# ROAD CIVIL WORK

## Level II

## NTQF

# Learning guide 41

**Unit of Competence: Conduct and Support Pit Run Material Production Operation**

**Module Title: Conducting and Supporting Pit Run Material Production Operation**

**LG Code: CON RCW2 M11 LO1-41**

**TTLM Code: CON RCW2 TTLM 1019 v1**

## LO 1: **Plan and prepare**

| Instruction Sheet | Learning Guide 41 |
|---|---|

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics –

- Occupational Health & Safety requirements
- Types and sources of Information
- Signage requirements
- Plant, tools and equipment selection
- Materials identification, handling and locating
- Employment conditions, responsibilities and obligations
- Environmental protection requirements

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to –

- Obtain, confirm and apply Types and sources of Information to the allotted task.
- Obtain Occupational Health & Safety requirements from the site safety plan and organizational policies and procedures, confirmed and applied to the allotted task.
- Identify Signage requirements and obtain from the project traffic management plan.
- Select Plant, tools and equipment to carry out tasks are checked for serviceability and any faults are rectified and reported.
- Identify Materials appropriate to the work application safely handled and located ready for use.
- Communicate Civil construction employment conditions, responsibilities obligations
- Identify Environmental protection requirements from the project environmental management plan or appropriate regulatory specification

**Learning Instructions:**

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below
3. Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
4. Accomplish the “Self-checks”. in each information sheets.
5. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
6. If you earned a satisfactory evaluation proceed to “Operation sheets and LAP Tests if any”. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity.
7. After You accomplish Operation sheets and LAP Tests, ensure you have a formative assessment and get a satisfactory result;
8. Then proceed to the next information sheet

## Introduction to module

- **Introduction to Conducting and Supporting Pit Run Material Production Operation**

**Borrow pit**

A borrow pit is a term used in construction for a hole, pit or excavation that has been dug for the purposes of removing gravel, clay and sand used in a construction project such as when building an overpass or embankment.

**Deeper definition**

Almost all construction projects involve earthwork designed to ensure there's a suitable base for whatever is being built. A key aspect is to ensure that ground conditions are sound for stable construction.

While this process involves grading and excavation, frequently it's necessary to bring materials from another site that have to provide fill material with the right ground conditions.

These materials are mined from what are known as borrow pits. Abandoned borrow pits often are seen adjacent to highways where material was removed to build embankments and overpasses.

Many states and counties have regulations regarding borrow pits, and owners require permits to operate. Usually, there are strict requirements to be followed, including the rehabilitation of the site. Despite this, borrow pits are not popular with local residents who feel that they scar the countryside and promote erosion.

A borrow pit may be enclosed or open. Closed borrow pits are holes dug into the ground, and the coarse material produced often is used for gravel.

These borrow pits frequently fill with water. Open borrow pits are shallow excavations and are generally used to mine sand and clay. These are more susceptible to erosion.

Do you need a home equity loan or line of credit to improve your property? But which is better for me. This calculator will help you find out

| Information Sheet-1 | Occupational Health & Safety requirements |
|---|---|

## 1.1 Health and safety of workers requirements

The health and safety aspects of the workers are largely governed by the Health and Safety rules and regulation in Compliance with the requirements for the accommodation of traffic, which is not only intended for the wellbeing of the public but also to protect the workers involved on the road.

The following minimum practical requirements are, however, drawn to the contractor's attention:

The issue of protective clothing, boots, gloves, overall clothes, etc. to the workers is essential.

Use of diesoline by workers to clean hand arms and tools, when working with bitumen, must be discouraged – the use of paraffin is preferable.

A properly equipped first aid kit must be available at all times.

Transportation of workers on open trucks/trailers must be controlled e.g. all passengers must be seated with no legs hanging over the side of the truck/trailer.

## 1.2 Personal Safety equipment's:

- **Objectives**:-After completing the learning element the trainee will be able to wear safety working clothes, shoes and etc. in the working place.

| Safety equipment | Uses | Images |
|---|---|---|
| Head protection (hard hat) | Hard hat is used to protect head of the worker from any falling objects dropping from high level during construction. |  |
| Over all cloths | Protects the normal clothes from dust, grease and other spilling materials. |  |
| Safety shoe (boot) | Protects the worker form nail, sharp objects and heavy falling objects by hard-rolled leather shoes with metal toe caps |  |

| | | |
|---|---|---|
| Rubber boot | Protects the workers feet from colds, chemical, and mud in the working area. |  |
| Mask | Protects eyes of the worker from other endangering object and dust during construction. |  |
| Goggle | Protects eyes of the workers during welding of metal works and when placing reinforcement in the form work. |  |
| Glove | Protects the workers from oils, chemicals, and dust and other dangerous material that affect the skin. |  |
| Hand Guard | Protect hands of the worker while chiseling and hammering. It is available in different standard sizes of the chisel handle and designed for slipping over chisel handles |  |
| Safety Belt | Secures laborers working in a plane where the construction is done at high level. |  |
| Hearing protection | The noise levels in some areas on construction sites are often above the level which causes sensory hearing loss to workers in the vicinity. |  |

- ✓ **Note**: -Keep the working clothes in safe place so that you can change it easily. A locker should be used so that you can store your personal material safely while you are performing your works.
- ✓ **Body protection**: -Skin is extremely vulnerable to all types of hazards in works like painting, welding, sewer works, demolition works, etc. leading to different types of skin diseases. Full sleeved shirts and trousers provide good protection against many of the hazards. In case of ionizing radiation use of shielding layers inside the cloths is necessary.

| Self-Check 1 | Written Test |
|---|---|

**Directions:** Choose & write the letter of correct answer on the space provided under the blanket (8 pts)

1. ._____ is used to protect head of the worker from any falling objects dropping from high level during construction.(3 points)

   A, Rubber boot C. Goggle

   B, hard hat D. Glove

2. _____ Is Protects eyes of the worker from other endangering object and dust during construction s.(5 points)

   A, Mask C. Goggle

   B, spade D. Glove

***Note:*** **Satisfactory rating – 4 & above points Unsatisfactory - below 4 points**

You can ask you teacher for the copy of the correct answers.

**Answer Sheet**

Score = _____

Rating: _____

Name: _____ Date: _____

**Answer the Questions**

| Information Sheet 2 | Types and sources of Information |
|---|---|

## 2.1 Types, Sources of Information borrow pit material production

In general, the contractor will be expected to carry out the construction works in such a way as to minimize the need for the use of borrow materials, including careful attention to re-use of excavated material as sub-base/base where technically feasible. Contractors shall “Observe a minimum allowable offset of borrow pits from the road (set back out of sight of the road) and minimum longitudinal spacing in relation to the allowable free-haul in the standard

The contractor is also required to prepare a borrow pit management plan which takes account of these activities and follows them through to handing over. These plans need to take account of the potential environmental & social impact and health & safety hazard; including drowning hazards, water-borne disease vectors, impact on local land holdings, land-use and visual impacts.

The borrow pit management plan will include restoration measures for the site after decommissioning, such as removal and stockpiling of topsoil layers. If monitoring determines that natural regeneration is insufficient on restored sites, the contractor should use direct seeding of native leguminous species, such as some of the leguminous creepers that exist or a perennial shrub species.

Where borrow pits are to be left open, for their use in regular maintenance programs, the responsibility for their management should be assigned to the government entity / local authority in charge of road maintenance and compliance with the borrow pit management plan monitored.

## 2.2 Borrow pit management plan

| Stage | | Measures | Responsibility |
|---|---|---|---|
| Standards definition | Generic of definition materials required for the road rehabilitation | - Identify the most environmentally sound source of materials that is within budget<br>- Use material from local road cuts first, but only if it produces a fairly suitable, durable aggregate for either embankment fill or surface stabilization material. Local borrow material can be very cost-effective. Upon removal of material, the area should be | Consultancy (supervisors) |

| | | | |
|---|---|---|---|
| | | restored and receive erosion control measures<br>- Identify indicative quantities of material required from the borrow pits | |
| | Define the needs; in terms of borrow pits, for effective road rehabilitation with minimal environmental impact | - Minimize the number of borrow pits by increasing free haul distance in BOQ<br>- Cost estimates of the borrow-pit management plan included in the BOQ<br>- Estimate the number of borrow pits to be opened<br>- Define the standard maximum size to be excavated for each borrow pit<br>- Define the standard buffer area around the borrow pits (proximity<br>- to dwellings, water course, and presence of natural vegetation)<br>- Review the preliminary site assessment, undertaken by the contractor (below) | Consultancy (supervisors) |
| Site selection | Complete a preliminary site assessment prior to undertaking Excavation | - Outreach to the community leadership (e.g. operation, hazards, restoration)<br>- Written approval from community leadership for use of the proposed site<br>- GOSS clearance for land use<br>- Discuss with local community the option of retaining quarry pits as water collection ponds for watering cattle, irrigating crops or similar uses. Highlight issues of disease transmission and the need to prohibit its use for drinking, bathing, and clothes washing | Contractor |
| Excavation Operation | Excavation will take into account the following measures | - When sitting borrow pit areas, avoid using sensitive areas or sites that drain directly into a sensitive area<br>- Borrow pits will not be located in wetland or densely vegetated areas | Contractor |
| | Site access and safety | - Test pits/excavations to confirm the quantity and quality of material in the proposed site<br>- Determine presence of any groundwater | Contractor |

| | | | |
|---|---|---|---|
| | | - Map of the location and a plan of the site, including buffer zone, perimeter beam, stockpiles, operational area<br>- Borrow pit design must comply with standards defined (above), unless specifically approved by UNOPS<br>- Photographic record of the site in its undisturbed state | |
| | Protection of Vegetation | - Ensure that excavation is accompanied by well-engineer<br>- Topsoil is stripped and stockpiled away from other materials and is to be used only for reinstatement, once pit operations are complete<br>- Overburden soil (layer between topsoil and material of interest) to be used as a perimeter beam to direct drainage or stockpiled separately to backfill the pit<br>- Pit excavations maximum 6 meters in depth, with a vertical slope of 2:1<br>- Excavation below the water table is not permitted<br>- Heavy machinery access and operation | Contractor |
| | Water pond | - Barrier (e.g. warning tape, perimeter beams, fencing) to control or discourage public access to the pit<br>- Fence all sites with standing water deeper than 0.75 meters , to prevent public access<br>- Install signposts warning of danger and no trespassing, at no more than 50 meters' distance from the pit<br>- Community awareness and outreach on the dangers of borrow pits and that trespassing is prohibited. | Contractor |
| | Erosion | - Erosion control measures undertaken in all aspects of the borrow-pit operation, including: reduced slopes, seeding, etc | Contractor |

| | | | |
|---|---|---|---|
| | | - Protect topsoil stockpiles from wind and water erosion by reducing slopes, using a cover, and/or spraying with water | |
| | Dust and noise | - If a rock crusher is used, dust control measures shall be put in place (water truck or sprinklers on crushing equipment)<br>- Vegetation within the buffer area will screen noise of pit operations | Contractor |
| Reinstatement | Reinstatement will be completed prior to handover of the completed road section | - Fill excavated site with overburden stockpiles and perimeter beams, and graded to the desired slope and drainage path<br>- Spread topsoil on top of the overburden | Contractor |
| | | - Develop/construct suitable surface slopes, drainage ditches and conduits to prevent water from collecting at the sites<br>- Scarify the borrow pit operational site to encourage vegetation cover<br>- Establish a vegetation cover corresponding to at least 75% of the cover present prior to excavation (supporting photographs) and<br>- maintain following the first rains after reinstatement<br>- Minimize erosion by focusing vegetation cover on side slopes of the excavated area<br>- Any required seeding will make use of local plant varieties | Contractor |
| Review | Ensure the Borrow pit management plan implementation | - Review borrow pit management / monitoring reports<br>- Review reinstated borrow pit areas prior to handover of completed road sections<br>- Engage local community authorities to take responsibility for long term borrow pits in their areas<br>- Ensure that the responsibility for management of borrow pits left open is assigned to the government entity / local authority<br>- Verify conformance with Borrow Pit Management Plan | Consultancy (supervisors) |

Table 2.1 Borrow pit management plan

| Self-Check 2 | Written Test |
|---|---|

***Instructions**:* **Directions:** write the letter of correct answer on the space provided under the blanket (10 pts)

1. _____Is A written approval for use of the proposed site shall be obtained from the local authorities?
    A. Site property lines and location
    B. Geotechnical site investigation
    C. Land tenure and approval for use
    D. Shrinkage
2 _____Is Borehole drilling and/or excavation of test pits shall be carried out to confirm the extent and quality of the materials within the proposed site?
    A. Site property lines and location
    B. Geotechnical site investigation
    C. Land tenure and approval for use
    D. Shrinkage
3 Borrow pits should be preferably located in the areas with minimal volume of vegetation or existing/decommissioned pits can be used
    A. True
    B. False

***Note:*** **Satisfactory rating – 5 & above points Unsatisfactory - below 5 points**

You can ask you teacher for the copy of the correct answers.

**Answer Sheet**

Score = _____

Rating: _____

Name: _____ Date: _____

| Information Sheet 3 | Plant, tools and equipment selection |
|---|---|

### 3.1 Type and function of plant, tools and equipment

The surveying and setting out requirements for labor-based road construction vary with the type of work to be executed. The construction of new roads requires a complete by the survey Engineer to establish the alignment. The engineer provides the contractor with the relevant reference points and levels.

- **Borrow pit material production tools and equipment**

| Tools and equipment | Definition | Picture |
|---|---|---|
| Sieve and Pan | The sieves are fitted with wire screen with uniform, specified openings. |  |
| Balance | Balance is a device to measure weight or mass. These are also known as mass scales, weight scales, mass balance, weight balance, or simply scale, balance, or balance scale. |  |
| Splitter | Splitter is a static and fractional sub-sampling device that can be used for dividing a lot of dry particulate material into two half-lots. |  |
| Oven | Oven is a thermally insulated chamber used for the heating, baking, or drying of a substance, and most commonly used for cooking. |  |
| Sample bag | A bag of sample, especially trade samples or publicity material, available at events such as annual shows. |  |
| Tape Measure | A great variety of tape measures exist. The most common length of tape measure used for setting out is 30 meters. |  |

| | | |
|---|---|---|
| Tamper | Tamper/Hand rammers are used for compacting soil and gravel. It consists of a weight with a long handle. |  |
| Shovels and spade | Shovels are used for scooping up material and loading it on to a trailer, truck or wheelbarrow, or throwing it directly to where the material is needed. |  |
| Pick axe | A pickaxe, pick-axe, or pick is a generally T-shaped hand tool used for prying. Its head is typically metal, attached perpendicularly to a longer handle, traditionally made of wood, occasionally metal, and increasingly fiberglass |  |
| Wheelbarrows | Wheelbarrows are used for earth and concrete works, transporting construction materials such as soil, gravel, sand, aggregate, stone, concrete, etc. |  |
| Hammer | A hammer is a tool with a, flat, often metal head, attached to a wooden handle. |  |
| Leveling equipment | Leveling is a type of surveying which is carried out for measuring the elevation of ground points or near to it and to establish the elevation or heights of ground points which are vital for engineering design. |  |
| Bulldozer | A powerful track **used** to push large quantities of soil, sand, rubble or other such material during construction or conversion work and typically equipment |  |
| Dump truck | Dump trucks are the most common type of equipment used for hauling large quantities of materials from quarries and borrow pits to the work sites. |  |
| Excavator | To make hollow by removing the inner part; make a hole or cavity in; form into a hollow, as by digging |  |

| | | |
|---|---|---|
| Crowbar | The crowbar, like the pickaxe, is mostly used for penetrating or breaking up stony or hard soils. |  |

**Table 3.1**: borrow pit material production tools and equipment

| Self-Check 3 | Written Test |
|---|---|

***Instructions**:* **Directions:** Choose & write the letter of correct answer on the space provided under the blanket (6 pts)

1. _____A powerful track **used** to push large quantities of soil, sand, rubble or other such material during construction or conversion work and typically equipment
    a) Sieve and Pan
    b) Excavator
    c) Leveling
    d) Bulldozer
2. _____is a type of surveying which is carried out for measuring the elevation of ground points or near to it and to establish the elevation or heights of ground points which are vital for engineering design.
    a) Sieve and Pan
    b) Excavator
    c) Leveling
    d) Bulldozer
3. _____To make hollow by removing the inner part; make a hole or cavity in; form into a hollow, as by digging
    a) Sieve and Pan
    b) Excavator
    c) Leveling
    d) Bulldozer
4. _____Is fitted with wire screen with uniform, specified openings.
    a) Sieve and Pan
    b) Excavator
    c) Leveling
    d) Bulldozer

***Note:*** **Satisfactory rating – 3 & above points Unsatisfactory - below 3 points**

You can ask you teacher for the copy of the correct answers.

**Answer Sheet**

Name: _____ Date: _____

Score = _____

Rating: _____

| Information Sheet 4 | Traffic management Signage requirements |
|---|---|

## 4.1 Project traffic management

- **Work place traffic management plan**

Depending on circumstances, movement of traffic may be achieved in one of the following ways:-

- ✓ Through the work area by intermingling with workers or plant.
- ✓ Pass the work area by means of a delineated path alongside but clear of the work area.
- ✓ Around the work area by a detour which may be via a side track or an existing road
- ✓ the sign must be clean on in good condition
- ✓ the standard sign should be in standard lay out
- ✓ the lay out used must be give driver fix to understand and respond to the information which the sign control

Before work starting warning sign barriers and cons must be placed around the work area.

- ✓ main working sign should be placed 200m in front of the work area
- ✓ road narrow sign should be placed 100m in front of the work area
- ✓ keep left right at the work area

In order to achieve minimum disruption and inconvenience to road users only the minimum practicable length and width of a road shall be closed off at any time. Adequate provision shall be made for capacity requirements.

Work schedules shall be arranged to minimize:-

a. Disruption of established traffic movements and patterns;
b. Interference with traffic at peak movement periods and at night, weekends, holly day's period s or other special events;
c. Interference with public transport services.

The traffic guidance scheme shall provide for the safety of workers. Where they are not applicable during the work period, regulatory signs may need to be removed or covered.

- **Traffic through the work area**

Passage of traffic through a work area shall only be permitted where both the traffic and the work can be adequately controlled. Traffic controllers or traffic signals shall be employed as necessary to slow traffic on the immediate approach to an active work area, to stop traffic for

short periods when required for the movement of plant or other operations, or to control single line flow.

- **Traffic past the work area**

This will be the normal method of traffic management at sites where complete elimination of traffic from the site is not required. Traffic paths past the work area shall be clearly delineated. At long term works, if the travel path substantially deviates from normal, as far as practicable, original pre works delineation including pavement markings and raised pavement markers (RPMs) shall be obliterated if they are likely to misdirect drivers negotiating the site.

- **Traffic around the work area (side-tracks and detours)**

When it is not practicable to allow traffic through or past the work area, it may be created by for means of either a detour using existing roads or a specifically constructed side-track.

- **Night conditions**

Where work at a site extends for more than a single day or is to be performed at night the following requirements and recommendations for operating or securing the site at night apply:-

- **Work in progress at night**

The following requirements and recommendations applicable to works being carried out at night are additional to those given in Item.

Lighting at a work site shall, as a minimum requirement, illuminate the following areas:-

- ✓ The work area.
- ✓ Any locations where workers or plant might encroach on traffic lanes.
- ✓ Intersections in which works are taking place.
- ✓ Any traffic controller positions, noting item

Wherever practicable it is recommended that the entire work area and immediate approach be lit.

- ➢ Flood lighting is recommended as traffic route lighting levels will not normally be adequate for an active work site.
- ➢ Steps should be taken to ensure that floodlighting does not produce glare sources for approaching drivers.
- ➢ The adverse environmental effects of high lighting levels close to residential property should be considered.
- ➢ Dimming controls on illuminated flashing arrow signs and matrix type variable message signs should be checked for correct operation.

| Self-Check 4 | Written Test |
|---|---|

***Instructions**:* **Directions:** Choose & write the letter of correct answer on the space provided under the blanket (6 pts)

1. _____**Is** The following areas **not** Lighting at a work site shall, as a minimum requirement?
   a) The work area.
   b) Any locations where workers or plant might encroach on traffic lanes.
   c) Wastage material place
   d) Any traffic controller positions, noting item
2. main working sign should be placed _____m in front of the work area
   a) 100m
   b) 200m
   c) 300m
   d) 400m
3. road narrow sign should be placed 125m in front of the work area
   a) True
   b) false

***Note:*** **Satisfactory rating – 3 & above points Unsatisfactory - below 3 points**

You can ask you teacher for the copy of the correct answers.

**Answer Sheet**

Score = _____

Rating: _____

Name: _____ Date: _____

| Information Sheet 5 | Materials identification, handling and locating |
|---|---|

## 5.1 Materials identification, handling and locating

Material handling can minimize the costs that can be wasted for repairing and buying the materials. Therefore proper handling of construction material is very important. In all laboratory works, it is necessary to take measurements of different kinds and to record them. However, measurements made with the use of instruments are not the only kind of observations necessary when testing materials, visual observations requiring description in words can be equally important and therefore, proper handling is so important. Most of the tests run for the determination of material properties involve measurements of the fundamental quantities of length, volume, mass, fluid density, time, temperature and force.

When selecting a quarry site, a number of aspects need to be considered. These include:

- ✓ The quality of the gravel material,
- ✓ The depth of soil (or overburden) over the gravel,
- ✓ How to excavate the gravel,
- ✓ Hauling distance from the quarry to the road site, and
- ✓ Land ownership of the quarry site.

Preferably, the gravel pit should be located close to your road to limit hauling distances. Good gravelling material should contain between *35 - 65% stones, 20 - 40% sand, and 10 - 25% clay.*

## 5.2 Borrow Material identification standard

The material in borrow pits must be satisfactory for the use it is intended. If the character of the materials is not readily visible, adequate sampling and testing should be done to verify the quality and the quantity of material available. The Project Engineer should check the records to see that this determination has been made, and if any doubt exists to the adequacy of the source, the Regional Materials Engineer should be contacted to see if further testing is indicated. This detail could save considerable time, expense, and future problems if it is determined that a pit is unsatisfactory before extensive work is performed in opening the pit and then discovering that the material is not acceptable.

- ***Standard Specifications***

Sections 2-03.3(14)K, 9-03.20, and 9-03.21 provide for the use of select and common borrow for use in construction of embankments. Materials which meet these specifications are intended for use where it is not necessary to strictly control the strength properties of the borrow. Select or common borrow materials should not be used as backfill for mechanically

stabilized earth walls, to backfill unsuitable material excavation below groundwater, or as foundation material for any structure, unless specifically approved for use by the State Geotechnical Engineer. The material requirements for select and common borrow will not ensure that the materials will be workable and able to be compacted under inclement weather conditions. Because select or common borrow materials may be subject to moisture sensitivity as described above and in Section 2-3.2A5, compaction of these materials may require control as specified in*Standard Specifications* Section 2-03.3(14)D.

- **Common borrow,** as specified by *Standard Specifications* Section 9-03.14(3), may be virtually any soil or aggregate, either naturally occurring or processed, which is substantially free of organics or other deleterious material, and is nonplastic. The specification allows for the use of more plastic (clayey) common borrow when approved by the Engineer. The use of more plastic (clayey) material may require approval of the Regional Materials Engineer or the State Materials Lab. The 3 percent maximum organic material requirement for common borrow may be determined visually, or, as necessary, by one of the following test methods: AASHTO T 194 (Organic Content by the Wet Combustion Method) or AASHTO T 267 (Organic Content by Loss on Ignition). The correct test method is determined based on the type of organic material present in the soil sample. The Regional Materials Engineer should be consulted as to the appropriate test method. The sample may be field determined to be nonplastic if the fraction of the material which passes the U.S. No. 40 sieve cannot be rolled into a thread at any moisture content using that portion of AASHTO Test Method T 90 (Determination of the Plastic Limit of Soils) which describes rolling the thread.
  - ✓ The requirements of *Standard Specifications* Section 2-03.3(13) must be observed in theoperation and cleanup of borrow pits. With the requirement for reclamation of all pits, a plan must be developed to meet the requirements of the specifications and special provisions and approved before the start of pit operations.

- **Material handling**

Materials shall be protected against damage in transit to the site. Where materials are to be supplied packed the manufacturers' recommendation as to packing and stacking during shipment shall be adhered to.
Materials shall generally be stored at site in a manner that would prevent damage to the materials. The methods of storage & handling as specified under each particular section of this Specification shall be adhered to

| Self-Check 5 | Written Test |
|---|---|

***In ructions**:* **Directions:** write the letter of correct answer on the space provided under the blanket (12 pts)

1 _____Is selecting a quarry site, a number of aspects need to be considered?
   A. The quality of the gravel material,
   B. Governmental taxation
   C. How to excavate the gravel,
   D. Land ownership of the quarry site.

1. All laboratory works, it is necessary to take measurements of different kinds and to record them?
   A. True
   B. False
2. Prepare a plan is one needs to have available essential data and background information except

   A. Site inspection report
   B. The amount of gravel required
   C. List of available equipment
   D. Contract document with specifications and work drawings

***Note:*** **Satisfactory rating – 6 & above points Unsatisfactory - below 6 points**

You can ask you teacher for the copy of the correct answers.

**Answer Sheet**

Score = _____

Rating: _____

Name: _____ Date: _____

| Information Sheet 6 | Employment conditions, responsibilities and obligations |
|---|---|

## 6.1 Quarry Manager Job Description, Duties, Functions, Roles and Responsibilities

What is the job description and role of a Quarry Manager? What are the duties and responsibilities of a Quarry Manager?

- **Quarry Manager Job Description**

✓ Quarry managers are responsible for ensuring that quarries, pits and opencast sites operate successfully. They oversee all operations, both on site and in the office, manage staff, coordinate production and monitor all site systems.

✓ Quarries produce a wide range of materials for use in industry and construction. These include: rocks and stone of all types; slate; sand and gravel; china clay; brick and ball clay; coal; and other minerals and materials.

✓ Quarry managers combine their knowledge of extraction and processing systems with excellent interpersonal and management skills to ensure the profitability of quarry sites. Work takes place in the office and on site.

✓ Job Description, Duties, Functions, Roles and Responsibilities of a Quarry Manager balancing sales and output; ensuring that key government health and safety legislation is implemented throughout the site; altering the quarry's production system in accordance with the materials required; liaising with sales and commercial teams; maintaining up-to-date records and dealing with a range of paperwork; keeping up to date with relevant government legislation and industry developments; developing inspection systems and checklists; checking that the quarry's production levels are maintained safely to schedule; writing development proposals and reports;

✓ Managing and recruiting staff. Performance managing the production process and setting and monitoring targets; providing the owner company with information and statistics on the quarry's performance; developing links with local groups and organizations; managing and regulating the quarry's budget;

✓ On site examining the materials produced to ensure that a high quality of product is maintained; closely monitoring all areas of the quarry to ensure that extraction and

processing work is carried out to the highest standard; assessing equipment and production materials levels; undertaking regular site inspections and risk assessments in order to comply with all health and safety regulations; Checking that all vehicles on site are maintained to a good standard. Ordering new items as required; liaising with staff on site and dealing with any technical or staffing challenges that arise;

- ✓ Engineers and technicians involved in labor-based projects not only have duties as technical staff, but to a large extent also play an important role as managers. As a manager it is necessary to carry out the three main tasks of management: as a planner, as an administrator and as a leader.

- ✓ Labor-based work methods are competitive and can be more economical and provide lasting benefits, if they are well supervised, controlled and managed. This means that training must be provided at all levels, and cooperation and coordination must be established between the management at each level. Each supervisor, technician, engineer and administrator must know how to execute his/her duties effectively, and where he/she fits into the overall management organization.
- ✓ Managers who fail in a labor-based project normally do not fail because of their lack of technical ability, but because they are poor managers in terms of work organization and personnel management.

**Obligations of contractor**

The contractors must to be done on the work place have equal employment opportunity to skilled or unskilled personnel's with include disability and affirmative action's to women.

| Self-Check 6 | Written Test |
|---|---|

***Instructions**:* **Directions:** write the letter of correct answer on the space provided under the blanket (10 pts)

1. Engineers and technicians involved in labor-based projects not only have duties as technical staff, but to a large extent also play an important role as managers?
   A. true
   B. False
2. _____ are responsible for ensuring that quarries, pits and opencast sites operate successfully?
   A. Engineer
   B. Supervisor
   C. Quarry managers
   D. controller
3. The contractors it not must to be done on the work place have equal employment opportunity to skilled or unskilled personnel's with include disability and affirmative actions to women?
   A. True
   B. False

***Note:*** **Satisfactory rating – 5 & above points Unsatisfactory - below 5 points**

You can ask you teacher for the copy of the correct answers.

**Answer Sheet**

Name: _____ Date: _____

Score = _____

Rating: _____

| Information Sheet 7 | Environmental protection requirements |
|---|---|

## 7.1 Environmental protection

Environmental protection is the prevention/control of pollution and habitat disruption that may occur to the environment during construction. The control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants.

## 7.2 Environmental and safety management

The Contractor must undertake the following environmental protection and public safety measures:

- **Site Access/Safety**
  - ✓ The extraction site should have a barrier such as yellow warning tape and/or perimeter beams to control or discourage public access. Alternatively, the Contractor can post a local full-time guard until the site is reinstated.
  - ✓ Any deep excavation site that has standing water greater than 10 meters deep must be protected from public access by installing a fence and/or posting a full-time guard before the water level goes down.
  - ✓ Entrances to the site should be gated so as to block ease of access and shall be designed to provide vehicles with adequate sight distance to avoid a safety hazard.
  - ✓ Durable warning signs shall be posted around the perimeter of the borrow site not more than 50 meters apart which will provide symbols of danger and no trespassing (e.g. skull and crossbones).
  - ✓ Liaison with the local community should be undertaken, which includes information on dangers within borrow pit operational sites and that trespassing is not permitted.

- **Visual**
  - ✓ Ensure that existing vegetation within the minimum 25-meter buffer area is not disturbed, as it should provide some visual screening of pit operations from the road and nearby residents.

- **Noise**
  - ✓ Ensure that existing vegetation within the minimum 25-meter buffer area is not disturbed, as it should screen noise of pit operations from nearby residents.

- **Water**
  - ✓ If water is needed for borrow pit operations, a water extraction points such as a borehole, shall be established
  - ✓ Within the site, ideally located near the perimeter of the property for use by the local community once the site is reinstated.
  - ✓ Borrow pits shall not be located within a wet land area.
  - ✓ Excavation below the water table is not permitted.
  - ✓ Standing water in the borrow pit is not permitted and shall be removed either through drainage structures and/or pumping. Alternatively, any pits with deep (greater than 10 meter) pools of water must be secured by a fence and/or full-time guards to prevent public access.
  - ✓ Under no circumstances shall community members be allowed to use water at an active borrow pit site for any purpose (e.g. watering their animals, washing clothes, etc.).

- **Water discharge**
  - ✓ Overburden soil can be used as a perimeter beam to direct drainage away from the site.
  - ✓ Efforts shall be made to reduce the amount of runoff into the borrow pit.

- **Erosion**
  - ✓ Erosion control measures must be undertaken in all aspects of pit operations including stockpiles and access roads. These measures include reduced slopes, seeding, and stockpile covers to protect stockpiles and the adjacent land.
  - ✓ Topsoil stockpiles shall be protected from wind and water erosion by reducing slopes (i.e. less than 50% grade), using a covering, and/or spraying with water.

- **Dust**
  - ✓ In all operation of the borrow pits, measures shall be undertaken to minimize dust emission and spreading (water sprinklers, covering stockpiles, introducing speed limit, etc).
  - ✓ If a rock crusher is used, the dust control measures shall be undertaken by using a water truck or fixed sprinklers on crushing equipment.

| Self-Check 7 | Written Test |
|---|---|

***Instructions:*** **Directions:** Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. _____is needed for borrow pit operations, a water extraction points such as a borehole, shall be established
   a) Noise
   b) Water
   c) Visual
   d) Dust
   e) Erosion
2. Ensure that existing vegetation within the minimum 25-meter buffer area is not disturbed, as it should provide some visual screening of pit operations from the road and nearby residents
   a. Noise
   b. Water
   c. Visual
   d. Dust
   e. Erosion

3. Topsoil stockpiles shall be protected from wind and water erosion by reducing slopes (i.e. less than 50% grade), using a covering, and/or spraying with water
   a. Noise
   b. Water
   c. Visual
   d. Erosion
   e. Dust

***Note:*** **Satisfactory rating – 5 & above points Unsatisfactory - below 5 points**

You can ask you teacher for the copy of the correct answers.

Score = _____

Rating: _____

**Answer Sheet**

Name: _____ Date: _____

## List of Reference Materials


- **LABOUR BASED ROAD CONSTRUCTION _97**
- **ERA manual**
- https://www.ilo.org/dyn/asist/docs/F1287477762/lb_road_course.pdf
- https://www.academia.edu/9753785/Obligations_and_Responsibilities_of_Civil_Engineers_for_the_Prevention_of_Labor_Risks_References_to_European_Regulations
- https://www.ungm.org/UNUser/Documents/DownloadPublicDocument?docId=765539
- . http://www.dot.ga.gov/PartnerSmart/Training/technician/Documents/StudyGuide9_22_04.pdf
- https://assets.publishing.service.gov.uk/media/57a08d7e40f0b649740018ba/R68524.pdf

# Road civil work

## Level II

# Learning guide 42

## Unit of Competence: Conduct and Support Pit Run Material Production Operation

## Module Title: Conducting and Supporting Pit Run Material Production Operation

## LG Code: CON RCW2 M11 LO2-42

## TTLM Code: CON RCW2 TTLM 1019 v1

# LO 2: **Conduct survey, testing and identification of types and location of materials operation**

| **Instruction Sheet** | **Learning Guide 42** |
|---|---|

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics –

- Identify and Locate Sources of construction materials
- Construction materials investigation techniques
- Preparation of required tools, equipment and data
- Materials sampling and testing techniques
- Identification of thickness of the overburden material
- Quality and quantity of construction materials

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to –

- Identify location of the material
- Construction materials investigation techniques.
- Prepare required tools, equipment and data.
- Sample Materials per the specification.
- Identify  Thickness of the overburden material
- Identify Operation techniques for testing apparatus.
- carry out Field and laboratory tests in accordance with the technical specification
- Check Quality and quantity of construction materials.

- Identify Sources of construction materials

**Learning Instructions:**

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below
3. Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
4. Accomplish the “Self-checks”. in each information sheets.
5. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
6. If you earned a satisfactory evaluation proceed to “Operation sheets and LAP Tests if any”. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity.
7. After You accomplish Operation sheets and LAP Tests, ensure you have a formative assessment and get a satisfactory result;
8. Then proceed to the next information sheet

| Information Sheet-1 | Identify and Locate Sources of construction materials |
|---|---|

## 1.1 Locating construction materials

Work area is cleared of waste, cleaned, restored and secured in line with workplace procedures. Plant, tools and equipment are cleaned, checked and maintained in line with workplace procedures.

Adequate investigation is an essential preliminary to the execution of any civil engineering project. Sufficient information must be obtained to ensure that the structures to be designed would remain safe.

Tests are needed as part of the control measures which are applied during construction of earthworks /excavations, pavement materials, concrete and bituminous mixtures, for ensuring that the design criteria are met. The satisfactory completion and performance of any civil engineering project is dependent on Quality Control Tests being undertaken prior and during construction. By carrying out the required tests, the risk of costly failure of major structures can be avoided and worthwhile savings in cost of construction are possible.

Another issue critical to testing materials is obtaining a good sample of the material to be tested. Knowing how to get a good representative sample from a borrow source /crushing operation, a stockpile, a windrow, or a paving operation is absolutely critical to get good test results from a lab.

Poor sampling techniques have led to more controversy in material testing than any other factor. Every effort must be made to make sure that the sample brought to a lab is truly representative of the material in the field. Internationally accepted methods of sampling and testing should be followed.

Samples are taken for either of the following two purposes:

- ✓ To represent as nearly as possible an average of the bulk of the materials sampled, or
- ✓ To ascertain the maximum variation in characteristics which the material possesses.

The sample must be of sufficient mass, based on the nominal stone size of the material being sampled, it is a must to ensure that all relevant information is recorded relating to the sample such as:

a) date and location of sampling
b) type of sampling
c) name of sampler
d) The information needs to be provided with the sample to the testing laboratory.

During sampling standards i.e. ERA, AASHTO, IS, ASTM, BS, etc will instruct you on A bad sample is worse than no sample at all!!!

- **Priciple of quarry site selection**

Prior to quarry development, a site selection process must be conducted to insure that the expected quality and quantity of construction materials will be obtainable. Following site selection, quarry layout considerations are necessary to insure efficient operations. For clarification purposes, the term quarry (and pit) refers to sites where open excavations are made for the purpose of removing rock for use in construction projects.

The distinction between pits and quarries is based on the manner in which the site is excavated. Pits are sites from which materials can be removed, generally without blasting. Quarries usually require drilling, cutting, or blasting for the excavation of the materials.

- **Site Selection for Quarrying**
  - ✓ The quarry should be selected based on some conditions as follows.
  - ✓ The site should be near to human living areas where labor and tools are always available, required materials also should be available.
  - ✓ At least one of type transportation facilities (road or railway or port or all) should be available.
  - ✓ Clean water source should be available near the quarry site.
  - ✓ Good quality and quantity of stone should be available.
  - ✓ The site should be far from permanent structures like bridges, dams etc. because the vibrations due to blasting in the site may cause harm to them.
  - ✓ Non-living area should be available to dump the refuse obtained in quarrying.
  - ✓ Proper drainage facility should be available.
  - ✓ Geological information of site should be read.

- **Considerations for Quarrying**

After the site selection, some important considerations are to be followed before starting quarrying of stones. Which are as follows?

The rock surface should be properly checked for cracks and fissures. The presence of these may cause planes in the stones, along which they may split. Then, the quarrying will be easy and quick as well as economical.

Layout should be prepared which contains different stages involved in quarrying operation.

The machines used should be tested to operate them easily and quickly.

If the top surface of site contains soft soil, then it should be removed and dumped.

The removal of stones should be done carefully otherwise there may be chances of landslides or slips which can cause severe damage to the lives of labor.

| **Self-Check 1** | **Written Test** |
|---|---|

**Directions:** Choose & write the letter of correct answer on the space provided under the blanket (10 pts)

1. site selection process must be conducted to insure that the expected quality and quantity of construction materials will be obtainable
   a) true
   b) false

2. Is not the Site Selection for Quarrying

   a) Clean water source should be available near the quarry site.
   b) Proper drainage facility should be available.
   c) Geological information in population growth
   d) Good quality and quantity of stone should be available.

***Note:*** **Satisfactory rating – 5 & above points Unsatisfactory - below 5 points**

You can ask you teacher for the copy of the correct answers.

**Answer Sheet**

Score = _____

Rating: _____

Name: _____ Date: _____

| Information Sheet 2 | Construction materials investigation techniques |
|---|---|

## 2.1 Site assessment and selection techniques

A preliminary site assessment prior to undertaking excavation works should be undertaken. Such assessment shall include as a minimum the following:

- **Land tenure and approval for use**
  - ✓ A written approval for use of the proposed site shall be obtained from the local authorities. It is recommended to commence discussion with relevant authorities as soon as possible to understand requirements and potential limitations of the process. Negotiation may require preparation of the narrative that describes borrow pit operations, outlines potential risk to the community, proposes mitigation measures to control and minimise such risks and presents restoration plans.

- **Geotechnical site investigation**
  - ✓ Borehole drilling and/or excavation of test pits shall be carried out to confirm the extent and quality of the materials within the proposed site. Test pits and boreholes shall be decommissioned unless used as a borrow site.
  - ✓ Hydrogeological information shall be obtained to determine the presence and depth of any groundwater table.

- **Site property lines and location**
  - ✓ Borrow pits should be preferably located in the areas with minimal volume of vegetation or existing/decommissioned pits can be used.
  - ✓ The borrow pit site shall have clearly defined property lines which will be surveyed and clearly marked to limit excavation within the approved area of the site.
  - ✓ The size of the area to be excavated shall be a maximum of 10,000 m2 (or 1 ha). Larger area may be excavated upon written approval from the UNOPS representative.
  - ✓ The borrow pit operational site must have an undisturbed buffer area of natural vegetation of a minimum of 25 meters in width around the perimeter of the site – excluding entry roadway with a maximum width of 5 meters.
  - ✓ The property line of the site shall be a minimum of 100 meters from the nearest households and 100 meters away from the nearest watercourse.
  - ✓ Location of the borrow pit place shall be well documents. Documentation should include: a map showing the location and a plan-view of the site, a photographic

record of the site in its undisturbed state (photographs shouldbe taken from the geographic centre of the proposed site in 8 directions: north, northeast, east, southeast, south, southwest, west, and northwest).

## 2.2 Field Investigation Techniques

**Purpose**: - Soil investigations are conducted for most medium to large size buildings, high ways, bridges, dams, water control facilities, harbors and other structure.

The main purpose is to find the allowable bearing capacity for foundations. Investigations are also conducted to determine water resources, find aggregate deposits, estimate infiltration and seepage rates, and to help assess land use capabilities.
Information usually required in soils investigations includes depth, thickness, and properties of each soil layer, location of ground water table, and depth to bedrock.
Before a field investigation carried out at the site, preliminary information regarding soil condition can often be obtained from the following sources: -

- ✓ Geological and agricultural soils maps- These often indicate the types of soil and agricultural formation that cover the area being investigated.
- ✓ Aerial photographs- Drainage patterns can be identified, and color and tone of photos give a good indication of the type of soil that might be encountered.
- ✓ Area reconnaissance- The condition of other buildings in the area can give some clue as to potential foundation problems. The depth to water level in adjacent wells may indicate the evaluation of the ground water table.

- **Subsurface investigation of soils deposits**

Can be carried out by five main methods:-

a) Geophysical methods (seismic or electrical)
b) Probing or jetting with a stream of water
c) Test pits or trenches
d) Hand augers.
e) Boring test holes and sampling with drill rigs.

### a) Geophysical methods (seismic or electrical)

Variations in the speed of sound waves or in the electrical resistively of various soils are useful indicators of the depth to the water table and to bedrock.

### b) Probing or jetting with a stream of water

In this method, the material is washed up and left at the surface after drying. However, it doesn't represent the soil found since the fines are washed away. In addition, it is difficult to establish the depth at which various layers are encountered.

### c) Test pits or trenches

This method is suitable for shallow depth only.

### d) Hand augers

Again, this method is suitable for shallow depths only. Only disturbed or mixed samples of soil can be obtained.

### e) Boring test holes and sampling with drill rigs

This is the principal method for detailed soils investigations, and is described in the following sections. Avery important part of the soils investigation is to establish the water table elevation. This is done by measuring down the hole to the final water surface as water fills the hole. In granular solid, water table elevation is easy to determine since water flows in quickly and fills the hole usually the walls of the whole cave in up to the water table level. In clay soils or soils mixed with clay, a long time may elapse before a sufficient quantity of water seeps out of the soil to fill the hole. Judgment is involved in a assessing the significance of water level measurements in these soils.

**Soil reports**

The final step in a soils investigation is the preparation of a soils report. This report includes a summary of the test program, a general description of the soil conditions, a detailed analysis of each type of soil found and recommendations for design (as required).

| Self-Check 2 | Written Test |
|---|---|

***Instructions**:* **Directions:** write the letter of correct answer on the space provided under the blanket (10 pts)

1 Adequate investigation is an essential preliminary to the execution of any civil engineering project?
   a) True
   b) False

2 The sample must be of sufficient mass, based on the nominal stone size of the material being sampled, it is a must to ensure that all relevant information is recorded relating to the sample the following aspects are not need to be considered when selecting a quarry except?
   a) date and location of sampling
   b) type of sampling
   c) name of sampler
   d) The quarry should contain sufficient gravel

***Note:*** **Satisfactory rating – 5 & above points Unsatisfactory - below 5 points**

You can ask you teacher for the copy of the correct answers.

**Answer Sheet**

Score = _____

Rating: _____

Name: _____ Date: _____

| Information Sheet 3 | Preparation of required tools, equipment and data |
|---|---|

### 3.1 Preparation of required tools, equipment and data

The correct tools for the job must be used, in correct time and place. Tools must be maintained in good condition and stored properly. Any defective tools must not be used. All tools must be regularly cleaned with moving and adjustable parts lightly oiled to prevent wear and misalignment. Cutting edges must be kept sharp and sharpened in the correct manner to prevent a change in the temper of the metal.

Metal tools conduct electricity and therefore where work is taking place on or near electrical apparatus, insulated tools must be used. Sparks from tools can cause fire or explosion and care must be taken near combustible or flammable materials.

The user must wear appropriate personal protective equipment as determined by the risk assessment for the activity being carried out

- **Equipment, Machinery and Materials**
  - ✓ Written by ILO Content Manager

Construction work has undergone major changes. Once dependent upon craftsmanship with simple mechanical aids, the industry now relies largely on machines and equipment.

New equipment, machinery, materials and methods have contributed to the industry's development. Around the middle of the 20th century

- **European Community Directives Relating to Workers' Health and Safety**

In 1985, the European Community (EC) decided on a "New Approach to Technical Harmonization and Standards" in order to facilitate the free movement of goods. The New Approach directives are Community laws which set out essential requirements for health and safety that must be met before products may be supplied among member countries or imported to the Community.

- **Earth-moving machinery**

Earth-moving machinery is designed primarily to loosen, pick up, move, transport and distribute or grade rock or earth and is of great importance in construction, road-building and agricultural and industrial work (see figure 1). Properly used, these machines are versatile and can eliminate many of the risks associated with the manual handling of materials. Earth-moving machinery can endanger the operator and people working nearby. The following summary of the hazards associated with earth-moving machines

- **Roll-over and falling object protection**

Loaders, dozers, scrapers, graders, articulated steer dumpers and backhoe loaders with an engine performance of more than 15 kW should have a structure that will protect against roll-over. Machines intended for use where there is a risk of falling objects should be designed for and fitted with a structure that will protect the operator against falling material.

- **Operator's seat**

Machinery with provision for a seated operator should be fitted with an adjustable seat that keeps the operator in a stable position and allows him or her to control the machine under all expected operating conditions. Adjustments to accommodate to the operator's size and weight should be easily made without the use of any tool.

- **Controls and indicators**

The main controls, indicators, hand levers, pedals, switches and so on should be selected, designed and arranged so that they are clearly defined, legibly labeled and within easy reach of the operator. Controls for machine components should be designed so that they cannot accidentally start or be moved, even if exposed to interference from radio or telecommunications equipment.

Earth-moving machinery should be equipped with:

- ✓ stop lights and direction indicators for machines designed with a permissible travelling speed over 30 km/h
- ✓ an audible warning device controlled from the operator's station and of which the sound level should be at least 93 distance Base Area at a 7 m distance from the front-end of the machine and
- ✓ a device which allows a flashing light to be fitted.

- **Uncontrolled movement**

Creep (drift away) from the stopping position, for whatever reason (e.g., internal leakage) other than action of the controls, should be such that it does not create a hazard to bystanders.

- **Steering and braking systems**

The steering system should be such that the movement of the steering control shall correspond to the intended direction of steering. The steering system of rubber-tyred machinery with a travelling speed of more than 20 km/h should comply with the international steering system standard (ISO 1992).

Machinery should be fitted with service, secondary and parking brake systems that are efficient under all foreseeable conditions of service, load, speed, ground conditions and slope. The operator should be able to slow down and stop the machine by means of the service brake. In case it fails, a secondary brake should be provided. A mechanical parking device should be provided to keep the stopped machine from moving, and it should be capable of remaining in the applied position. (ISO1985).

- **Lighting**

To permit night work or work in dusty conditions, earth-moving machines should be fitted with large enough and bright enough lights to adequately illuminate both the travelling and the work areas.

- **Stability**

Earth-moving machinery, including components and attachments, should be designed and constructed to remain stable under anticipated operating conditions. Devices intended to increase the stability of earth-moving machinery in working mode, such as outriggers and oscillating axle locking, should be fitted with interlocking devices which keep them in position, even in case of hydraulic hose failure.

- **Guards and covers**

Guards and covers should be designed to be securely held in place. When access is rarely required, the guards should be fixed and fitted so that they are detachable only with tools or keys. Whenever possible, guards should remain hinged to the machine when open. Covers and guards should be fitted with a support system (springs or gas cylinders) to secure them in the opened position up to a wind speed of 8 m/s.

- **Tanks for fuel and hydraulic fluid**

Tanks for fuel and hydraulic and other fluids should have means for relieving any internal pressure in case of opening and repair. They should have easy access for filling and be provided with lockable filler caps.

- **Fire protection**

The floor and interior of the operator's station should be made of fire-resistant materials. Machines with an engine performance exceeding 30 kW should have a built-in fire extinguisher system or a location for installing a fire extinguisher that is easily reached by the operator.

- **Maintenance**

Machines should be designed and built so that lubrication and maintenance operations can be conducted safely, whenever possible with the engine stopped. When maintenance can be performed only with equipment in a raised position, the equipment should be mechanically secured. Special precautions such as erecting a shield or, at least, warning signs, must be taken if maintenance must be performed when the engine is running.

- **Marking**

Each machine should bear, legibly and indelibly, the following information: the name and address of the manufacturer, mandatory marks, designation of series and type, the serial number (if any), the engine power (in kW), the mass of the most usual configuration (in kg) and, if appropriate, the maximum drawbar pull and maximum vertical load. Other markings that may be appropriate include: conditions for use, mark of conformity (CE) and reference to instructions for installation, use and maintenance. The CE mark means that the machine meets the requirements of European Community directives relevant to the machine.

- **Warning signs**

When the movement of a machine creates hazards not obvious to a casual spectator, warning signs should be affixed to the machine to warn against approaching it while it is in operation.

- **Verification of safety requirements**

It is necessary to verify that safety requirements have been incorporated in the design and manufacture of an earth-moving machine. This should be achieved through a combination of measurement, visual examination, tests (where a method is prescribed) and assessment of the contents of the documentation that is required to be maintained by the manufacturer.

- **Operating manual**

A handbook giving instructions for operation and maintenance should be supplied and kept with the machine. It should be written in at least one of the official languages of the country in which the machine is to be used. It should describe in simple, readily understood terms the health and safety hazards that may be encountered (e.g., noise and hand-arm or whole-body vibration) and specify when personal protective equipment (PPE) is needed. A space intended for the safekeeping of the handbook should be provided in the operator's station.

- **Operating conditions**

In addition to the above requirements for design, the instruction handbook should specify conditions that limit use of the machine (e.g., the machine should not travel at a greater angle of inclination than is recommended by the manufacturer). If the operator discovers

faults, damage or excessive wear that may present a safety hazard, the operator should immediately inform the employer and shut down the machine until the necessary repairs are completed.

- **Positioning a machine for work**

When positioning a machine, the hazards of overturning, sliding and subsidence of the ground beneath it should be considered. When these appear to be present appropriate blocking of adequate strength and surface area should be provided to assure stability.

- **Overhead power lines**

When operating a machine near overhead power lines, precautions against contact with the energized lines should be taken. In this connection, cooperation with the power distributor is advisable.

- **Standards and Legislation**

There are numerous written standards or guidelines for recommended manufacturing and operating practices. Some are based on design principles, some on performance. Subjects covered in these standards include methods of testing various safety devices; design, construction and characteristics of the cranes; inspection, testing, maintenance and operation procedures; recommended equipment and control lay-out. These standards form the basis of government and company health and safety regulations and operator training.

| Self-Check 3 | Written Test |
|---|---|

***Instructions**:* **Directions:** write true or false the correct answer on the space provided under the blanket (6 pts) f

1. Earth-moving machinery is designed primarily to loosen, pick up, move, transport and distribute or grade rock or earth and is not a great importance in construction
   a) True
   b) False
2. Earth-moving machinery should be equipped except?
   a) stop lights and direction indicators for machines designed with a permissible
   b) an audible warning device controlled from the operator's station and of which the sound level
   c) travelling speed over 80 km/h
   d) a device which allows a flashing light to be fitted.

***Note:*** **Satisfactory rating – 3 & above points Unsatisfactory - below 3 points**

You can ask you teacher for the copy of the correct answers.

**Answer Sheet**

Score = _____

Rating: _____

Name: _____ Date: _____

| Information Sheet-4 | Materials sampling and testing techniques |
|---|---|

## 4.1sampling and testing in borrow pit production

- **Taking Representative Samples**

The selection and taking of representative material samples is often the most important and difficult task to be carried out during a borrow pit site investigation.

A sample must be a small quantity of material that represents in every way a much larger quantity of material. When taking a sample the aim is not usually to select the best or worst examples of the material.

Within the identified workable deposit sampling should be carried out on a random basis. This may be from a grid of trial pits or at say 20m intervals along an existing pit face, but personal preferences must not be allowed to interfere with the selection.

It will typically be necessary to sample at least 5 locations per borrow pit (covering the full depth of the layer to be used) in order to quantify variability.

Greater care has to be taken when sampling coarse grained (gravelly) materials than when sampling fine grained (sandy and clayey) materials. In particular, it is necessary to make sure that all particle sizes are included in the sample bag – **do not remove large stones from the sample**.

The following guidelines apply to the sampling method:

Always use a scoop or shovel with sides to take samples. If a flat spade is used the large stones will roll off the sides and the remaining sample will contain more fines than is representative.

When sampling from a stockpile the material on the top and sides of the pile must not be taken because this material is generally coarser than the interior of the stockpile. Dig small holes in the stockpile and sample from the base of these holes. Sample various locations then thoroughly mix them together.

Similarly when sampling river bed deposits **do not sample from the surface** where large stones collect. Dig a hole and sample from at least 500mm depth.

- ✓ If a sample obtained is too large when sub-samples are mixed together it must be reduced to the required size by quartering. This procedure is described below.
- ✓ The final sample should be placed in a hessian bag, strong polythene bag or other strong bag of suitable size(ie clean empty rice, flour or sugar sack**). Care should be taken to make sure that there are no small holes in thebag through which fine material may be lost**.

Prepare **Sample Labels** that provide the following information: Sample Reference No; Pit Name and Location; Location Sampled including depth; Date Sampled; Lab Tests Required (if known). Use of pre-printed sample record cards is recommended. Preferably place one label in the bag and attach one to the outside (or write details directly on the bag).

**Sampling a small river bed gravel stockpile**


**Sample bag ticket**

**Samples drying under cover prior to testing**

- **Size of Sample**

The size of sample is important for two main reasons:

- ✓ There is a minimum size below which a sample cannot accurately represent the original material. Larger samples are required for coarse grained (gravelly) materials.
- ✓ Sufficient sample must be taken to enable the required laboratory tests to be performed (and repeated if necessary).

If transport of the samples is not a constraint then it is better to take large samples, that can be divided in the Laboratory

**Recommended minimum sample sizes are given below:**

| Tests Required | Fine grained soil (Max size 2mm | | | | Coarse grained gravel (max size 40 mm) Not susceptible to Crushing | | | | Coarse grained gravel (max size 40 mm) Susceptible to crushing | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Grading | | * | * | * | * | * | * | * | * | * | * | * |
| Atterberg Limits (PI, LL & LS) | * | * | * | * | * | * | * | * | * | * | * | * |
| Compaction | | * | * | * | | * | * | * | | * | * | * |
| CBR (I point) | | * | | | | * | | | | * | | |
| CBR (3 points) | | | * | * | | | * | * | | | * | * |
| Treatment Tests | | | * | * | | | | * | | | | * |
| Minimum Sample Mass (kg) | 5 | 20 | 35 | 80 | 20 | 40 | 60 | 150 | 20 | 60 | 80 | 180 |

Table 4-1 Recommended Minimum Mass of Sample

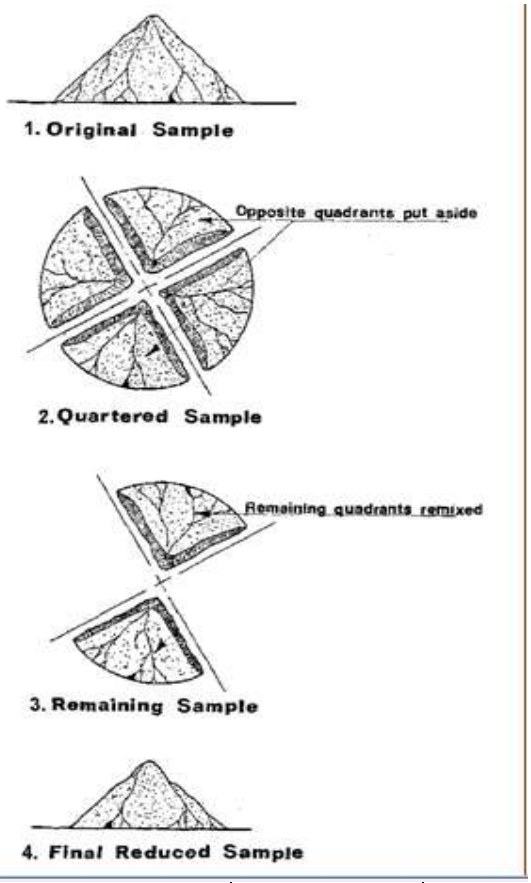
Sample Quartering

If a sample obtained is too large when sub-samples are mixed together it must be reduced to the required size by a procedure called quartering:

- ✓ The original sample is placed in a neat circular pile.
- ✓ Using a shovel, this pile is then separated into quarters by making two lines at right angles through the centre of the pile. Two opposite piles quarters are then put aside and the remaining two quarters mixed together to give a smaller sample.
- ✓ If the divided sample is still too large the procedure is repeated

This will make sure that the smaller sample represents the larger sample.

During a testing program a small sub sample should be retained, in case any repeat testing is required.



**Materials Testing**

The most suitable materials for building low cost unpaved roads consist of a well graded -sand mixture with a small proportion of clayey fines (for details refer Section 4).

Testing of pit materials is required during a borrow pit site investigation for the following reasons:

- ✓ To determine the engineering properties of the material including:-
- ✓ Proportions of gravel, sand and fines;
- ✓ The cohesion/plasticity characteristics of the fine material;
- ✓ Strength of the aggregate particles
- ✓ Load bearing characteristics of the compacted material
- ✓ To establish whether the materials in a pit are all of similar quality (ie determine material variability)
- ✓ To provide a documented record of pit material characteristics (for future reference)

IDEAL COMPOSITION OF GRAVEL MATERIAL

- **Preliminary On-Site Testing and Evaluation**

There are a number of field tests that may be used to make an initial assessment of the quality of materials in an existing or potential material source. These are described below.

Settlement test for grading

✓ **On- site Grading Tests**

Settlement Test - place a sample in a glass jar, add water and shake hard. Then leave to allow the particles to settle. Gravel, sand and coarse silt will settle within a few minutes.


Vibration test for grading

The approximate quantities of each particle size will be seen as layers in the sample. The finer material usually being a different color Settling will be clearer if a little salt is added to the water before shaking.

A good gravel road surfacing material should have a mixture of gravel, sand and clay in about the following proportions:

| | |
|---|---|
| Gravel (>2mm) | 50% |
| Sand | 40% |
| Silt & Clay | 10% |

Table 4.2 standard material ratio

Vibration Test - dry materials can be tested by placing a broken up sample on a slightly inclined board and tapping it lightly with a stick or penal. The coarser materials will move down slope more quickly than the fine material.

If there is a good range of different sized particles between the largest and smallest then the sample is said to be “Well Graded” and it will compact well. If only a few sizes can be seen it is single sized or Poorly Graded

- **On- site Cohesion/Plasticity Evaluation**

Take a hand full of damp material (moisten if necessary) and mould it into a ball to check for the presence of cohesive fine material (binder material).

If cohesive fines are present the material will stick together when placed on a flat surface. Silts and Clays will also stain the hands.

- **On- site Aggregate Strength Evaluation**

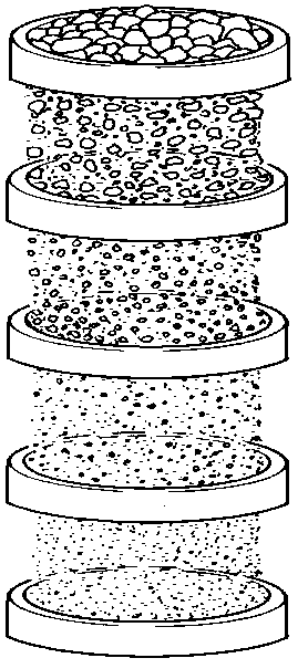
Take dry sample of material and break it up. Test the gravel particles by tapping lightly with a hammer. If they disintegrate easily the material is unlikely to be suitable for road gravelling as the same disintegration is likely to occur under traffic. However, some materials with relatively weak particles may perform satisfactorily

- **Laboratory Testing**

In order to fully assess the engineering properties of a borrow pit material it is necessary to have samples tested in a Materials Laboratory. The laboratory will use standard testing procedures to classify the samples taken. The results obtained can then be compared with appropriate material specifications that define the desirable properties of gravel road materials (refer Section 4)

- **laboratory Grading Tests**

The particle size distribution grading of a road surfacing material is an essential guide to the suitability of the material since the engineering properties are very dependent on Grading.



Particle size distribution analysis using sieves (Source Bomag 1983)

| Description | | Particle Size |
|---|---|---|
| Boulders | | Greater than 200 mm |
| Cobbles | | 60 – 200 mm |
| Gravel | Coarse<br>Medium<br>Fine | 20 – 60 mm<br>6 – 20 mm<br>2 – 6 mm |
| Sand | Coarse<br>Medium<br>Fine | 0.6 – 2 mm<br>0.2 – 0.6 mm<br>0.06 – 0.2 mm |
| Silt | | 0.002 – 0.06 mm |
| Clay | | Less than 0.002mm |

Table 4.2 Grading Classification (After British Standards)

- **Laboratory Cohesion/Plasticity Evaluation**

Material for surfacing unpaved roads requires some clayey fines to act as “binder”. The cohesion associated with clay soils helps to hold the aggregate particles in place on the road. Cohesion is related to plasticity and is measured in the laboratory by three test procedures, namely:

- ✓ Liquid Limit Testing
- ✓ Plastic Limit Testing
- ✓ Linear Shrinkage Testing

- **The Liquid Limit (LL)** is an indication of the percentage moisture content at which soil changes from a firm plastic state to a soft liquid state. The test is carried out on the fine material which passes the 0.425mm test sieve. About 200 grams of material is required for the test.
  Two methods are available for determining the liquid limit: the "traditional" method using the Casagrande apparatus and the more recently developed cone penetrometer method.

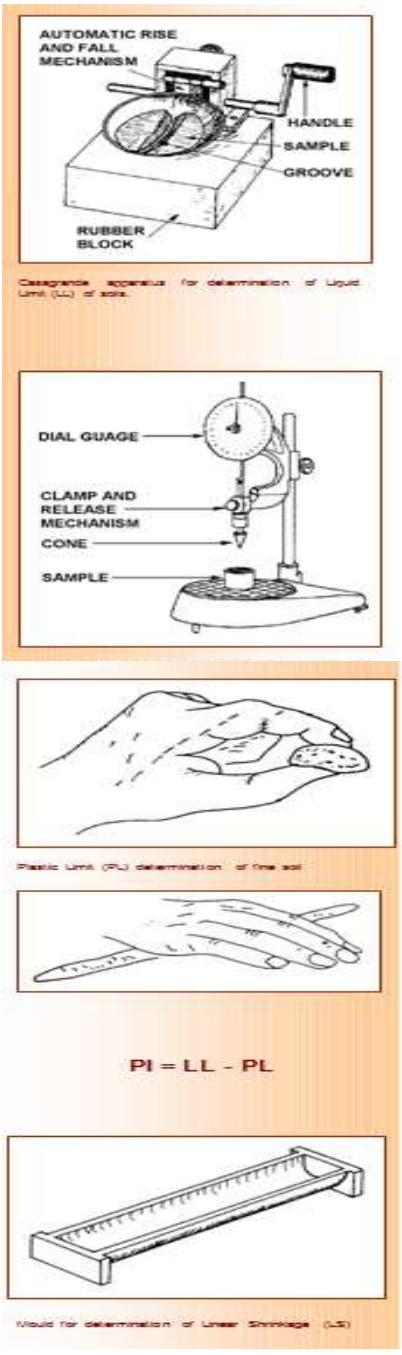
  In the Casagrande test the moisture content at which the soil groove would be just closed by 25blows along a 13mm length is the liquid limit.

  In the cone penetrometer test the moisture content at which the test cone penetrates the cup of soil 20mm is the liquid limit.

  A certain amount of skill and judgment is required when carrying out these tests and estimating the amounts of water needed. The two test give broadly similar results but the cone penetrometer is quicker and gives more consistent results.

  **The Plastic Limit (PL)** is an indication of the percentage moisture content at which the soil fines change from a semi solid to a plastic state. In this test a 20 gram sample of material passing the O.425 mm sieve is mixed with a little water until it becomes plastic enough to be formed into a ball. The soil is then molded between the fingers until the surface begins to crack.

  The difference between the Liquid Limit and the Plastic Limit is called the Plasticity Index (PI). This index provides a good guide to the cohesive properties of a road building aggregate. A high PI may indicate the presence of an undesirable amount or type of clay.




In the **Linear Shrinkage** (LS) Test a 150 gram sample of material passing the 425 mm sieve is mixed with water to bring the moisture content to about the Liquid Limit. The sample is then placed in a standard mould (usually 140 mm long) and dried in an oven. The sample length after drying is measured. The Linear Shrinkage is expressed as the original

length minus the final length divided by the original length. There is typically a close relationship between Linear Shrinkage and Plasticity Index (PI = 2.13 x LS)..

| **Self-Check 4** | **Written Test** |
|---|---|

**Directions:** Choose & write the letter of correct answer on the space provided under the blanket (10 pts)

1. There is a maximum size below which a sample cannot accurately represent the original material?
   a) True
   b) False
2. Testing of pit materials is required during a borrow pit site investigation for the following reasons?
   a. To determine the engineering properties of the material including:-
   b) Determine manpower history
   c) The cohesion/plasticity characteristics of the fine material;
   d) Strength of the aggregate particles

***Note:*** **Satisfactory rating – 5 & above points Unsatisfactory - below 5 points**

You can ask you teacher for the copy of the correct answers.

**Answer Sheet**

Score = _____

Rating: _____

Name: _____ Date: _____

| Information Sheet-5 | Identification of thickness of the overburden material |
|---|---|

## 5.1 Identification of thickness of the overburden material

Overburden is a soil or rock layer by the weight of the overlying layer. Over burden are located on the above parts of earth. In order to obtain quality quarry products the overburden on the top of the fresh rock should be removed.

Ground level Thickness of overburden materials must be identified. This section addresses the identification of over burden material. The vast majority of peat and clay overburden that needs to be removed to gain access to their reserve and to build infrastructure will be stored in an Overburden Disposal Facility (ODF). Low permeability clays will be salvaged and stockpiled in sufficient quantities to enable the construction of low permeability liners where required.

- **Overburden determination for quarry prospecting using seismic refraction**

Quarry is a place which rock, sand, gravel, dimension stone and construction aggregates are being produced and excavated from the ground. Quarry products are used daily for buildings, roads and railways construction.

However the thickness and the volume of the overburden material for to removed should be determined before the quarry operation. It helps to identify the only area that will be actively used for extraction. Besides that, the quarry management can plan their operation wisely including transportation of the overburden, travel distance, numbers of suitable heavy machineries and rehabilitation process after extraction of the source is done. One of the methods used to determine the amount of overburden of the quarry is by using geophysical survey. According to previous study, seismic reflection, electromagnetic and electrical resistivity has been used in mapping the bedrock [1-3]. Seismic refraction survey method is geophysical survey commonly used in exploration of groundwater, depth of water table, determine the depth of bedrock, and determine the bedrock competency, mining, site investigation and engineering. This survey provides information to the geotechnical engineers related to the design process, resources management, or planning works.

Seismic refraction survey is capable in providing detailed information on thickness of subsurface layer and subsurface materials based on characteristic of seismic velocities of materials. The information related to the overburden and bedrock can be determined by the images produced as the end final product of seismic refraction survey.

| Self-Check 5 | Written Test |
|---|---|

**Directions:** Choose & write the letter of correct answer on the space provided under the blanket (10 pts)

1. Overburden is a soil or rock layer by the weight of the overlying layer?
   a) true
   b) false

2. The vast majority of peat and clay overburden that not needs to be removed to gain access to their reserve and to build infrastructure?
   a) true
   b) false

***Note:*** **Satisfactory rating – 5 & above points Unsatisfactory - below 5 points**

You can ask you teacher for the copy of the correct answers.

**Answer Sheet**

Score = _____

Rating: _____

Name: _____ Date: _____

| Information Sheet 6 | Quality and quantity of construction materials |
|---|---|

## 6.2 Quality of construction materials

The minimum amounts of samples required for testing in field and laboratory sampling it requires skill and care. The sample should be packed and tied and the following information shall be included:

1) Client /contractor's name/
2) Project name
3) project location/ sample location
4) Date of sampling

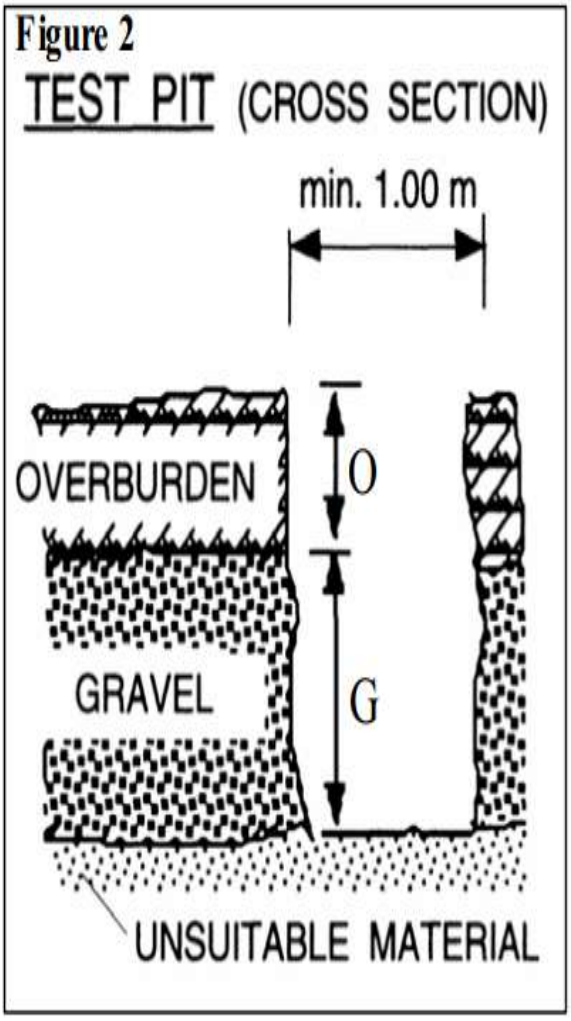
Quality manual has to document those procedures and policies that are carried out in the laboratory that can affect an analysis.

The quality control and check work that could be done by both the contractor and the supervising officer may include insuring:

- ✓ The borrow site land should be cleared of all materials unsuitable for the work by cutting, trimming, removing and disposing of all materials, such as trees, bushes, shrubs, stumps, roots, grass, weeds, top organic soil not exceeding 150 mm in thickness and rubbish, etc. This should be carried out well in advance of earthwork operations.
- ✓ The top soil removed during clearing and grubbing of site, if suitable for re-use shall be transported, conserved and stacked for re-use.
- ✓ All trees, stumps, etc. falling within the excavation and embankment lines should be cut to such depth below ground level that in no case these fall within 500 mm of the sub-grade. Beyond these limits, they need to be cut down to 500 mm below ground level.
- ✓ Excavations below the ground level arising out of removal of trees, stumps, etc., should be filled in layers with suitable material and compacted to the specified density given by the Engineer.
- ✓ Ant-hills both above and below the ground shall be removed by excavating to a suitable depth as directed by the Engineer. Cavities in the ground after removal of ant-hills shall be filled with appropriate material and properly compacted to the specified density.

**Quantity of Gravel material**

As part of the design and tender document preparations, the consultant, with the help of the local authorities, identifies the quarries from which the contractor will extract the material to gravel the road. The consultant, as part of his Terms of Reference, makes an assessment of quality and available quantity of gravel in the proposed source by establishing a number of test pits, which he analyses by calculating the so-called “Gravel – Overburden Ratio”. It is economical to develop the quarry if the gravel thickness is twice the thickness of overburden (G/O-ratio > 2.0m). The results of the assessment are contained in the “Quarry Organization Plan”. By mapping the selected test pits with ratio > 2.0m in a plan, the consultant determines as a first assessment, which part of the total area must be selected for excavation. At this point it must be stressed that it is the obligation of the contractor upon the start of contract implementation, to dig additional test pits at smaller intervals, to confirm the consultant’s findings, before he starts with costly operations such as overburden removal




**G = gravel**

**O = overburden**

| Self-Check 6 | Written Test |
|---|---|

**Directions:** Choose & write the letter of correct answer on the space provided under the blanket (10 pts)

1. The sample should be packed and tied and the following information shall be included?
    a) Project name
    b) project location/ sample location
    c) Unsuitability
    d) Date of sampling

2. economical to develop the quarry if the gravel thickness is twice the thickness of overburden (G/O-ratio > 5.0m)?
    a) true
    b) false

***Note:*** **Satisfactory rating – 5 & above points Unsatisfactory - below 5 points**

You can ask you teacher for the copy of the correct answers.

**Answer Sheet**

Score = _____

Rating: _____

Name: _____ Date: _____

**Short Answer Questions**

| Operation sheet—1 | investigate construction materials site |
|---|---|

**Direction: - investigate construction materials site**

**Procedures:-**

**Step.1** Apply OH&S requirements properly

**Step.2** selects appropriate tools and equipment

**Step.3** apply Land tenure and approval
**Step.4** locate Site property lines
**Step.5** investigate construction materials site
**Step.6** submitted testing report

**Quality Criteria:**

The depth, length and width of the road pavement to be construct by the given size.

| Operation sheet 2 | Conduct materials test |
|---|---|

**Direction: - conduct materials test**

**Procedures:-**

**Step.1** Apply OH&S requirements properly

**Step.2** selects appropriate testing tools and equipment

**Step.3** Procedure of Sampling

- The bore hole shall be advanced with any suitable technique. It is preferable to use rotary drilling in combination with drilling fluid for advancement of borehole; particularly, for deeper depths which limits the lengths of casing to the upper depths.

- In case of rotary drilling using drilling fluid, the drilling fluid of required consistency shall be kept continuously agitated in a tank by paddle or any other arrangement. This fluid shall be circulated through a drill rod during drilling operation. It is advantageous to use fish tail bit for such drilling.

**Step.4** Conduct materials test

4.1 perform specific field and laboratory materials test

**Step.5** evaluate material quality and quantity

**Step.6** submitted testing report

**Quality Criteria:**

The depth, length and width of the road pavement to be construct by the given size.

| LAP Test | Practical Demonstration |
|---|---|

Name: _____ Date: _____

Time started: _____ Time finished: _____

***Instructions:*** Given necessary templates, workshop, tools and materials you are required to perform the following tasks within 3 hours.

**Task 1-** investigate construction materials site

**Task 2-** perform materials test

## List of Reference Materials


- **LABOUR BASED ROAD CONSTRUCTION _97**
- **ERA manual**
- https://www.ilo.org/dyn/asist/docs/F1287477762/lb_road_course.pdf
- https://www.academia.edu/9753785/Obligations_and_Responsibilities_of_Civil_Engineers_for_the_Prevention_of_Labor_Risks_References_to_European_Regulations
- https://www.ungm.org/UNUser/Documents/DownloadPublicDocument?docId=765539
- . http://www.dot.ga.gov/PartnerSmart/Training/technician/Documents/StudyGuide9_22_04.pdf
- https://assets.publishing.service.gov.uk/media/57a08d7e40f0b649740018ba/R68524.pdf

# Road civil work

## Level II

## NTQF

# Learning guide 43

**Unit of Competence: Conduct and Support Pit Run Material Production Operation**

**Module Title: Conducting and Supporting Pit Run Material Production Operation**

**LG Code: CON RCW2 M11 LO3-43**

**TTLM Code: CON RCW2 TTLM 1019 v1**

## LO 3: Conduct, support and run production of borrow and selected materials, quarry materials, and natural sand operation

| Instruction Sheet | Learning Guide 43 |
|---|---|

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics –

- Acquisition of the quarry pit
- Develop Access road to the quarry site
- Selecting appropriate equipment for production
- Removing overburden materials
- Monitoring material production
- Stockpiling the produced material

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to –

- Obtain Acquisition of the quarry site
- Develop Access road to the quarry site
- Select appropriate equipment for production.
- Remove Overburden materials
- Support and conduct Material production from approved quarry.
- Monitor Material production process according to technical specification.
- stock pile The produced material ready

**Learning Instructions:**

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below
3. Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
4. Accomplish the “Self-checks”. in each information sheets.
5. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
6. If you earned a satisfactory evaluation proceed to “Operation sheets and LAP Tests if any”. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity.
7. After You accomplish Operation sheets and LAP Tests, ensure you have a formative assessment and get a satisfactory result;
8. Then proceed to the next information sheet

| Information Sheet-1 | Acquisition of the quarry pit |
|---|---|

## 1.1 Acquisition of the quarry pit

A quarry lease grants the lessee the exclusive right to remove material from a pit or quarry site. A lease term can be for a maximum period of ten years. The review process is extensive and involves various departments and agencies. Along with the quarry lease application the lease applicant is required to submit for review; plans for site development, site operation, environmental protection and site reclamation. Royalty is paid on material removed from the pit or quarry on a semi-annual basis

Before you start quarrying, you should have to ask permission from ministry of natural resource that found in your local area. Pit run base is a processed pit run material from local sources which may be specified on the Plans or in the Special Provisions for work where ordinary earth fill may not be satisfactory.

Companies who can demonstrate the need for the exclusive use of a pit or quarry may be eligible for a quarry lease.

## 1.2 Quarry Rights Administration

This section provides detailed information on quarry rights acquisition, maintenance and assessment

- **Materials Administration**

Applications and Permitting

- ✓ Cost of Permit/Lease:
  - Rental
  - Royalty
  - A non-refundable quarry permit application fee of must be submitted with the rental fee.
- ✓ Duration of Permit/Lease:
  - Quarry Permits are issued for up to 12 months and must be re-applied for within two months of the expiry date listed on the permit.
  - Quarry Leases are typically issued for a period of 5 years up to a maximum of 20 years.
- ✓ Condition(s) attached to Permit/Lease: different departments may set certain terms and conditions on the permit or lease in order for it to be approved.

- ✓ Administration of the Quarry Materials Act
  - Setting regulations to effectively administer the Quarry Materials Act
- ✓ Implementation of the Quarry Materials Act
  - Enforcing the Act and its regulations through quarry inspections

- **Materials Assessment**
  - ✓ Assessment of Quarry Materials
    - Aggregate source which deals with sand and gravel pits.
    - Rock source which deals with road-cuts and rock quarries.
    - Aggregate quality deals with the petrography and geological history of the source.
  - ✓ Management of Resource
    - After an assessment is done, it is decided what the resource may be used for (ex. asphalt, concrete aggregate, Class A or B material for road building or for fill material).
  - ✓ Implementation of the Quarry Materials Act
    - Enforcement of the Act and regulations relating to the Act.
- **Legislation**
    - Quarry Materials Act
    - Quarry Materials Regulations
- **Boundaries & Maps**

## 1.3 QUARRY PERMIT AND LEASE BOUNDARIES

**DISCLAIMER:** The Mineral Lands Division provides this information for reference only. Please note that this is a working file, and it does not contain all permit or lease boundaries issued to date. These boundaries/files have not been formally edited or peer reviewed and is based upon preliminary data and evaluation. The Mineral Lands Division assumes no legal liability or responsibility for any alterations, changes, representations or misrepresentations made by users or third parties with respect to the boundaries/files and original data. Users and third parties should consult with the Mineral Lands Division to ensure the originality and correctness of the materials and original data provided. The users of these boundaries/files and original data agree not to provide a digital reproduction or copy of same to a third party. Furthermore, the Mineral Lands Division assumes no liability of any nature or kind with respect to digital reproductions, copies of original products or for derivative products which may be made by or for third parties. Derivative products should acknowledge the source of the data upon which the products are based.

| Self-Check 1 | Written Test |
|---|---|

**Directions:** Choose & write the letter of correct answer on the space provided under the blanket (8 pts)

1. A quarry lease grants the lessee the exclusive right to remove material from a pit or quarry site. A lease term can be for a maximum period of thirty years?
   a) True
   b) False
2. _____Is the Assessment of Quarry Materials?

a) Aggregate source which deals with sand and gravel pits.
b) Rock source which deals with road-cuts and rock quarries.
c) Aggregate quality deals with the petrography
d) geological history of the source
e) all

***Note:*** **Satisfactory rating – 4 & above points Unsatisfactory - below 4 points**

You can ask you teacher for the copy of the correct answers.

**Answer Sheet**

Score = _____

Rating: _____

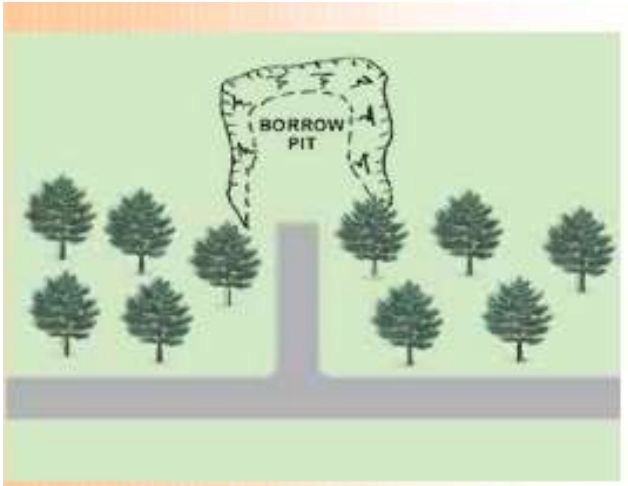
Name: _____ Date: _____

| Information Sheet 2 | Develop Access road to the quarry site |
|---|---|

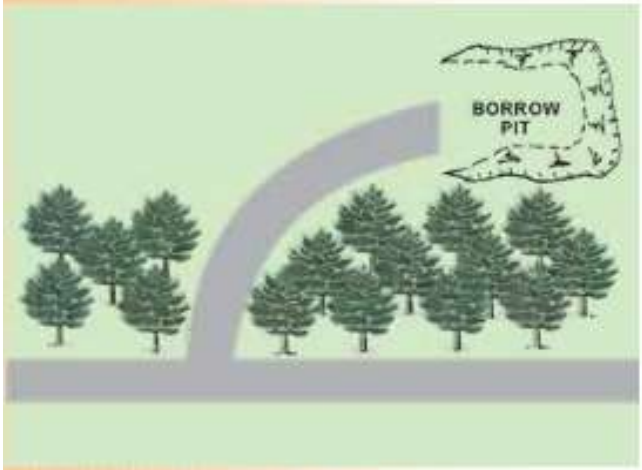
## 2.1 Access Roads for quarry site

The following recommendations relate to the provision of access tracks to borrow pits:

- ✓ Access tracks should be designed to be strong enough to carry the expected haulage traffic without significant deformation. Economies of construction may easily be outweighed by increased haulage costs (refer Section 9.3).
- ✓ Adequate provision should be made for cross drainage and for side drainage in order to prevent soil erosion, sediment pollution or road closure due to flooding.
- ✓ Pit access tracks should be aligned in such a way that they cause minimum disturbance to the local population and the environment. They should be located at a safe distance from permanent dwellings and if necessary fencing should be provided to protect local people and livestock.
- ✓ The route of an access track may be used to reduce the visual intrusion of pit located close the road being supplied.




Undesirable access route




Preferred access route

| Self-Check 2 | Written Test |
|---|---|

***Instructions**:* **Directions:** write the letter of correct answer on the space provided under the blanket (8 pts)

1. Access tracks should be designed to be strong enough to carry the expected haulage traffic without significant deformation.
   a) True
   b) False
2. Pit access tracks should not be aligned in such a way that they cause minimum disturbance to the local population and the environment.
   a) True
   b) False

***Note:*** **Satisfactory rating – 4 & above points Unsatisfactory - below 4 points**

You can ask you teacher for the copy of the correct answers.

**Answer Sheet**

Score = _____

Rating: _____

Name: _____ Date: _____

| Information Sheet-3 | Selecting appropriate equipment for production |
|---|---|

### 3.1 Selecting production equipment

With only a few maple trees and a basic understanding of how to collect and produce aggregates, the person who quarries the stone can produce their own high quality stones. The equipment needed is easily purchased. The materials such as chisel etc

### 3.2 Construction planning and controlling procedures

- Master program (only key mile stone activities ….)
- Construction program (derived from the master schedule)
  - ✓ Work schedule
  - ✓ Resourcing schedule
  - ✓ Budget planning and control
  - ✓ Procurement planning
- Material Production program Work schedule
  - ✓ Set out project group and areas with description
  - ✓ Make sequential list of each group
  - ✓ Determine resource type, quantity and output rate for each activity.
  - ✓ Calculate duration using the output rate and which is acceptable by the company.

- **Orientation on production rate and schedule**
  - ✓ Production rate (the site /construction manager shall introduce the workers production rate, used by the project engineer while the work schedule of the project is prepared, to the section supervisor, trade foreman and workers.
  - ✓ Standard construction output rate have been developed by MOUCM.
  - ✓ Construction manager shall orient to his subordinate about master schedule of the project and he shall prepare monthly and weekly work program in detail from the master schedule and distribute them to the section supervisor and foreman

### 3.3 Material Production Resource schedule

- Manpower schedule
  - ✓ Derived from the list of resources assigned to develop the work schedule
  - ✓ Timely deployment to take labor utilization
  - ✓ Review manpower assigned to each activity in the scheme

- ✓ List manpower by quantity and duration
- ✓ Draw man power using histogram.

- Equipment schedule
  - ✓ Review resources assigned to each resources
  - ✓ List of equipment by type, power and capacity
  - ✓ Construction Material quantity
- Budget planning and control
  - ✓ Review resource type ,quantity and duration from set of resources , Summarize resources under each cost categories including type, quantity and duration , Determine resource unit cost, calculate required budget based on type quantity and duration , include other miscellaneous costs. And Set cash inflow and outflow
- Procurement planning
  - ✓ Timely arrival of materials

| Self-Check 3 | Written Test |
|---|---|

**Directions:** Choose & write the letter of correct answer on the space provided under the blanket (8 pts)

1. _____Is not Manpower schedule
   a) Timely deployment to take labor utilization
   b) Review manpower assigned to each activity in the scheme
   c) Budget planning and control
   d) List manpower by quantity and duration
2. _____Is not Equipment schedule
   a) Review resources assigned to each resources
   b) Derived from the list of resources
   c) List of equipment by type, power and capacity
   d) Construction Material quantity

***Note:*** **Satisfactory rating – 5 & above points Unsatisfactory - below 5 points**

You can ask you teacher for the copy of the correct answers.

**Answer Sheet**

Name: _____ Date: _____

Score = _____

Rating: _____

| Information Sheet 4 | Removing overburden materials |
|---|---|

## 4.1 Removing overburden materials

During construction, to make the sites easy and workable the construction sites must be clear and clean. These removed materials may be of different types: Dry wastes, liquid wastes, and may also be overburden materials.

Overburden will be managed in several ways. The vast majority of peat and clay overburden that needs to be removed to gain access to the ore reserves and to build infrastructure will be stored in an Overburden Disposal Facility (ODF). Low permeability clays will be salvaged and stockpiled in sufficient quantities to enable the construction of low permeability liners where required. For example, a low permeability liner will be installed on the upstream side of the Tailings.

Dredging was selected as an overburden management option for the Open Pit, because of logistical challenges, tight scheduling issues, and capital and operational costs related to safe disposal of mechanically excavated overburden. Dredged material will be deposited in the ODF. Victory Nickel is also considering using mechanical equipment to remove the overburden material from the pit area. The mechanical removal option of the overburden will be undertaken during the winter months.

- **Peat Overburden**

The in-situ peat is unsuitable for construction purposes, but it may have potential for use in site reclamation. If pre-loaded, the peat may be used as foundation material for structures that are not sensitive to settlements, such as waste rock dumps. Pre-loading tests on the peat were not carried out for determination of consolidation characteristics. These tests will be conducted during the detailed engineering design phase.

- **Clay Overburden**

The construction of water containment structures and dykes across the site will require low permeability materials

Geotechnical investigations and the results of laboratory tests on selected clay samples may be summarized as follows:

- ✓ The optimum moisture content ranged from 16.3% to 18.6% at standard Proctor maximum dry densities ranging between 1,600 and 1,752 kg/m3.
- ✓ It was found that site areas with shallow thickness of overburden contained stiff clays that exhibited natural moisture contents close to the optimum for compaction.

- ✓ Recovery of clays from perennially flooded terrain will pose formidable logistical challenges as the muskeg/peat is water logged. More specifically, these areas will require that the muskeg/peat is beamed off so that the upper stiff clay may be excavated in a “dry” condition. Also, clays may experience moisture uptake during excavation even if the borrow areas are Beamed off.

- **Overburden Removal using Mechanical Equipment**

Victory Nickel is evaluating alternative options to hydraulic methods as the removal of the material using conventional methods (excavator, load, haul) are generally feasible during the winter months. There will be additional impacts should VNI decide to use mechanical methods.

.

| Self-Check 4 | Written Test |
|---|---|

***Instructions**:* **Directions:** Choose & write the letter of correct answer on the space provided under the blanket (6 pts)

1. During construction, to make the sites hard and unworkable the construction sites must be clear and clean?
    a) True
    b) False
2. The in-situ peat is unsuitable for construction purposes, but it may have potential for use in site reclamation?
    a. True
    b. False

***Note:*** **Satisfactory rating – 3 & above points Unsatisfactory - below 3 points**

You can ask you teacher for the copy of the correct answers.

**Answer Sheet**

Score = _____

Rating: _____

Name: _____ Date: _____

| Information Sheet 5 | Monitoring material production |
|---|---|

## 5.1 Monitoring material production

Aggregate production: There are many ways to produce aggregate and rock products for road construction and maintenance activities. In some cases, rock of sufficient quality can be obtained by excavation into a road cut or other exposure. This can be placed on the road as is, or improved through processes such as blasting, ripping, screening, crushing, sorting and/or mixing. Aggregate production normally requires crushing and screening to produce consistent (reliable products) for road surfacing uses. Procedures for management of major quarries include:

- ✓ Thorough field investigation of the rock source.
- ✓ Classify source materials using the Unified Rock Classification System (URCS) to determine best potential products and uses.
- ✓ Perform topographic surveys of the rock source development area(s).
- ✓ Prepare a geologic model that displays materials distribution, plan and profiles, cross sections and initial volume calculations.
- ✓ Verification of the geologic model by sub-surface testing (excavation, drilling)
- ✓ Develop a quarry management plan, including aggregate/rock specifications and any special development requirements.
- ✓ Test aggregate/rock during production, including visual and sieve analyses.
- ✓ Monitor aggregate performance during uses.

## 5.2 Supervisor should carry out following checks:

- ✓ Check that a proper excavation plans for the quarry is implemented, allowing smooth flow of traffic.
- ✓ Check that the excavated gravel is not mixed with overburden.
- ✓ Check that the laborers engaged in the excavation and loading operation, have payment conditions related to fair daily task rates.
- ✓ Check that the haulage equipment, depending on the quality of the haul route, is loaded to its correct capacity.
- ✓ Check that at the end of the day, at least one daily production of gravel is stock piled in the quarry.
- ✓ Advise contractors on labor allocation in the quarries.

- **Responsibilities of the site supervisor**
  - ✓ To plan to carry out the work
  - ✓ To plan which work is going to be done
  - ✓ To organize your workers
  - ✓ To give clear instructions on the work to be done
  - ✓ To motivate and encourage workers to perform well
  - ✓ To control the work on the site
  - ✓ To correct the work
- **Labor Supervision**
  - ✓ Break up projects into smaller work packages
  - ✓ Divide the project direct manpower into several construction crew
  - ✓ Assign a group of crew to each work package of the project to be headed by a section supervisor….
  - ✓ Ensure that each crew is fully supported with design and drawings and other resources.

| Self-Check 5 | Written Test |
|---|---|

***Instructions**:* **Directions:** Choose & write the letter of correct answer on the space provided under the blanket (6 pts)

1. _____Is the Supervisor should carry out following checks except?
   a) Check that the excavated gravel is not mixed with overburden.
   b) Check that the laborers engaged in the excavation and loading operation, have payment conditions related to fair daily task rates.
   c) Advise supervisor on labor allocation in the quarries
   d) Check that the haulage equipment, depending on the quality of the haul route, is loaded to its correct capacity.

2. _____ is not Responsibilities of the site supervisor

   a) To organize your workers

   b) To give budget on the work to be done

   c) To motivate and encourage workers to perform well

   d) To control the work on the site

***Note:*** **Satisfactory rating – 3 & above points Unsatisfactory - below 3 points**

You can ask you teacher for the copy of the correct answers.

**Answer Sheet**

Score = _____

Rating: _____

Name: _____ Date: _____

| Information Sheet 6 | Stockpiling the produced material |
|---|---|

## 6.1 Stockpiling the produced material

The produced materials must be stockpiled properly for further. This stockpiled material must be checked. During stockpiling, the material that will be collected at that place should have to be quarried from the same quarry. Stockpiles shall be built at locations specified in the Contract Documents to a maximum height of 3 m. Stockpiles shall be constructed in such a manner that compaction, other than by the weight of the material itself, shall not result. Equipment shall not be run over the surface of the stockpile

- **Stockpile design**

Given the various drawbacks of stockpiles as an intermediary step in remediation, the following principles should be used. When designing stockpiles:

- ✓ Wherever possible, stockpiling should always be preceded by in-situ sampling and mapping of the contaminant concentrations. This in situ information should be used to identify areas that are sufficiently homogeneous that the mixing of material from different contamination categories is avoided.

- ✓ To minimize the possibility of misclassification of contaminated material, the size of stockpiles must be kept relatively small, especially when the material is in the vicinity of any very highly contaminated in situ samples. Stockpiles should never exceed 50 $m^3$ when any of the stockpiled material is within 50 m of an in situ sample in which the contamination exceeds the concentration for BC Environment's \special waste" category. In no situation should stockpiles ever exceed 250 $m^3$.

- **Stockpile sampling**

Though proper stockpile sampling is difficult, it is not impossible. Three appropriate methods for sampling a stockpile are:

- ✓ If the stockpile is small, create a random sub-sample by shoveling the pile into two separate piles, with one shovelful in every N shovels being randomly selected to go into the smaller pile that will form the sub-sample. With this approach, the selection of N depends on the size of sub-sample we can manage. If we need a small sub-sample, this random splitting of the entire pile may have to be repeated two or more times to obtain an appropriate sub-sample.

- ✓ If the stockpile is too large for the previous procedure to be pragmatic, then collect samples at a regular spacing from vertical borings that completely penetrate the pile. These vertical borings should either be located randomly on the pile or should be located on a regular grid that covers the areal extent of the pile. In this approach, if the discrete samples from a single vertical boring are composited to produce a single analysis for each vertical boring, then the calculation of the average concentration in the entire stockpile should recognize that the borings have different lengths. Estimating a global mean describes how to accommodate different weights in the estimation of a global mean and in the quantification of the uncertainty on such an estimate.

- ✓ As the stockpile is being created, whether by a shovel, by a loader, or by a series of dumped truckloads, the material can be randomly sampled as it accumulates. This approach to stockpile sampling ensures that some samples from the core of the ultimate stockpile will be available when it comes time to classify the material. As an example, if we are building a 200 m3 stockpile by dumping 10 m3 truckloads, then we could choose a random sample from each truckload immediately before it is dumped. By the time the entire stockpile has been created, we will have twenty samples that do a much better job of fairly representing the entire pile than any twenty samples we could collect from the surface of the ultimate pile.

  Regardless of the method used to collect stockpile samples, the sampling program should be accompanied by a QA/QC program that monitors and documents the reliability and repeatability of the sample analyses.

- **Classification of stockpiled material**

  When an entire stockpile is being classified, there are two questions that need to be considered:

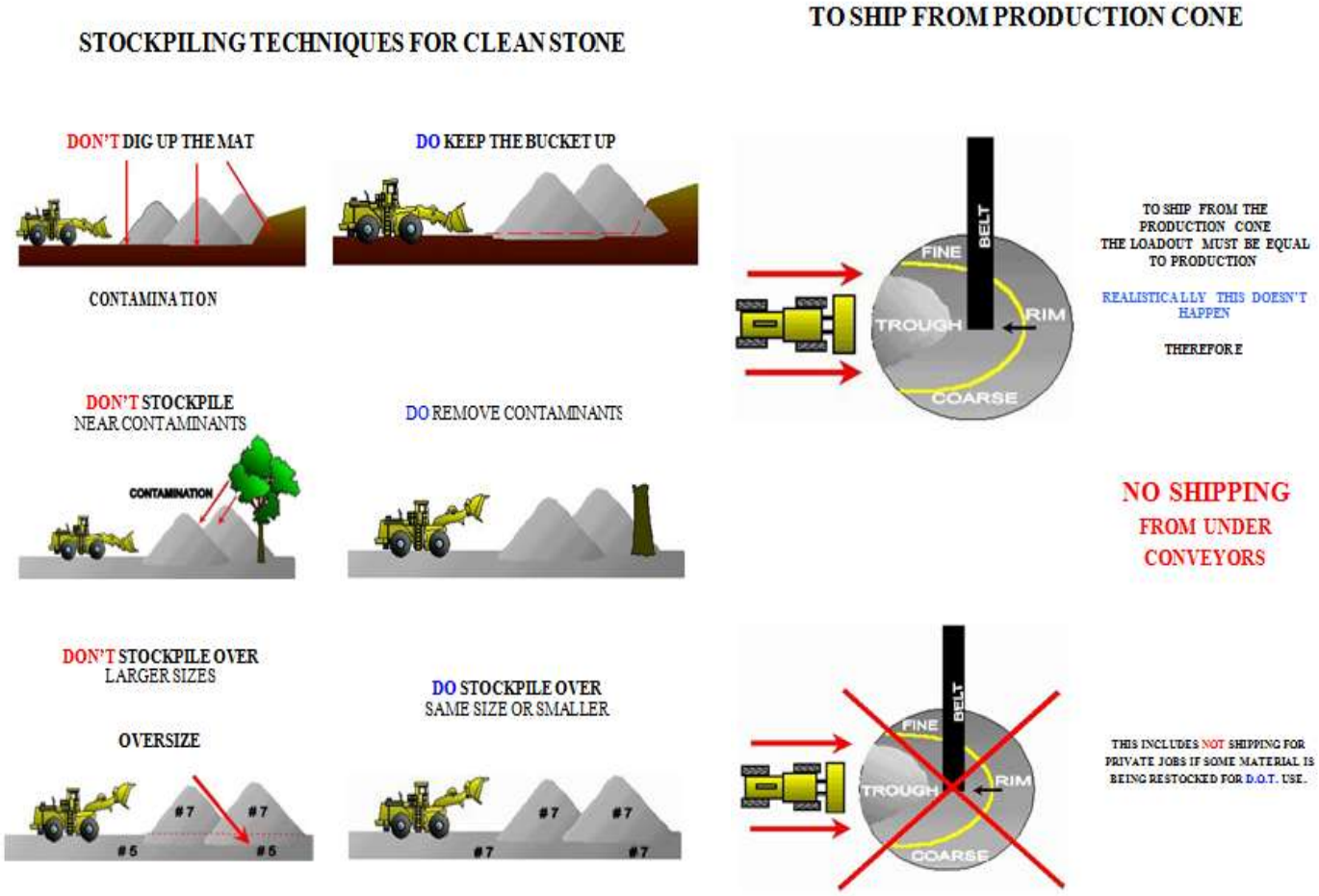
  - ✓ Is the average contaminant concentration in the entire pile above or below the classification threshold?
  - ✓ Is the pile sufficiently homogeneous that classification on the estimated mean is appropriate?

- **Recommended practice**
  - ✓ Stockpiles should be created only where in situ sampling has confirmed that the material being stockpiled is homogeneous, with a coefficient of variation of one or less.
  - ✓ Stockpile sampling programs should be designed to ensure a fair representation of the contaminant concentrations in the entire pile. Particular attention should be paid to the possibility that the concentrations in the core of the pile are different from those on the surface.

- ✓ If the standard deviation of the available analyses is larger than their mean, then the stockpiled material should be classified according to whether the highest analysis is above or below the classification threshold.

- ✓ If the stockpiled material is classified as being above the threshold for the reasons, then the stockpiling practice is not accumulating homogeneous material; in this event, the stockpiling practice should not continue until the reasons for lack of homogeneity have been documented and corrective action has been taken.

- ✓ Though the classification of stockpiled material may make use of composite samples, all of the discrete samples should be analyzed separately for at least one in every ten of the stockpiles. If the analyses of the discrete samples have a coefficient of variation greater than one, then the stockpiling practice should not be continued until further in situ sampling and data analysis allow more homogeneous regions to be identified.
- ✓ As with any sampling program, stockpile samples should be accompanied by a QA/QC study that allows the quality of the analytical values to be monitored and documented.



| Self-Check 4 | Written Test |
|---|---|

***Instructions**:* **Directions:** Choose & write the letter of correct answer on the space provided under the blanket (6 pts)

1. The produced materials must be stockpiled properly for further?
    a) True
    b) false
2. Stockpiles is not shall be built at locations specified in the Contract Documents to a maximum height of 6 m?
    a) True
    b) False
3. If the stockpile is too large for the previous procedure to be pragmatic, then collect samples at a regular spacing from vertical borings that completely penetrate the pile?
    a) True
    b) False

***Note:*** **Satisfactory rating – 3 & above points Unsatisfactory - below 3 points**

You can ask you teacher for the copy of the correct answers.

**Answer Sheet**

Score = _____

Rating: _____

Name: _____ Date: _____

| Operation sheet 1 | produce construction pit materials |
|---|---|

- **Direction: - produce construction pit materials**

**Procedures:-**

**Step.1** Apply OH&S requirements properly

**Step.2** selects appropriate testing tools and equipment

**Step.3** produces construction pit materials

**Step.4** submitted testing report

**Quality Criteria:**

The depth, length and width of the road pavement to be construct by the given size.

| LAP Test | Practical Demonstration |
|---|---|

Name: _____ Date: _____
Time started: _____ Time finished: _____

**Instruction:-** given necessary tools & materials you are required to perform the following tasks with in 2hr.

**Tasks 1-** produce construction pit materials

## List of Reference Materials


- **LABOUR BASED ROAD CONSTRUCTION _97**
- **ERA manual**
- https://www.ilo.org/dyn/asist/docs/F1287477762/lb_road_course.pdf
- https://www.academia.edu/9753785/Obligations_and_Responsibilities_of_Civil_Engineers_for_the_Prevention_of_Labor_Risks_References_to_European_Regulations
- https://www.ungm.org/UNUser/Documents/DownloadPublicDocument?docId=765539
- . http://www.dot.ga.gov/PartnerSmart/Training/technician/Documents/StudyGuide9_22_04.pdf
- https://assets.publishing.service.gov.uk/media/57a08d7e40f0b649740018ba/R68524.pdf

The trainers (who developed the LEARNING GIDE)

| No | Name | Qualification level | TVET College |
|---|---|---|---|
| 1 | ABRHAM GEREMEW | B | (BAHIR DAR Polly Technique College) |
| 2 | TEMESGEN DESSE | B | ( HARAR Polly Technique College) |
| 3 | HABTAMUSHIMELS | BSc | (NIFAS SILK Polly Technique College) |
| 4 | HABIB SURUR | B | (HAWASA Polly Technique College) |

The facilitator (who approved the LEARNING GIDE)

| No | Name | Qualification level | TVET Bureau |
|---|---|---|---|
| 1 | AYELE ESHETE | A | ( ADIS ABABA TVET Bureau) |

# Answer key lo 1

| Self-Check 1 | Written Test Answer key |
|---|---|

1. B,  Hard hat
2. A. mask

| Self-Check 2 | Written Test Answer key |
|---|---|

1. C, Land tenure and approval for use
2. B, Geotechnical site investigation
3. A, true

| Self-Check 3 | Written Test Answer key |
|---|---|

1. D, Bulldozer
2. C, Leveling
3. B, Excavator
4. A, Sieve and Pan

| Self-Check 4 | Written Test Answer key |
|---|---|

1. C, Wastage material place
2. B, 200m
3. B, false
1. B, false

| Self-Check 5 | Written Test Answer key |
|---|---|

1. B, Governmental taxation
2. A, True

| Self-Check 6 | Written Test Answer key |
|---|---|

1. B, true
2. C. Quarry managers
3. A. False

| Self-Check 7 | Written Test Answer key |
|---|---|

1. b, Water
2. a), Noise
3. d), Erosion

# Answer key lo 2

| Self-Check 1 | Written Test Answer key |
|---|---|

1. A, true
2. C, Geological information in population growth

| Self-Check 2 | Written Test Answer key |
|---|---|

1. A, true
2. D, The quarry should contain sufficient

| Self-Check 3 | Written Test Answer key |
|---|---|

1. A, false true
2. B, travelling speed over 80 km/h

| Self-Check 4 | Written Test Answer key |
|---|---|

1. A, false
2. B, Determine manpower history

| Self-Check 5 | Written Test Answer key |
|---|---|

1. A, true
2. B, false

| Self-Check 6 | Written Test Answer key |
|---|---|

1. A, Unsuitability
2. B, false

# Answer key lo 3

| Self-Check 1 | Written Test Answer key |
|---|---|

1. B, false
2. E, all

| Self-Check 2 | Written Test Answer key |
|---|---|

1. a. true
2. b. false

| Self-Check 3 | Written Test Answer key |
|---|---|

1. C, Budget planning and control
2. B, Derived from the list of resources

| Self-Check 4 | Written Test Answer key |
|---|---|

1. B, False
2. A, True

| Self-Check 5 | Written Test Answer key |
|---|---|

1. C, Advise supervisor on labor allocation in the quarries
2. B, To give budget on the work to be done

| Self-Check 6 | Written Test Answer key |
|---|---|

1. A, True
2. B, False
3. A, True