is adequate ventilation so carbon monoxide from the wheel loader's engine will not build up.
- Do not try to operate the controls from beside or behind the wheel loader. Operate only from the wheel loader seat so that you will have full control over the entire machine.
- Use the wheel loader only for its specific purpose

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
LU5. Backfill trenches & Excavate	• Place backfill material • Manage piles of imported aggregates to minimize waste • Spread materials at work area • Excavate soft soil strata	• Describe the techniques/methods of back filling • Describe safety precautions while backfilling	.

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. 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.

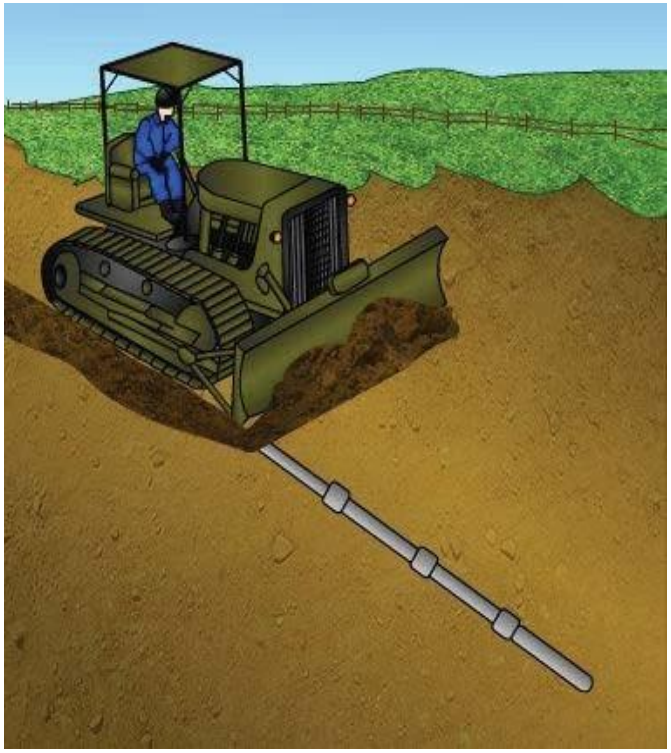


Culvert backfilling.

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

NOTE

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



Practical simulations to perform "Excavation & its Safety Precautions" using Wheel Loader:

https://www.youtube.com/watch?v=xs5V1liLm1Y

Practical simulations to perform "Backfill & its Safety Precautions" using Wheel Loader:

https://www.youtube.com/watch?v=32nvaN21iBA

https://www.youtube.com/watch?v= 5NmcKbe0g

https://www.youtube.com/watch?v=TL5A4ybJimA

https://www.youtube.com/watch?v=a3t85vHJK4Y

https://www.youtube.com/watch?v=b3wZQo2VjS0

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
LU6. Load Trucks	• Arrange the loading site • Maintain the pit floor, level, smooth and clear of obstructions • Load smoothly and gently • Communicate with signaler • Load truck as per capacity	• Describe different site conditions for loading trucks • Describe methods/techniques of loading trucks • Describe coordination/communication to be done between truck driver and Operator • Describe capacities of different dump trucks	.

WHAT IS A DUMPER TRUCK?

A **dump truck**, known also as a **dumper truck** or **tipper truck**, is used for taking dumps (such as sand, gravel, or demolition waste) for construction.

TYPES OF DUMPER TRUCK:

1. **Standard dump truck -** Standard dump trucks hold 32 metric tons (35 short tons; 31 long tons)

2. **Transfer dump truck -** Transferred trucks are typically holding between 26 and 27 short tons (23.6 and 24.5 t; 23.2 and 24.1 long tons) of aggregate per load.

3. **Truck and pup-** A *truck and pup* is very similar to a transfer dump. It consists of a standard dump truck pulling a dump trailer. The pup trailer, unlike the transfer, has its own hydraulic ram and is capable of self-unloading.

Super dump truck-Super dump truck carries 26 tons(23.6 t; 23.2 long tons)

TECHNIQUE/METHODS OF LOADING DUMPER TRUCKS BY WHEEL LOADER:

A wheel loader is one of the most mobile heavy machines on any construction project. It can be employed all over a site, doing all kinds of tasks, and working in reverse nearly half the time. We need to pay attention to the importance of knowing site details such as where people are entering and exiting the work area, where haul trucks are running, and where the other trades are working.

There are Two key factors determine how fast a properly sized wheel loader can load trucks—the trucks'

1. position relative to loading face, and
2. how well the operator fills the bucket with each pass.

Construction sites present some challenges that aren't found on a mine's loading floor, but most obstacles can be overcome. Barely perceptible losses in loader efficiency can be quite costly.

Suppose, for example, a 3-cubic-yard loader is loading a mixture of rock and dirt from a loose stockpile into 9-cubic-yard trucks. On a decent loading surface, a good operator can fill a bucket, dump it into a truck and get back to the face in 30 seconds. Assuming there are 50 minutes of work in every hour, you'd expect to move 133 truckloads in a morning. But suppose the trucks aren't spotted properly and the operator isn't employing the loader's full power to fill the bucket quickly, and cycle time increases by 20 percent—adding just six seconds to each pass. You move 111 truckloads in four hours. That's 22 fewer trucks, leaving nearly 200 cubic yards of material on the pile.

It's not hard to fill a bucket to 100 percent of its rated capacity in these conditions. But if the operator can only manage 85 percent bucket fill, it'll take three and a half passes to fill the trucks. Choose to send the trucks after three passes with just 7.65 cubic yards on board and you'll move 1,017 cubic yards in four hours (about 180 yards less than optimal production). Or overload the trucks by more than a cubic yard with four bucket loads and move 1,020 yards in four hours.

"You have to start by matching the loader to the trucks," says Toby Welch, senior demonstrator/instructor at Caterpillar's Tinaja Hills training center. "Two to three passes of the loader to fill the truck is optimal." Once you have the right equipment, the best opportunity to safely improve productivity comes in planning.

Fill a bucket and hoist it over the spot where you want the dump body. The trucker should drive underneath the bucket.

Put the trucks as close as possible to the spot where the loader is working, at a 30- to 45-degree angle to the loading face. The loader should be able to approach the loading face squarely, back away from the loading face, change direction, and drive forward to the dump box, arriving with less than a 5-degree angle in its articulation joint. Caterpillar recommends that the loader's wheels should turn only about 1.5 revolutions on each side of this tight V-shaped pattern.

"You want to work from one side to the other, usually left to right across the face," says Dains. "Open a space up in the face against one end and then back the second truck, and all those following, into the hole you've created. It places them closer to the work.

"Truck placement can be a little more difficult on construction sites," says Dains, "where there might be piles of material around here and there and they're loading different kinds of trucks, like tri-axles and tractor-trailers, or rear dumps and belly dumps."

Tractor-trailer combinations can be harder to back into position. It can be better to pull trailers through close to the face, between it and the loader. They can turn sharply away from the face to create the shallow angle with the dump bed.

"You may not have radio communication with hauling contractors," says Dains. "So if you don't have a CB in the loader, you have to rely on hand signals and horns.

"If you need to, stop for a couple minutes and talk to truck drivers to get things set up at the face. You'll be surprised at how quickly you'll make up that time with the right planning."

Quickly moving the truck close to the face is critical.

"You only need enough travel time to raise the bucket to dump, and then get it back down on the floor before you reach the pile," according to a videotape called "Tips from the Pros: Wheel Loader" from VISTA Training.

Set the throttle at high idle to get a loader's best hydraulic performance.

"The power train, hydraulics and cooling system are at their most efficient at high idle," says Dains. "Decelerate with the neutralizer pedal or impeller clutch when necessary.

"You need to run in first gear," he adds. "Machines are designed so that the hydraulic speeds are matched for loading when you're operating in first."

Fill the bucket starting flat on the loading floor.

"A lot of guys will fill the first bucket from a couple of feet off the floor," says Dains. "But the lower third of the loader's lifting range is where the machine is most efficient."

It's a problem that can be minimized by the return-to-dig setting.

"Set the lower hoist kick out so that when you're coming out of the truck and back to the loading face, you push the boom lever forward to a detent and it lowers the bucket to a preset height," says Welch. "If you set it 6 to 8 inches off the ground, it only takes a slight movement just before you go into the pile to get the bucket down on the floor."

If you're loading sized material from a stockpile, Welch warns against dropping the bucket to the ground too soon. You don't want to contaminate the stone with material off the loading floor.

Return-to-dig takes the guesswork out of leveling the bucket to penetrate the face. Go into the pile with the bucket flat or parallel to the floor. As your forward progress begins to slow, just before the tires begin to spin, boom up to transfer weight to the front tires. Keep hoisting until the bucket is full, and then tip the bucket back to retain the load.

Curling the bucket before booming up puts pressure on the heel of the bucket, which accelerates wear on that area and actually unloads the front tires. Traction suffers.

"The key is to keep that bucket moving through the face—to keep filling the bucket," says Dains.

In tough digging, such as a bank or consolidated stockpile, judicious use of bucket breakout force can help keep the bucket moving and fill it more completely.

"Once the machine can't handle the hoist (hydraulics begin to stall), you need to curl just a bit, and continue to hoist," says Dains. "First penetrate the pile and hoist as much as you can, then curl a bit, then hoist again, then curl a bit, then hoist again. If the bucket stops moving, you need to either curl or hoist until it's full."

Sometime during the process, continuing to crowd the pile with the transmission serves only to rob hydraulic power. Stop pushing before the tires spin using the transmission disconnect, sometimes known as a neutralizer pedal or impellor clutch. With the neutralizer turned on, stepping on the left brake pedal disengages the transmission. You can slow the machine and still maintain engine speed for peak hydraulic performance.

"The bucket should be loaded by the time the loader arms are halfway through their range of travel, or about parallel to ground," says Dains.

Never back a wheel loader without looking behind you first. Setting the boom-height kick out to hoist the bucket just high enough to make the dump automates the boom function so you can concentrate on backing and maneuvering the machine safely.

Operators need to know how many buckets it takes to fill each kind of truck being loaded and where to place those buckets.

"Center the load right to left and distribute it evenly from front to rear, especially on highway trucks," says Dains. "The DOT really watches axle splits. You want to carry maximum capacity, but you don't want to get nailed for being overloaded on one axle."

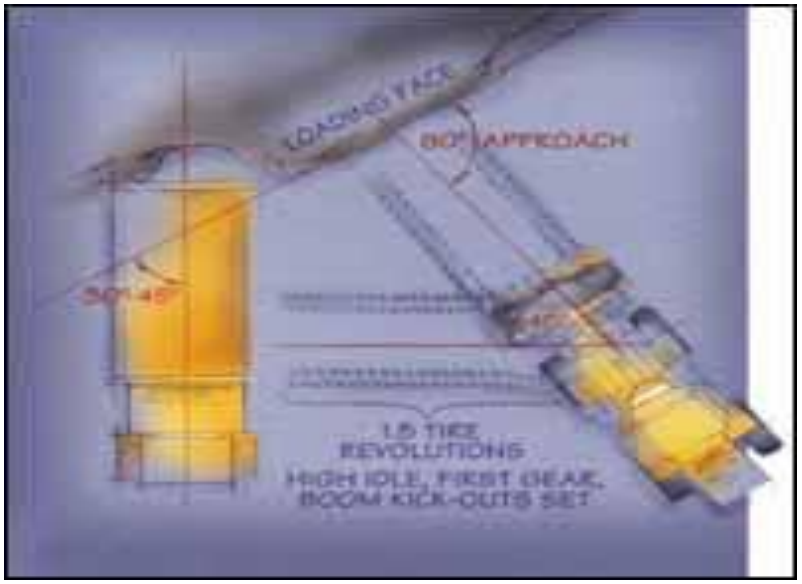
Choose travel routes for load-and-carry operations carefully, and prepare them to prevent spillage. Protect curbs or apron edges with a ramp of gravel or clean soil. Use ride control, if the loader's equipped, and carry the load as low as possible in transit.

When setting pipe, always follow OSHA sling and lifting guidelines. A boom attachment in place of the bucket will help keep the machine back from the trench wall.

"If you don't have a lift chart, you must do test lifts to make sure the machine can safely handle the load on the hook," says Dains.

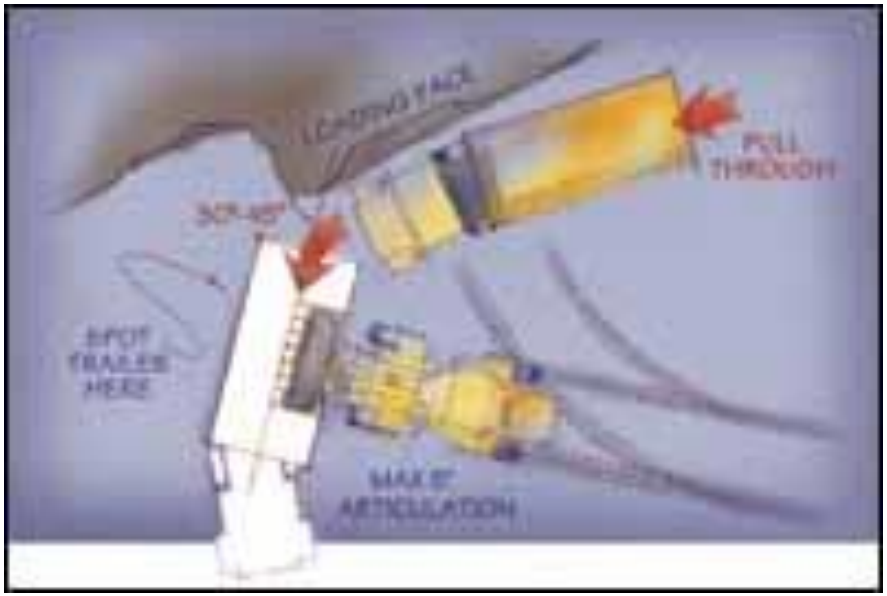
When backfilling, stay back from the edge of the trench as far as possible. Keep the bucket on the ground, using it like a dozer to push spoil into the trench. To extend the machine's reach, you can even use one pile to push another pile into the trench. Just keep the bucket full and move the material in front of the bucket.

Equipment dealers, manufacturers, and third parties like VISTA and operators' unions will likely know of more ways to refine the safety and productivity of a loader operator who already knows the basics. The closer you can come to recreating textbook conditions in the real world, the more profitably your loaders will work.



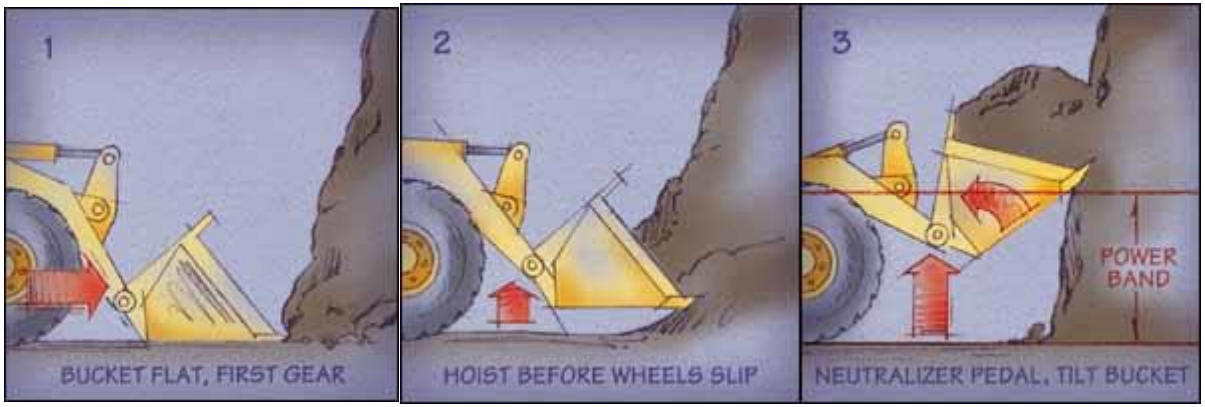
No Wasted Moves

Spot trucks close to the material—in the pocket you dug filling the last truck, if possible—at an angle that gives the loader a tight V pattern. Tires should roll about 1½ revolutions in each direction. You want only enough travel time to raise the bucket over the truck's sideboards and drop it back to the loading floor. Use boom-height kick out and return-to-dig functions to position the bucket automatically. Speed cycle times by setting the throttle at high idle, the transmission in first gear, and using the neutralizer pedal.



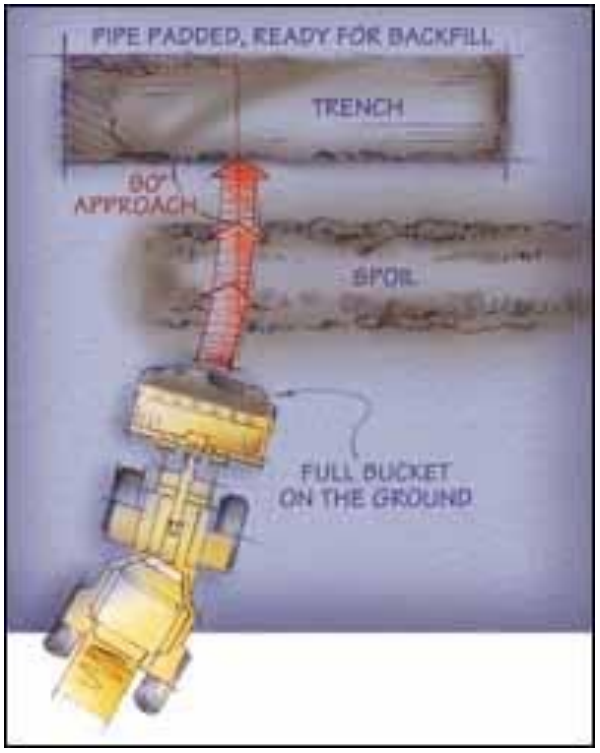
Pull Trailers Through

Tractor-trailer combinations may move faster through a tight loading area by pulling in between the loader and the face. As the loaded truck leaves, fill the bucket and raise it above the spot for the empty truck. The entering trucker should be able to jackknife the trailer into a shallow angle close to the face to save backing time. The loader's V pattern may need to adapt. As always, though, limit the loader articulation angle to 5 degrees when the bucket is raised.



Full Loads in the Power Band

Drive into the pile with the bottom of the bucket flat on the loading floor. Before the tires slip, hoist the boom but leave the bucket flat to transfer weight to the front wheels and improve traction. Continue booming up. Before the boom cylinders stall or wheels slip, step on the neutralizer. Roll the bucket back to finish the pass and retain the load. The loader arms should be about halfway through their travel, or parallel to the ground.



Doze from a Distance

You'll move backfill faster if you leave the bucket on the ground to push spoil. Stay further back from the edge of the trench, reducing the likelihood of a cave-in, by keeping a full bucket and using the dirt in the bucket to doze a second pile into the trench.

All Spoil over the Cut

Pile all the spoil within the boundaries of the trench walls so that it will settle back into the cut, rather than piling next to the filled trench.

Practical simulations to perform "Loading Trucks and its safety precautions" using Wheel Loader:

https://www.youtube.com/watch?v=zV0wda4XhOs
https://www.youtube.com/watch?v=S8qPEKR8KQ4
https://www.youtube.com/watch?v=az5sUo6dbXE

Question	**11**	What is the correct machine to use for dumping materials from one place to other?		A	Grader
			Xx	B	Wheel Loader
				C	Excavator
				D	Bull Dozer
Question	**12**	Is the following statement true or false?		A	TRUE
		Wheel Loader has an articulated blade at the front.	Xx	B	FALSE
Question	**13**	Is the following statement true or false?		A	TRUE
		“Wheel loader have tracks and chains”		B	FALSE
Question	**14**	Which is the best machine to use for loading trucks?		A	Grader
			Xx	B	Wheel Loader
				C	Excavator
				D	Bull Dozer

Question	**15**	Which one of the following is not a function of Wheel Loader?		A	Dig, Carry (tram) & Stockpile Materials
				B	Place and Spread materials
				C	Backfill trenches & Excavate
			Xx	D	Create slopes

HEAVY MACHINE OPERATOR

Module-F

LEARNER GUIDE

National Vocational Certificate Level 3

Version 1 - November, 2019

Module F: Transport Machines

Objective: This module covers the skills and knowledge required to Prepare to load machine and attachments, Load or assist with loading machine and attachments, Assist with securing machine and attachments, Unload or assist with unloading machine and attachments, Prepare rubber-tired machine for road travel and Drive rubber tired machine on public roads.

Duration: 80 Hours **Theory:6 Hours** **Practice: 64 Hours**

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
LU1. Prepare to load machine and attachments	• Assess hazards, such as ground and utility lines • Prepare machines and attachments for transport, such as clean tracks or wheels or disassemble for transport	• Describe type of hazards to be encountered during loading • Describe carrying capacities of transport vehicles • Describe road, weather and deck conditions • Describe preparation of loading sites (ramp) • Describe the methods/equipment of lifting up of attachments on the trailer • Describe maintenance to be ensured before loading the machine	.

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LOADING MACHINES

Loading heavy equipment on and off flatbed trucks and trailers is so common that it's easy not to give it a second's thought. But a recent report on the number of fatalities suffered in performing these tasks should alert workers to give the job at the very least a second thought.

Taking precautionary safety measures

1. Have the flatbed truck or trailer parked on level, stable ground.
2. Make sure the trailer and ramp is wide enough for the mobile equipment being loaded.
3. Make sure the trailer ramp is long enough to avoid steep angles when loading or unloading the equipment.

4. The mobile equipment operator should be experienced in operating the equipment being loaded or unloaded, and should be trained in how to safely load or unload the equipment off trailers.
5. Workers on foot around equipment being loaded and unloaded should be alert to the movement of both the equipment being loaded or unloaded.
6. Have a spotter to provide directions to the operator in positioning the equipment while loading/unloading.
7. The flatbed truck should have brakes set and motor turned off.

Preparing Construction Equipment for Transport:

Preparation is key. When nearly half of all injuries occur during loading and unloading heavy equipment, safety measures need to be taken from the beginning for mitigating liabilities and avoiding construction accidents. Let's review the proper ways to prepare heavy equipment for transport.

1. Perform a Documented Risk Assessment

When it comes to heavy equipment liability, construction companies bear the responsibility of dotting their i's and crossing their t's. Risk assessments are preemptive compliance documents allowing you to prove how detailed and thorough your fleet management processes are.

Consider adding one for your equipment transportation preparation protocol. They can be done by a senior manager or supervisor, containing the full operation and transportation timeline and its weight loads, plus relevant project risks and what's been done to address them.

2. Outfit Sites With PPE

We can't say it enough — safety is the backbone of the industry. Having your crew wear a complete set of personal protective equipment is a safety standard across all construction operations, not just when preparing for safe & legal transport of heavy cargo. It's also something routinely overlooked, with many sites taking shortcuts to chain up a trailer quickly and move on to the next task.

PPE documentation is also a risk-mitigation strategy. You'll round out a stronger risk assessment and permit application when you note all the safety protocols you and your crew adhere to on top of routine tie-down requirements for heavy equipment.

3. Inspect the Hauling Capacities of Your Truck or Trailor

Next in line when preparing for heavy equipment transport is to check the things that'll be doing the actual transporting. A complete inspection of your trailer or truck includes the following:

- **Tires**: Assess the condition of your trailer and truck tires, notably for tire pressure. Multi-ton machines take a toll on tire air pressure and will quickly deflate any that are already weak.

- **Lights**: Front and brake lights should work without a hitch.
- **Brakes**: Similar to tires, your oversized load affects your vehicle's braking abilities. Assure all brake functions and components are in good shape.
- **Tie-Down Points**: Check your load's required point number, their securement condition, and spacing. Most states' standards mandate a minimum of four tie-down points for loads exceeding 10,000 lbs., each with its own binder or boomer and individual chains connected to trailer hitch points. These boomers are responsible for supplying the tension to tighten the actual chain connection and as such should be inspected themselves.
- **Weight**: Confirm your tie-down working load limits add up to equal at least half the weight of your load.

While most states mandate four tie-down points, and most operations concede to that number, some heavy equipment requires even more. Any machine with attachments or appendages must have those attachments dislodged and separately secured, meaning now a minimum of five tie-down points. A typical example of this is when securely transporting excavators.

How to Load Heavy Equipment Safely

A load is only as strong as its weakest link. And those weak links often come not because a basic heavy equipment loading procedure wasn't followed, but because it was — just in a rushed, halfhearted, or passive way.

Loading heavy equipment safely is not just about driving a new dozer up the ramp, looping in a few chains, and sending it on its way. We've got a few more points of consideration to ensure you reliably and legally transport heavy cargo. Refer to these safety measures for secure loading operations.

1. Designate Duties

Before actual loading occurs, the team should have a clear understanding of who's in charge of what. You'll need someone to drive the equipment onto the deck, but you'll also need a spotter to deliver hand signals and direct the driver up the ramp and onto the trailer bed. It's likely they won't have a clear line of site to do so themselves.

What's more, the rest of the crew should be notified if a loading procedure is on the docket. No drifting personnel or other vehicles should interrupt loading operations, which are generally unsafe to stop once they have started.

2. Clean the Ramp and Trailer

Ramps and trailer decks should be as dirt-, oil-, and debris-free as possible, especially if they are metal. This ensures the piece of loading equipment has as much traction as possible to move up its ramp. A clean ramp and trailer bed also means a dry one, clear of ice, snow, and water. If you are still concerned about equipment smoothly moving up ramps, consider employing ramp friction devices during this step.

3. Clear and Level the Loading Area

Pick an uninhabited and even space to set up the ramp and perform heavy equipment loading. Again, this is intuitive, but in the midst of a busy workday or at peak hours in the yard, such measures can fall to the wayside.

You'll also want to ensure the actual ground in the loading area is compact enough to bear the full weight of your loaded trailer. After rain or during seasons with thaw, the combined weight of these two vehicles has the potential to cause sinkage.

4. Begin the Machine/Ramp Line-Up

Slow and steady is the name of the game here. With the driver in the cab and a spotter positioned in plain view, begin driving the heavy equipment up the cleared ramp and onto the transportation vehicle's deck.

Note that during this ramp movement, the machine's center of gravity will shift. This is the most dangerous part of the loading process, with the equipment's weight caught momentarily in a point of limbo. Just keep moving gradually.

Also note that when appropriately positioned at final rest on deck, the majority of the equipment's weight should be distributed toward the front of the trailer. This avoids fishtailing while en route.

5. Start Chaining Down Heavy Equipment

Check state laws on how heavy equipment must be secured during public highway transportation. While the 4-5 tie down points is near-universal, each state has additional oversized cargo restrictions and regulations to respect.

With the heavy equipment safely positioned on deck, you can initiate one of the most critical steps in the loading and unloading procedure — tying it down.

There are three predominant concerns with chaining down:

1. **Tight, Secure Chains:** There should be no wiggle room or movement with your chain. Equipment cannot shift or bounce while en route.
2. **Properly Located Tie-Down Points**: Most manufacturers label the appropriate tie-down points on their machines for you to follow. Be especially careful if these land near a machine's cylinders, hydraulic hoses, or brake components, though. Tying down heavy equipment at appropriate points prevents equipment damage plus ensures the tightest, most compliant links.
3. **Adequately Matched Chain and Hook Binder Grades:** If you look closely, every 4-5 chain links you'll find a number etched into the metal. Cross-reference that number with the one printed on the boomer handle, making sure they're aligned. The sum of the working load limits of all your tie-down components must equal at least 50 percent of the weight of the cargo. Always ensure the grade of the chain and its working load limit doesn't exceed the boomers' listed limit.

Here are a few additional reminders in order to achieve the proper way to chain down an excavator, loader, and more:

- **All chains fastened linearly, with downward force**, with no horizontal twists, bends, or angles
- **No slack**. Wrap excess chain around the rest of the link so it won't come loose.
- **At least four chains in use.** Use two connecting to the trailer's front corners and two connecting to the trailer's back corners. The tension from these opposing forces should keep the equipment in place.
- **Always review chain and hook sizes**. You need to guarantee they're complementary and tight, not mismatched.

How to Transport Heavy Equipment Safely

Vehicle accidents due to heavy trucks and cargo transport are on the rise. This merely reinforces how vital it is to not only follow proper loading and unloading procedures in the yard but also safely haul that equipment while on the road. We've got a few strategies.

1. Map the Most Linear Transport Route Ahead of Time

We've all heard the horror stories and seen the videos of trucks too tall to clear an overpass. A designated transport route planned ahead of time — plus an actual on-the-road run-through — ensures nightmares like this don't strike.

Keep an eye out for road widths and bridges analysis for the safest heavy cargo transportation, especially in rural areas. The least amount of bridges, turns, starts, stops, and difficult terrain encountered by the driver, the better.

2. Apply for a Transportation Permit

This is especially important if your load qualifies as oversized or overwidth, which — let's face it — most heavy construction equipment will. Cranes, excavators, dump trucks, graders, dozers, and scrapers are just a few that carry extra heavy equipment liability. Prepare accordingly, whether that means deconstructed transport strategies that avoid overwidth or overweight designations or applying for the proper state permit from the onset.

3. Immobilize Equipment Wheel Components

It takes a little extra time, but the security is worth it. Apply the equipment's parking brake. Also consider using wedges, chocks, or cradles against equipment wheels, securing them in place and preventing them from rolling on deck. They will also bolster your defenses against the following weight-distribution forces that naturally occur during transport:

- **Forward Force**: 80 percent of vehicle weight gets applied when braking during transport

- **Rearward Force**: 50 percent of vehicle weight gets applied when accelerating, shifting gears, or reversing
- **Upward Force**: Up to 20 percent gets applied when driving uphill or over bumpy terrain
- **Sideways Force**: 50 percent gets applied when turning, lane changing, or braking while turning

This is also a great time to double check any extra machine-specific loading and transportation conditions outlined by a spec sheet or manufacturer's guidelines.

4. Outfit Transport Vehicles With Signs and Flashing Lights

Oversize loads are designated on the road with proper banners, signs, and lights. In the most extreme cases, you may be required to have escort vehicles — one guiding your own transportation truck and the other following behind, alerting others on to the road to the technical operation.

It's also important to note that proper communications between transport and escort vehicles do not mean by cell phone. Two-way or CB radios are the industry standard for safe communication between drivers.

5. Run and Document Complaint Inspections While En Route

The safe and legal transport of heavy cargo doesn't stop once you start the ignition. Heavy load securement requires check-ins and inspections while on the road, especially when traveling long distances.

Industry safety standards recommend the following as inspection benchmarks while heavy cargo is en route:

1. Once during the **first 50 miles** of transport.
2. **Once every 150 miles or once every 3 hours** — whichever comes first for long-distance hauls.
3. At **every change of duty** or change of driver station. Have the new driver run a full inspection themselves, then document that inspection in a transport log.

Equipment Transportation & Load Securement Guide

Equipment Load Securement Guidelines

If you're transporting a piece of equipment or cargo, you get a trailer, load, fasten the equipment or cargo to the trailer and hit the road. Load securement is a blanket term that refers to all aspects of fastening that piece of equipment or cargo to the trailer. While the process of transporting equipment sounds straightforward, there are very specific rules for you to follow to make sure the piece of equipment or cargo arrives safely at its destination — and these rules are enforced.

Load securement rules are enforced by the Department of Transportation (DOT) — more specifically, the Federal Motor Carrier Safety Administration, the federal government agency responsible for regulating and providing safety oversight of all commercial motor vehicles.

Before we get into the specific rules for transporting equipment, it's important to understand a few key DOT definitions:

- **Securement system** — This is a group of individual parts that work together to secure equipment on a trailer. If the cab shield is providing some restraint against forward movement, it may be included. You can choose the combination of parts that work best for you if they are appropriate for the equipment size, shape, strength and characteristics. The most common parts of a securement system are:
  - Floors
  - Walls
  - Decks
  - Tie-down anchor points
  - Headboards
  - Bulkheads
  - Stakes
  - Posts
  - Anchor points
- **Securing device** — These devices are designed specifically to hold your piece of equipment in place on a trailer or vehicle. They may include:
  - Synthetic webbing
  - Chain
  - Wire rope
  - Manila rope
  - Synthetic rope
  - Steel strapping
  - Clamps and latches
  - Blocking
  - Front-end structure
  - Grab hooks
  - Binders
  - Shackles
  - Winches
  - Stake pockets
  - D-rings
  - Pocket
  - Webbing ratchet
  - Bracing
  - Friction mat
- **Tie-down** — A combination of securing devices that forms an assembly that attaches your piece of equipment to, or restrains it, on a vehicle — and is attached to anchor points.
- **Working Load Limit (WLL)** — The maximum load that may be applied to a component of a securement system during normal service. Each component should have a WLL from the manufacturer.

Be aware of the capacity of your trailer.

Once you've established the weight of the equipment you're hauling, the next step is to use it to ensure you have the proper hauling equipment. Make sure your trailer capacity is appropriate for the piece of equipment you're hauling and remember to take into consideration the weight of the trailer itself. It's critical to transport your piece of equipment on a trailer that was designed to hold the weight of your cargo.

Take time to inspect your hauling vehicle, trailer and anchor points.

Once you've established the combined weight of the piece of equipment and the trailer are appropriate for the trailer size, you need to make sure the trailer, hauling vehicle and anchor points are in good shape — that means:

- No obvious damage
- No distress
- No weakened parts or sections

It's also important to make sure the trailer and equipment are free of rocks and other debris. While it may not seem harmful sitting still, rocks that dislodge during travel can end up flying through the air and into someone's vehicle. Checking for rocks and small debris may not seem like a big deal, but it can make a big difference.

Ensure loaded equipment will be contained, immobilized or secured.

In simplest terms, your piece of equipment cannot roll, tip, slide or fall from the vehicle during transportation. According to the DOT, you must secure your cargo in such a way that it will not blow off the vehicle, fall from the vehicle, become dislodged from the vehicle or shift to the extent that it adversely affects the vehicle's stability or maneuverability.

2. Failure to Secure Vehicle Equipment

While our focus has primarily been on the piece of equipment you're transporting — your cargo — but it's equally important to make sure your vehicle's equipment is secure when you're hauling cargo. Think about things like your tailgate, doors, tarpaulins, spare tires and any other equipment that may be part of your vehicle and need to be secured. If you secure the piece of equipment properly, but fail to secure some part of your vehicle, you could still have your vehicle taken out of service and/or cause an accident as a result of a loose part of your vehicle.

3. Leaking, Spilling, Blowing or Falling Cargo

If your equipment falls off the vehicle, or a substance from the equipment spills onto the roadway, you would be cited for this violation. In addition to having the vehicle placed out of service, the damage caused to your equipment, vehicle and people as a result of this violation add up — and that's not even taking into consideration the amount of the fine. By following the rules, you can ensure your securement system will not allow this movement to happen.

4. Insufficient Tie-Downs to Prevent Forward Movement

The DOT tie-down laws are straightforward. If you don't follow them, you'll likely be cited for this insufficient tie-down violation — which has the potential to lead to others if your load isn't secured properly. Forward movement or force is important because it can have an impact on your vehicle's brake system. If you need to make a stop and the piece of equipment isn't tied down properly to reduce forward motion, you'll have additional force in forward motion, which could prevent you from stopping at your regular interval. This inability to stop can cause expensive accidents and damage to your vehicle and cargo, as well as other vehicles. Your vehicle will be labeled out of service, too.

5. Failure to Secure Load

If you fail to secure your load, you're putting yourself, and others on the road, in danger. Shifting cargo can cause accidents that result in injury or death. As with many of these other violations, if you get cited for this violation, your vehicle will be put out of service, and the driver and company will have to pay the fines that come with these violations.

All these violations have one thing in common: They are easy to prevent. As long as you follow the DOT laws related to transporting cargo, you eliminate the risk not only of being cited for one of these violations, but also the risk of accidents and other damage that can occur as a result of cargo not being securely fastened.

You want to make sure you're not missing anything when it comes to your equipment load securement. To avoid these and other violations — or worse, an accident — make sure you understand the DOT rules and have the right equipment.

Practical simulations to perform "HEAVY MACHINERY LOADING/UNLOADING" on trailer:

https://www.youtube.com/watch?v=-CZOSkID5Gs
https://www.youtube.com/watch?v=MabY8TEnjuE
https://www.youtube.com/watch?v=bVuD5E8h5tI

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
LU2. Load or assist with loading machine and attachments	• Avoid hazards, such as uneven ground and utility lines • Load or assist with loading of machines and attachments • Respond to hand signals	• Describe Loading techniques • Describe Tie-down points. • Describe expected hazards • Describe how to avoid hazards while loading • Describe important signals followed while loading	.

Practical simulations to perform "HEAVY MACHINERY LOADING/UNLOADING" on trailer:
https://www.youtube.com/watch?v=Eik1xjFmC7E
https://www.youtube.com/watch?v=Srhgf3YifBM
https://www.youtube.com/watch?v=4J5lCdY45O4
https://heavyhaulers.com/blog/how-to-load-a-wheel-loader/

TOP 4 HAZARDS AND HOW TO AVOID THEM

Potential danger 1: Foot run over

When driving an AWP/MEWP with the upper control box detached, keep a safe distance and use smooth driver or steer movements. Know and watch where the machine is going.
Potential danger 2: Trapped between machines
Do not stand in between machines – it could be fatal! Never assume you know which direction the AWP/MEWP will travel – always check by driving slowly to start. Concentrate on what you are doing and stop if you get distracted.

Potential danger 3: Falling while driving down ramps

Drive the AWP/MEWP slowly and carefully. Use the winch to prevent runaway. Avoid adjusting steering on the ramps. Use a vehicle with a full width ramp. Never drive on or off a ramp at an angle. Always approach the ramp with the AWP/MEWP aligned straight. Watch out for slips and trips.

Potential danger 4: Catapult effect

Loading and unloading of booms also presents significant risk of ejection. Make sure you wear your harness with a short lanyard and fasten on at all times.

TIE DOWN POINTS

Additional regulations apply when transporting front end loaders, bulldozers, tractors, and power shovels that operate on wheels or tracks. The following four-point rule applies only when such equipment weighs more than 10,000 pounds:

- Accessory equipment must be completely lowered and secured to the transport vehicle.
- Equipment on articulated vehicles shall be restrained to prevent any change of position during transit.
- Equipment must be restrained against movement by using at least four tie-downs.
- Two tie-downs each must be affixed as close as possible to the front and as close as possible to the rear of the vehicle being transported, or to specifically designed mounting points on the vehicle.

Equipment heavier than 10,000 pounds must be secured at four independent points, and each point of attachment must have its own binder. A separate, appropriate grade chain connected to each corner meets that requirement. But hooking the chain to the trailer and equipment and driving forward to tighten the chain, then using a binder just on the front, is not allowed.

In the example above, a chain hook is attached to the trailer, run through a single attachment such as a clevis or hitch hole, and hooked on the other side. In this case, there is only one attachment on the equipment; it does not meet the regulations for equipment heavier than 10,000 pounds.

A unit that weighs 10,000 pounds or more requires four adjustable securement devices, one on each corner. This load would also require a fifth to secure the hydraulic blade to the deck. The driver of this rig was pulled over for not having the dozer secured.

HEAVY MACHINERY LOADING SOPs PPT

https://www.slideshare.net/TerryPenney/loading-and-unloading-heavy-equipment-safely

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
LU3. Assist with securing machine and attachments	• Protect equipment from damage, such as cover windshield and exhaust pipe • Secure attachments, such as bucket • Assist transport vehicle driver as required, such as secure machines, attach warning flags and reflectors.	• Describe methods of securing machine, parts and attachments • Describe accessories/ attachments to be used for securing • Describe communication signals between trailer driver and Operator	.

transporting a **compact excavator** from one jobsite to another involves several steps that should not be overlooked when using thorough and consistent hauling techniques. Sound hauling practices, such as using right-sized transport and **towing vehicles**, and correctly loading, positioning and securing equipment will help you minimize loading challenges that can hinder your productivity.

Following three key steps outlined by Jason Archbold, marketing manager for Bobcat Company, and the recommendations in your Operation & Maintenance Manual, you can properly transport your compact excavator to your next jobsite or back to your storage facility.

Select the right transport and towing vehicles

The first step before transporting your compact excavator from one location to the other is to properly match the transport and towing vehicles to the equipment. According to Archbold, it's important to ensure that the transport and towing vehicles are of adequate size and capacity for the weight of the machine and attachments being transported.

"Trailers are one of the most popular and efficient ways to properly transport excavators and attachments," Archbold says. "Some smaller equipment can be transported on a 10,000-pound trailer, while larger equipment may require a 20,000- to 30,000-pound trailer or larger. If transporting an excavator and couple of attachments, you will most likely need a larger trailer with a larger weight rating to handle the load you are moving."

Adequately designed ramps of sufficient strength (wood ramps can break and cause personal injury) are needed to support the machine's weight when loading onto a transport vehicle.

Load the machine properly

Loading excavators onto trailers requires consistency to ensure critical actions are not missed.

Follow the correct loading procedures as outlined by Archbold:

- Block or support the rear of the trailer when loading or unloading a compact excavator to prevent the front end of the trailer from rising.
- Make sure the compact excavator's undercarriage is free of mud, sand and any other debris before loading the machine.
- Always disengage the auto-idle feature (if equipped) when loading or unloading a compact excavator on a trailer.
- Travel up the ramp with the heaviest end up when you are loading the compact excavator onto the trailer. The excavator will be heavier in the front since it is likely connected to an attachment.

Secure the compact excavator

The third step in the transport process is also critical and is best performed in a methodical manner to ensure that each measure is performed. Once the compact excavator is on the trailer, lower the boom, arm, bucket and blade to the trailer floor, stop the engine and engage the parking brake. Upon completion of a machine's positioning, install chains at the front and rear tie-down positions as identified by your Operation & Maintenance Manual. Some manufacturers provide multiple tie-down points, making it easier to trailer the equipment. Finally, secure the chains and binders using recommended practices listed in the manual.

Securing excavators with attachments and accessories is especially important if you are hauling several items to jobsites on one trailer.

"Some companies are able to customize their trailers to accommodate their most commonly used attachments by adding side pockets or racks built to hold them," Archbold says. "Operations that might benefit from a customized trailer include landscaping companies that use buckets to prepare sod or seed."

With efficient planning and loading procedures, your trailers can accommodate a wide variety of attachments helping you avoid using multiple vehicles to move equipment and attachments from jobsite to jobsite. Creative trailer designs and careful planning can add up to significant vehicle and fuel savings in the long run.

Following the fundamentals of transporting compact excavators cannot only save you time because procedures are performed consistently and orderly, but it can save money as trailer customization allows for more efficient hauling. Following these three key steps and instructions along with the recommendations in your manual can help minimize issues or problems the next time you transport your excavator to the jobsite.

How to Load an Excavator

Proper transporting practices such as using the right type of trailer, loading properly, correct positioning and securing property can play a vital role in ensuring there are minimal challenges that could slow your productivity and reduce time wastage during transit. In addition to proper loading and positioning, abiding by proper practices helps in reducing load securement violations issued by the Federal motor carrier safety administration. The following recommendations in addition to following the owner's

Select the Right Transport Trailer

You need to make your choice of the trailer has enough space and capacity to accommodate your excavator and the weight of the attachments you're transporting, it will generally be an **RGN, step deck or flatbed trailer.** Since most excavators are generally an oversize load, you will require a larger transportation device with a higher weight rating to handle your weight correctly. You can find out the weight rating of the trailer on owners equipment manual or the identification plate.

Since load ratings vary in different states, you need to be aware of the state, local and federal laws and regulations concerning weight width length and height of the excavator before making the necessary arrangement to transport your machine on public roadways, highways, bridges, and interstates. Depending on the size of your excavator, there are quite a good number of **trailers used for transportation**. They include RGNs for transport of larger excavators, step deck trailers or **hotshot trailers for transportation** of small excavators or flatbed trailers for **transportation of medium-sized excavators.** Other trailers available for transportation of excavators are double drop decks and extended double drop decks.

Follow the Right Loading Guidelines

The loading guidelines outlined in the owner's manual are important and following them while loading your excavator will help in ensuring you do not miss critical details. Some procedures to consider include:

- Make sure you are aware of how to operate the machine you are loading correctly.
- Pack the trailer you are loading into on a firm, level ground to avoid shifting or tilting during loading
- Select Ramps that are designed to handle the weight of the machine you are loading. Also, if necessary add blocks under the ramps for support.
- Remove any grease, debris or mud that might be in the ramp or on the machine you are loading that could cause the device to slide.
- Turn the engine of the excavator on, reverse it, and with the heaviest side of the excavator travel up the ramps.
- Maintain the slowest speed possible while going up the ramp until you make sure the excavator has settled on the trailer and positioned in a way that its weight is evenly distributed to prevent any pull or tire wear during transportation.

Secure The Equipment Properly: Straps & Chains

Once the excavator is on the transportation trailer, securing it into position is an important part that plays a vital role in determining whether your excavator will arrive at its destination safely and securely. Following the following guidelines will help you to ensure you properly secure the **heavy equipment for transport.**

- Lower all the attachments and the buckets on the floor of the trailer
- Stop the engine and disconnect the battery connection points to off position. Disconnection ensures the engine does not restart during transit.
- Lock all the doors and covers of the excavator before you start transportation.
- If the excavator has articulation points, pivots or hinges, ensure they have articulated frames and lock them before you start transportation to prevent articulation while on transit.
- Place all the wedges, cradles, chocks and other means behind each wheel of the machine to firm them and prevent shifting or rolling during transportation.
- Install tie-downs on the rear and front-tie downs positions. Most manufacturers recommend a minimum of four tie-downs to prevent any movement. always use maximum securements and connection points to maximize effectiveness and minimize damages during transit.
- Before hauling, inspect all the tie-down equipment and tie-down points used to secure the machine.
- Check all the connection pins and hooks and make sure they are all functional
- If you find any fatigued links, stretches or cracks remove the tie-downs and services them.
- Make sure all the tie-downs equipment meets or exceeds the machines weight rating. Additionally, verify the excavator's tire pressure before you start transporting to prevent any tire leaks or improper inflation which can cause loosening of the tie-downs.

Secure The Equipment's Attachments and Accessories Efficiently

Securing the excavator's attachment and accessories are equally important.If possible, secure all the attachment to the machine during transit. If it is not possible, set the accessories on the trailer in an orientation that can allow chains and straps to contain them and prevent any movement during transportation appropriately.

- For smaller excavators, ensure the buckets and other attachments are adequately secured to the trailer.
- Set all the hydraulic attachments and hoses in an orientation such that they do not interfere with the equipment in the trailer.
- Ensure all the hoses lies underneath the equipment and are located in the way of the tie-downs or connect in a way they won't be disengaged because of movement.
- Secure all the attachments correctly and per the owner's manual

Excavators are heavy equipment, and their transportation is not a small deal. It requires proper observation of details especially in loading, positioning and securing the material on the trailer to prevent any movements, shifting or tilting during transit. Proper securing of the machine's attachment and accessories is equally important to ensure there is no interference which can cause damage to the equipment or the transportation machine. Once you are set and have followed all the stipulated guidelines transportation of your excavator should be seamless, and you have nothing to worry about. You can be sure your equipment will reach its destination safely, on time and in its original condition.

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
LU4. Unload or assist with unloading machine and attachments	• Assess and adjust to hazards, such as overhead obstructions, narrow landing areas • Unload or assist with unloading machines and attachments. • Assist transport vehicle driver as required, such as remove tie-down, warning flags and reflectors • Clean equipment.	• Describe unloading techniques • Describe hazards to be encountered during unloading • Describe methods of unloading • Describe special characteristics of the unloading sites	.

How to Safely Unload Heavy Equipment

Safely unloading construction equipment rounds out the compliant transportation process. As with other protocol, there are key steps and risk-mitigation strategies to assure the success of this final step.

1. Clear and Level the Unloading Site

Before the transportation vehicle even arrives, take the time to review and clear the designated unloading area in the receiving yard. Just as you pay attention to this during the loading phase, wet and muddy ramps and uneven unloading ground make this part of the operation much harder than necessary. This doesn't stop at clearing away dirt and debris, either. Alert personnel of cargo schedules so only relevant crew members are in the area when the transport vehicle arrives.

2. Do a Walk Through

Guide the transport vehicle to its exact unloading area. Once the vehicle is parked, have the ramp clean and ready for deployment. Line it up with the rear of the trailer bed as methodically as possible, taking time to match joints and eliminate any gaps between the trailer and the ramp. Once the machinery begins backing up later on, there will be no time to reposition.

With everything in place, conduct a final condition survey. Look over the equipment's tires and hitches to ensure their health. Review roles with personnel, appointing a spotter and an equipment operator just like during the loading process and before you begin breaking down the chain tie points. You'll also want to do a brief survey on the condition of the tie downs themselves before their release. It is highly unsafe to undo straps and chains if the load has shifted, even minutely. If this is the case after performing a walk-through, you and the operators will have to draw up a custom unloading plan.

And remember — try not to rush this review, even if everything seems in place. It never hurt any fleet supervisor's reputation to be methodical.

3. Free the Load

Unlease chains and tie bounds one at a time, beginning with the rear corners. Unravel excess chain that may have been wrapped around the links, then start loosening tie downs with their ratchet-style wrench boomers. Do so carefully, as chains and binders have been wound and should still be tight and pressurized. You don't want a metal chain unexpectedly snapping up because joints and tension weren't adequately reduced with the ratchet boomer.

4. Slowly Back the Heavy Equipment Down the Ramp

Maintain a safe distance between the piece of equipment and its spotter. The equipment operator's visibility may become hindered, so position the spotter in a way where they're accessible but out of harm's way. Keep the rest of personnel away from the unloading site while the heavy machinery is in reverse. All attention should remain on safely ushering it down the ramp.

5. Wrap It Up

Do a final ground inspection of all equipment, the transport vehicle, anchor points, and tools before sending everyone on their way. Document the conclusion of the transport — and pat yourself on the back for successfully completing the safe and legal transport of heavy cargo.

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
LU5. Prepare rubber-tired machine for road travel	• Secure attachments in proper position for road travel. • Complete inspection, such as check brakes, steering, lights, tires and back-up warnings. • Clean equipment.	• Explain limitations on public roads, such as speed, overhead restrictions and blind spots • Explain route and destination	,

DRIVING WHEELED EXCAVATOR ON ROADS

https://www.youtube.com/watch?v=dU0_vUTKSAg

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
LU6. Drive rubber tired machine on public roads	• Comply with legislation, such as traffic laws. • Possess appropriate and valid driver license. • Read maps • Follow route to destination • Adjust to road and weather conditions, such as adjust speed. • Recognize and avoid potential hazards.	• Define applicable legislation, such as traffic laws • Describe reading of road map and following of routes to destination • Describe road conditions and speed limits • Describe travel limitations and hazards	.

DRIVING WHEELED EXCAVATOR ON ROADS

https://www.youtube.com/watch?v=DvKtkVsUFSE
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Question 16 When loading a machine?

A Machine Engine should be on

B Machine should be switched off

C Machines attachments should be lifted

D Machine

Question 17 Why it is important to secure attachments?

A It is the standard safety precaution for loading machines

B It is necessary to avoid damage to attachments.

C Loading vehicle can get damaged.

D Attachments can fall off during the journey

Question 18 What is the standard safety precaution in loading machine?

A Secure the machine with proper slings and tie down

B Use a 22 wheeler trawler

C Use a big crane to lift machines

D Operator should sit inside the cabin

Question 19 What is preparation of loading/ unloading site?

A Prepare strong ramp or platform for loading and un loading

B Clean the windscreen of machine

C Check the headlights of machine

D Check the brakes of machine

Question 20 What is the importance of communicating with the driver of loading vehicle?

A It is very important to perform smooth job completion

B Without proper communication hazards can happen

C To maintain friendly relation

D To encourage driver

FREQUENTLY ASKED QUESTIONS (FAQs)

1. What is Competency Based Training (CBT) and how is it different from currently offered trainings in institutes?	Competency-based training (CBT) is an approach to vocational education and training that places emphasis on what a person can do in the workplace as a result of completing a program of training. Compared to conventional programs, the competency based training is not primarily content based; it rather focuses on the competence requirement of the envisaged job role. The whole qualification refers to certain industry standard criterion and is modularized in nature rather than being course oriented.
2. What is the passing criterion for CBT certificate?	You shall be required to be declared “Competent” in the summative assessment to attain the certificate.
3. What are the entry requirements for this course?	The entry requirement for this course is 8th Grade or equivalent.
4. How can I progress in my educational career after attaining this certificate?	You shall be eligible to take admission in the National Vocational Certificate Level-3 in Leather Products Development Technician (Pattern Maker). You shall be able to progress further to National Vocational Certificate Level-4 in Heavy Construction Machinery Operator Course; and take admission in a level-5, DAE or equivalent course (if applicable). In certain case, you may be required to attain an equivalence certificate from The Inter Board Committee of Chairmen (IBCC).
5. If I have the experience and skills mentioned in the competency standards, do I still need to attend the course to attain this certificate?	You can opt to take part in the Recognition of Prior Learning (RPL) program by contacting the relevant training institute and getting assessed by providing the required evidences.
6. What is the entry requirement for Recognition of Prior Learning program (RPL)?	There is no general entry requirement. The institute shall assess you, identify your competence gaps and offer you courses to cover the gaps; after which you can take up the final assessment.
7. Is there any age restriction for entry in this course or Recognition of Prior Learning program (RPL)?	There are no age restrictions to enter this course or take up the Recognition of Prior Learning program
8. What is the duration of this course?	The duration of the course work is 1,510 hrs. (11 months)

9. What are the class timings?	The classes are normally offered 25 days a month from 08:00am to 01:30pm. These may vary according to the practices of certain institutes.
10. What is equivalence of this certificate with other qualifications?	As per the national vocational qualifications framework, the level-4 certificate is equivalent to Matriculation. The equivalence certificate can be obtained from The Inter Board Committee of Chairmen (IBCC).
11. What is the importance of this certificate in National and International job market?	This certificate is based on the nationally standardized and notified competency standards by National Vocational and Technical Training Commission (NAVTTC). These standards are also recognized worldwide as all the standards are coded using international methodology and are accessible to the employers worldwide through NAVTTC website.
12. Which jobs can I get after attaining this certificate? Are there job for this certificate in public sector as well?	You shall be able to take up jobs in the local or overseas construction companies in heavy machinery operator job profile.
13. What are possible career progressions in industry after attaining this certificate?	You shall be able to progress up to the level of supervisor after attaining sufficient experience, knowledge and skills during the job. Attaining additional relevant qualifications may aid your career advancement to even higher levels.
14. Is this certificate recognized by any competent authority in Pakistan?	This certificate is based on the nationally standardized and notified competency standards by National Vocational and Technical Training Commission (NAVTTC). The official certificates shall be awarded by the relevant certificate awarding body.
15. Is on-the-job training mandatory for this certificate? If yes, what is the duration of on-the-job training?	On-the-job training is not a requirement for final / summative assessment of this certificate. However, taking up on-the-job training after or during the course work may add your chances to get a job afterwards.
16. How much salary can I get on job after attaining this certificate?	The minimum wages announced by the Government of Pakistan in 2019 are PKR 17,500. This may vary in subsequent years and different regions of the country. Progressive employers may pay more than the mentioned amount. The heavy Machinery Operator normally earns 20,000 to 25,000 in the start.
17. Are there any alternative certificates which I can take up?	There are some short courses offered by some training institutes on this subject. Some institutes may still be offering conventional certificate courses in the field.
18. What is the teaching language of this course?	The leaching language of this course is Urdu and English.

19. Is it possible to switch to other certificate programs during the course?	There are some short courses offered by some training institutes on this subject. Some institutes may still be offering conventional certificate courses in the field.
20. What is the examination / assessment system in this program?	Competency based assessments are organized by training institutes during the course which serve the purpose of assessing the progress and preparedness of each student. Final / summative assessments are organized by the relevant qualification awarding bodies at the end of the certificate program. You shall be required to be declared “Competent” in the summative assessment to attain the certificate.
21. Does this certificate enable me to work as freelancer?	You can start your small business by purchasing your own heavy construction machine and can start earning 50,000 per month. You may need additional skills on entrepreneurship to support your initiative.

ANSWER Sheet:

Question # 01 = B

Question # 02 = B

Question # 03 = B&C

Question # 04 = D

Question # 05 = C

Question # 06 = A

Question # 07 = D

Question # 08 = B

Question # 09 = D

Question # 10 = A

Question # 11 = B

Question # 12 = B

Question # 13 = B

Question # 14 = B

Question # 15 = D

Question # 16 = B

Question # 17 = A

Question # 18 = A

Question # 19 = A

Question # 20 = B

National Vocational and Technical Training Commission (NAVTTC)

Plot 38, Kirthar Road, Sector H-9/4, Islamabad, Pakistan
+92 51 9044 322
+92 51 9044 322
info@navttc.org
www.navttc.org