



BASIC INFRASTRUCTURE OPERATIONS

NTQF Level I

Learning Guide-56

Unit of Competence: Spread Asphalt by Hand Module

**Title: Spreading Asphalt by
Hand**

LG Code: CON BIO1 M14LO-1LG-56

TTLM Code: CON BIO1TTLM 019v1

LO 1: Plan and prepare



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

- Compliance documentation
- Safety requirement during construction
- Identifying and implementing traffic management plan
- Selecting Tools and Equipment's
- Identifying and applying Environmental protection

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:**

- Access, interpret and apply compliance documentation relevant to the work activity
- Obtain and confirm safety requirements from the site safety plan and organizational policies and procedures, and apply to the allotted task
- Identify, obtain and implement signage requirements from the project traffic management plan
- Select tools and equipment to carry out tasks consistent with the requirements of the job, check for serviceability and rectify or report any faults
- Identify, confirm and apply environmental protection requirements from the project environmental management

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 6.
3. Read the information written in the information “Sheet 1, Sheet 2, Sheet 3, Sheet 4” and Sheet 5.
4. Accomplish the “Self-check 1, Self-check t 2, Self-check 3, Self-check 4” and Self-check 5” **in page -4, 8, 11, 15, and 18** respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1, Operation Sheet 2 and Operation Sheet 3” **in page -19,21.**
6. Do the “LAP test” **in page – 22** (if you are ready).



1.1. Documentation

Documentation is essential to all aspects of every worksite. From environmental plans through to extraction plans, documentation exists that outlines what to do, when to do it and how it is to be done.

Compliance documentation is the name given to the documents that require you to undertake tasks in a particular way or to meet a given standard. Every civil construction worksite will have site-specific requirements that will be outlined during your initial induction. Staff should be notified of changes to compliance documentation during tool box meetings, staff news letters or other established forms of communication used on the site.

As a civil construction supervisor, you will be working extensively with compliance documentation, both in your work activities and for the work activities of those people you are supervising. The range of compliance documents on your work site may include:

- Legislative, organizational and site requirements and procedures, e.g. for Occupational Health & Safety/Work (OHS/WHS), environmental protection, licensing requirements, personnel/workers training records.
- Site specific policies and procedures.
- Codes of Practice.
- Employment and Workplace Relations legislation.
- Ethiopian guidelines and specifications e.g. EBCS (Ethiopian building codes of standards).
- Manufacturer's guidelines and specifications, e.g. machinery pre-start checklists, service requirements, vehicle operators' manuals, vehicle specifications (operating capabilities and limits).
- Equal Employment Opportunity and Disability Discrimination legislation

1.2. Interpret compliance documentation

When interpreting compliance documents for others, ensure you are giving the other person detailed information as to what is expected of them. As a supervisor in a civil construction site, you must be able to interpret compliance documentation for yourself and for members of your team.

When interpreting documents it is vital that you understand the difference between words such as should, consider and must.

- **Should:** indicates a preferred course of action, if you take a different course of action you will need to be able justify this in the event of an accident or incident
- **Consider** -means that you have a choice of action and need to select the action. that will give the best and safest result for the particular circumstances.
- **Must /mandatory:** means that the action is a legal requirement and must be complied with. Your statutory compliance requirements and procedures must be met. These statutory requirements and procedures are the minimum level of performance,



responsibilities and duties that are set by local, state and federal government. Each statutory compliance requirement will change between states, between sites and between tasks completed on the site. It is essential that each supervisor inform themselves of the requirements that must be met for each particular task and location. While some of the compliance requirements may be similar, such as compliance with OHS requirements, others will vary greatly depending on the environmental conditions, work processes and tasks being undertaken.



Self-Check -1

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

1. _____ is essential to all aspects of every worksite. (3 points)
- A. Legislative C.
 - staff
 - B. Documentation D.
 - Service
2. -----is the name given to the documents that require you to undertake tasks in a particular way or to meet a given standard.
- A. civil construction C. Compliance documentation
 - B. communication D. mandatory

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____

- 1. -----
- 2. -----



**2.1.****Safety 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, overalls, etc. to the workers is essential.
- Use of diesel 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. A number of parties are involved with safety during construction namely:
 - The traveling public using the facility/road under construction.
 - The contractor executing the work.
 - The client/consulting engineer responsible for designing, specifying and supervising the contract.
 -

The Occupational Health and Safety has important implications for the contracting parties and it is important that the parties are conversant with the act and its implications, as it affects the execution of the work; and that the necessary Health and Safety Plan is in place in accordance with the client's Health and Safety Specifications.

2.2.**Safety precautions**





- Always use protective clothing when operating spray equipment, i.e. gloves, boots and overalls.
- Use a flint gun and not matches to light the burner.
- Make sure all valves are closed on the gas cylinder when finished spraying.
- Store the gas cylinder in a safe place on completion of spraying.
- Do not use diesel for cleaning spray equipment or hands.

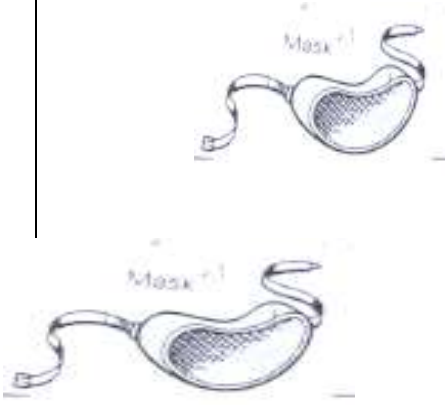



2.3. and shoes

Personal Safety, Working Clothes

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

Table-2.1 Personal paratacttic equipment

Name	Type	Use
<p>Figure2.1 Overall clothes</p>		<p>Overall clothes: - protects the normal clothes from dusts, grease, bitumen and the other spilling materials.</p>
<p>Figure 2.2. Helmet/hard hat</p>		<p>Helmet/hard hat: - protect head of the worker from any falling objects dropping from high level during construction.</p>
<p>Figur2.3. Safety shoes/ Boots</p>		<p>Safety shoes/boots: - Protects the worker from nails, sharp objects and heavy falling objects by hard rolled leather shoes with metal toe caps.</p>
<p>Figure2.4 Rubber boot</p>		<p>Rubber boot: - Protects the workers feet from colds; chemicals and mud or mortar in the work area.</p>

<p>Figure2.5 Mask</p>		<p>Mask: - Protects eyes of the worker from other endangering objects and dust during construction.</p>
<p>Figure2.6 Gloves</p>		<p>Gloves: - Protects the workers from oils, chemicals, dust and other dangerous material that affect the skin and hand fingers.</p>
<p>Figure2.7 Google</p>		<p>Google: - protects eyes of the workers during welding of metal works and when placing reinforcement in the formwork. Google with safety glass or plastic lenses.</p>
<p>Figure2.8. First aid</p>		<p>First aid First aid is an immediate care given to a person who has been injured or suddenly ill. It includes self-care & home care if medical assistance is not available. A building site should have a first aid box which as minimum contents: -</p> <ul style="list-style-type: none"> • Plasters; • Bandages; • Ointments; • Disinfectant.



Self-Check -2

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

1. Which one of the following to protect head at the worker from falling object?

A) Helmet	C) Mask
B) Safety shoes	D) None of the above
2. A safety shoe is to protect the workers from oils, chemical etc.

A. true	B. false
---------	----------
3. _____ Protect the eyes of the workers.
4. A simple first aid box minimum contents of?

A) _____
B) _____
C) _____
D) _____

Note: Satisfactory rating - 3 points Unsatisfactory - below 3 points

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

Answer Sheet

Score = _____

Rating: _____

Name: _____

Date: _____

Short Answer Questions

1. _____
2. _____
3. _____
4. _____

Information Sheet-3	Identifying and implementing traffic management plan
----------------------------	---

3.1. implementing traffic management plan

Traffic safety in construction zones is an integral and high priority element of every project from planning through design and construction. Similarly, maintenance and utility work should be planned and conducted with the safety of road users and workers kept in mind at all times. Traffic signs conforming to the regulation must be correctly placed before starting any work this is to ensure the safety

- Of the road users
- Of the personal working on the site
- Of the vehicles and equipment to be used on the site



Figure.3.1 Road Work Sign

The sign lay-out shown warning signs should be placed before work starts and must be placed in the following order.

- Men working signs should be placed at the approaches to the work area.
- Road clear signs should be placed at the end of the work area.
- Men working signs should be placed 200m in front of the working area.

Above all, ensure that traffic control is in place and being heeded by both the public and the paving crew. Even then, the crew should always maintain an awareness of the nearby traffic and protect a clothier. Traffic causes more injuries and fatalities than any other aspect of road construction.



3.2. Safety of road users/public

The safety of the public is materially affected by the actions of the contractor and his staff i.e. the manner in which traffic is accommodated during construction, the erection of suitable road signs and warning devices and adherence by the workers to these road signs and other safety arrangements.



Figure.3.3 Erection of suitable road signs and warning



Self-Check -3

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

1. _____ is an integral and high priority element of every project from planning through design and construction. (3 points)

- A. Analyzing information
- B. Interpreting information
- C. Traffic safety
- D. Gathering information

Answer Sheet

Score = _____

Rating: _____

Name: _____

Date: _____

1. _____



Information Sheet-4	Selecting Tools and Equipment's
----------------------------	--

4.1. Tools and Equipment

Labour-based construction methods require an adequate number of hand tools and equipment to successfully carry out the task. Most are relatively inexpensive, either already in the possession of the local labour force or are easily obtained. In addition, small mechanized plant that a contractor may have should be employed whenever possible. The plant will provide the means to more accurately meet construction requirements and speed up the work.

The tools and equipment that are thought essential for various types of labour based work are listed below. the numbers of each item required will be depend on the nature of the surface treatment and the size of the construction project.

4.2. Select consistent tools and equipment

4.2.1 Particular plant required for labour-based construction can include those described **Table-3.1 Tools and equipment**

Name	Type	Use
Figure4.1 Rake		<p>Rakes and Spreaders tools Rakes are used in road works for raking out vegetation from loose soil. Commercially produced rakes have 10 to 16 teeth, each about 75 - 100mm long, with an overall length about 400- 450mm. Spreaders are useful when forming the camber and when spreading gravel. Spreaders are made of sheet metal (2 - 3mm thick) with ridges on one side, which are used to level the road surface according to set levels and gradients.</p>
Figure4.2. Straight edge		<p>Straight edge this is a perfectly straight metal/aluminum/ with all long and short edges parallel to its centerline. It is employed to check straight alignments of walls. Together with the sprit</p>

		<p>level,. A straight edge/Level/ can also be made from a wooden plank with perfectly parallel edges.</p>
<p>Figure4.3.Shovel</p>		<p>Shovels can be used to throw soil up to about 4 m. If a longer distance is needed, only a very strong worker will be able to throw soil further than 4 m, perhaps up to 6 m or 7 m.. Excavation productivity is lower if the soil has to be thrown or carried over a distance.</p>
<p>Figure4.4. String</p>		<p>String Alignment string /mason line/, sometimes called, Fish line, is rope used to transfer horizontal & vertical alignments or lines, i.e., use to mark base line on the floor or vertical point alignments of wall. In other words, it is used to align the walling blocks, (stone, bricks, concrete blocks, hydra form etc). It is available in different thickness & sizes in the market.</p>
<p>Figure4.4. Hand rammers</p>		<p>Hand rammers are used for compacting soil and gravel. It consists of a weight with a long handle. The effectiveness of a hand rammer depends on its weight and the area that hits the ground. Ideally, the weight should be as heavy as possible and the area as small as possible (without the rammer penetrating the soil). The weight can be made of various materials such as steel, concrete or solid wood. Rammers made from concrete or wood can be manufactured locally.</p>





Self-Check -4

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

- 1. _____ are used in road works for raking out vegetation from loose soil. (2.5 points)
 - A. Analyzing information
 - B. String
 - C. Fish line
 - D. Rakes

- 2. -----is a perfectly straight metal/aluminum/ with all long and short edges parallel to its centerline. (2.5 points)
 - A. Straight edge
 - B. String
 - C. Fish line
 - D. Rakes

- 3. -----are used for compacting soil and gravel. It consists of a weight with a long handle. (2.5 points)
 - A. Straight edge
 - B. String
 - C. Hand rammers
 - D. Rakes

- 4. -----is rope used to transfer horizontal & vertical alignments or lines, i.e., use to mark base line on the floor or vertical point alignments of wall. (2.5 points)
 - A. Fish line
 - B. Hand rammers
 - C. Shove
 - D. Rakes

Note: Satisfactory rating – 10 points Unsatisfactory - below 5 points
You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____

- 1 -----
- 2 -----
- 3-----
- 4-----

**5.1 Environmental protection requirements**

- Safety precautions have to be followed
- Economical aspects has to be taken into account
- Environmental protection has to be considered
- Should ensure that adequate support personnel are available
Asphalt spray
- Should be checked adequate tools, equipments and other auxiliary tools are on site.

This Environmental Protection Plan (EPP) describes conceptual environmental protection measures that will limit the environmental disturbances associated with the project's design and construction.

- Anchor fields, including well sites, production facilities and flow lines
- Gathering pipelines and the gas pipeline
- Access roads
- facility sites

5.2 Construction environmental management plans (CEMP)

Construction activities include demolition work, site preparation, road maintenance or repair work, the operation of vehicles entering or leaving the construction site, and activities, at or within the immediate vicinity of a construction site, of persons who perform work at the site, or work connected with work at the site. Air emissions, noise, site contamination, waste, and water quality need to be managed to prevent impacts on the land subject to development, and on nearby land uses and the natural environment. Construction activities can affect the amenity value of an area, interfering with the enjoyment of that area by people who may live in or use it. Causing an 'environmental nuisance' is an offence under the Environment Protection for which a person could be prosecuted.

5.2.1 Construction Waste Construction waste will be generated as a result of road rehabilitation. All construction waste that has been generated will be recycled or placed in designated disposal sites and covered with soil.

5.2.2 Water Quality During construction phase, the bridges, side drains, miter drains and culverts will require cleaning, de-silting, reshaping and repair. Some of the drains and culverts might be prone to soil erosion, which will result in siltation of nearby water courses. Also impacts on water quality may be caused by contaminated run-off of petroleum product spillages, leakages from storage areas and heavy vehicles, improper disposal of used oils and from hydraulic fluids which enters the nearby surface water sources. Similarly, easily eroded destabilized soils may be washed into surface water sources and cause siltation and



sedimentation which will reduce the water quality. Activities that will give rise to this impact include construction of detours, access roads, drainage channels, excavation and grading works. During construction phase water will be needed for various purposes such as for watering down the dust. Abstraction of water in large quantities from local sources may lead to water shortage to the local community. This impact is considered significant. In some section of the road, labour force will put up temporary camps and will require sanitation facility such as pit latrines. Construction of sub-standard pit latrines for campsite labour force will contaminate groundwater through seepage to groundwater.

5.2.3 Noise management will be limited to standard sound retarding devices on all operational vehicles as recommended by the manufacturer.

Noise generated from operations at the project site is not expected to impact on local communities due to the distances between the operations area and areas of habitation. However, the Environmental Management unit from Roads Department will investigate any noise complaints received.



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

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

1. _____ is an offence under the Environment Protection for which a person could be prosecuted. (3 points)

- A. Construction
- B. Interpreting

- C. updating information
- D. environmental nuisance

Note: Satisfactory rating – 3 points

Unsatisfactory - below 3 and 4 points

Answer Sheet

Score = _____
Rating: _____

Name: _____ Date: _____

1. _____



Operation Sheet 1	The techniques for identifying key Safety requirements
--------------------------	---

1.1. **The techniques for identifying key Safety requirements**

Steps 1- Implement Personal Safety, Working Clothes and shoes

Step 2- check Safety requirements



Operation Sheet 2	Techniques of identifying traffic management plan
--------------------------	--

Techniques of identify traffic management plan:

Step 1- Prepare temporary road work ahead sign posting

Step 2- Prepare the sign lay-out shown warning signs



Techniques of Selecting Tools and Equipment's:

1. Step 1- Select proper tools and equipment



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

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 1.30 hours.

Task 1: Put temporary road work ahead sign posting

Task 2: implement sign lay-out shown warning signs

Task3: implement Safety requirements

Task3: proper tools and equipment



List of Reference Materials

- Road Work Theory and Practice
- Building Rural Roads, Bjorn Johannessen
- Contractor's Handbook, Roads Training School, Zambia
- Guideline for Quality Assurance Procedures and Specifications for Labor-Based Road Works
- “Overseas Road Note 2: Maintenance Techniques for District Engineers (2nd Edition)”,
- Highway Administration, 200
- Rural Road Maintenance Handbook, TRANSPORT PUBLISHING HOUSE Ha No - 2003



BASIC INFRASTRUCTURE OPERATIONS

NTQF Level I

Learning Guide-57

Unit of Competence: Spread Asphalt by Hand
Module Title: Spreading Asphalt by Hand
LG Code: CONBIO1M14 LO-02 LG-57
TTLM Code: CONBIO1TTLM0919v1

LO 2: Spread asphalt

**Instruction Sheet****Learning Guide # 57**

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

- Conducting Manual Asphalt Spreading
 - ✓ Procedure for operating and applying binder using the motorized hand sprayer
 - ✓ Procedure of operating and applying binder using the non-motorized hand sprayer
- Placing asphalt
- Constructing joints
- Identifying and repairing defects
- Identifying and report faults

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:

- Conduct hand asphalt *spreading* in safe proximity to the pavers
- Hand place *asphalt* to required level and line
- Achieve even finish when raking and construct *joints* to correct level
- Identify and repair low spots, high spots and *defects* in the mat
- Identify and report faults in the mat detected prior to or during operations

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 6.
3. Read the information written in the information “Sheet 1, Sheet 2, Sheet 3, Sheet 4 and Sheet 5”.
4. Accomplish the “Self-check 1, Self-check t 2, Self-check 3, Self-check 4 and Self-check 5” **in page -13, 16, 19, 23 and 26** respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1 **in page -27**”
6. Do the “LAP test” **in page – 27** (if you are ready).

1.1 Asphalt

A dark brown to black cementations material in which the predominating constituents are bitumen's that occur in nature or are obtained as residue in petroleum distillation. Asphalt imparts controllable flexibility to mixtures of mineral aggregates with which it is usually combined. It is highly resistant to the action of most acids, alkalis, and salts. Although a solid or semi-solid at ordinary atmospheric temperatures, asphalt may be readily liquefied by applying heat or by dissolving it in petroleum solvents of varying volatility or by emulsifying it.

1.1.1 Asphalt Blocks - Asphalt concrete molded under high pressure. The type of aggregate mixture composition, amount and type of asphalt, and the size and thickness of the blocks are varied to suit usage requirements.

1.2

Asphalt spreading

A hand lance is fitted with a motor driven pump that operates at constant speed. Adjusting the setting on the pump by-pass system controls the pressure at two hand lance jets.

During spraying the lance must be held at a height that gives a 50 per cent overlap of the spray from each jet as shown in Figure 2.1 It is then possible to time a pass across a lane width, perpendicular to the centre-line of the road, to provide the correct application rate of bitumen.

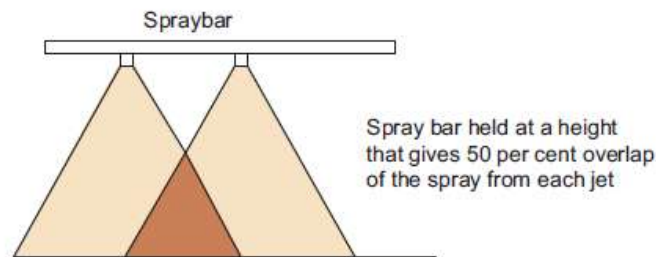


Figure 1.1 Overlap of spray from hand lance sprayer

The bituminous binder should be applied as the operator and trolley move backwards along the road. The spray pattern on one passes results in one third of the area receiving half the output of the trailing jet, one third receiving half the output of both jets and the final third receiving half the output of the leading jet. The first pass should be made with the trailing half spray being made on loose sand (a paper strip could be used) and the subsequent passes overlapped to ensure that the entire road surface receives half the output from each jet.

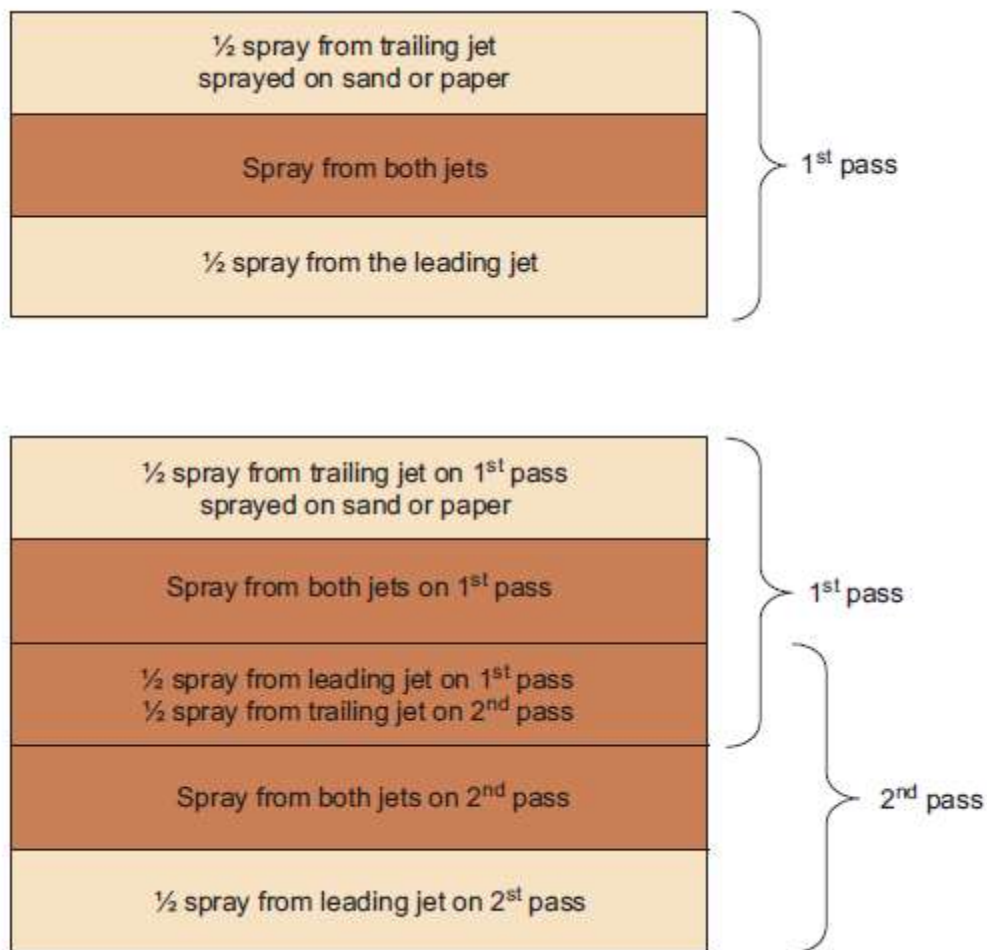


Figure 1.2 Spray coverage of the road surface

At the end of each pass, the lance has to be pulled back sharply to the new spraying position to avoid applying too much binder at the centre-line and road edge. Large cut-off boards or screens can be used to ensure that a clean cut off in the bitumen is produced along the centre-line of the road and at the road edge.

However, the nature of the spray produced by the lance and the method in which it is used must be considered if cut-off boards are used. The skin and eyes of people holding the boards and all other operatives should be protected from contact with sprayed binder and from any fumes that may be produced.

Rubber gloves, safety glasses and facemasks are considered suitable for this purpose.

It is important that operators of the hand sprayers are fully trained beforehand in its use. The training and practice in the use of hand sprayers should be carried out on ground away from the road to be treated. A good way to begin training is to use water as the sprayed liquid. In this way there will be no damage to the surrounding environment.

1.2.1 Asphalt mixes

Hot and cold asphalt mixes are comprised of two major materials: aggregates and asphalt cement. Higher quality materials produce higher quality mixtures. Because most municipalities lack the resources to analyze these materials for each project, it is well advised that you in assist on



materials from a New York State Department of Transportation (NYSDOT) approved source. NYSDOT maintains approved sources for materials on its web site: www.dot.state.ny.us.

- **Aggregates** to produce quality asphalt pavements, use quality aggregates. Aggregates should be clean, hard, sound, and durable, with a majority of crushed particles. Aggregates fall into several categories. The five major categories are sand, gravel, crushed stone, slag, and mineral filler:

- **Sand** –

the product of the breakdown of rock or sandstone. The result is a fine granular material. Different types of sand are blow sand, lake sand, gravel pit sand, bank run sand, manufactured sand, and river sand.

- **Gravel** larger than sand, usually larger than the #4 sieve, is generally a glacial deposit. Different types of gravel are pea gravel, river gravel, and bank gravel. Gravels are usually crushed and graded into various sizes.

- **Crushed stone** –

produced from crushing ledge rock or granites and producing 100 percent crushed aggregate of various sizes.

- **Slag** – a non-metallic product containing silicates, derived from the production of steel.

- **Mineral filler** –

a very fine material that usually passes the #200 sieve. Types of mineral filler are granular dust, or powdered rock, such as limestone screenings.

Hot mix asphalts (HMA) produced in a NYSDOT approved facility and from a NYSDOT approved job mix formula will be made with high quality aggregates.

When purchasing aggregate for use in cold mix asphalt mixes, the choice of a NYSDOT approved source will help ensure that the aggregate is of high quality.

NYSDOT routinely tests aggregates for soundness (durability) and hardness. The materials that gain NYSDOT approvals should provide long-lasting pavements.

1.2.2 Construction Procedures

An essential part of the construction of the Otto Seal is the extensive rolling required. On the day of construction, a minimum of 15 passes with a 12 tone pneumatic roller is required for the entire surfaced area. For each of the next two days, a similar amount of rolling should be carried out. After the first day of pneumatic rolling, it is useful to apply one pass with a steel roller thereby improving the embedding of larger aggregate. In practice this entails that two pneumatic rollers are available for the full period until rolling has been completed. Traffic should be allowed onto the surface immediately after the initial rolling, as this contributes to the Kneading process.

During the first two to three weeks after construction, any aggregate dislodged by traffic is brushed back into the wheel tracks, thereby allowing for a maximum amount of aggregate embedded into the binder. Any bleeding and fatty spots are blinded off with aggregate and preferably rolled into the surface. A work team for blinding may be required during a period of 4 to 8 weeks. A second layer or a cover seal should only be applied after a minimum period of 8 to 12 weeks, thereby allowing traffic to provide adequate compaction to the initial layer.

At the end of each pass, the lance has to be pulled back sharply to the new spraying position to avoid applying too much binder at the centre-line and road edge.

Large cut-off boards or screens can be used to ensure that a clean cut off in the bitumen is produced along the centre-line of the road and at the road edge.



However, the nature of the spray produced by the lance and the method in which it is used must be considered if cut-off boards are used. The skin and eyes of people holding the boards and all other operatives should be protected from contact with sprayed binder and from any fumes that may be produced.

Rubber gloves, safety glasses and facemasks are considered suitable for this purpose.

It is important that operators of the hand sprayers are fully trained beforehand in its use. The training and practice in the use of hand sprayers should be carried out on ground away from the road to be treated. A good way to begin training is to use water as the sprayed liquid. In this way there will be no damage to the surrounding environment.



1.2.3 Procedure for operating and applying binder using the motorized hand sprayer

For the efficient use and extended use of the equipment it is advisable and strongly recommended that the working, operation and maintenance of the equipment is thoroughly understood and that good sound practice is applied. Many hours can be wasted if the equipment is not systematically cleaned and serviced.

The motorized hot bitumen hand sprayer (e.g. Flexi an or similar) shall comply with the following specifications:

Engine: + 5 kW diesel engines (also available with 3.7 kW petrol engine)

Pump: Gear type pump, direct drive from the output shaft of the engine reduction gear through a flexible coupling. The output when spraying is approximately 17 – 18 liters/minute.

Lance: 5 meter oil resistant delivery hose fitted to a 1 meter lance including handle grip, shut off valve and two flat spray adjustable nozzles.

Heating equipment: Ideally sized burner ring, gas regulator, air control valve, heat deflector shield and gas bottle carrying bracket.

1.2.4 Operation before starting the engine

- Check the oil levels by unscrewing the two oil plugs at the bottom of the engine.
- The oil level must always be flush with the bottom rim of the oil plugs.
- Use only SAE 30 oil for the spray machine.
- Check whether there are enough diesels in the tank.
- Never let the tank run dry as this will lead to the engine having to be “bled”. when removing the diesel cap, there is a filter at the tank opening to prevent dirt entering the tank.
- Before removing the cap, clean the areas around the cap using a mutton cloth.

The storage of the diesel in 210 liter drums must be organized so that the drum is left in one position (vertically) if a pump is used or on a stand (slightly tilted away from the tap) if a tap/valve is used for decanting into a container (clean) for at least 24 hours to allow the sludge to settle.

1.2.5 Starting of the engine

- Before starting the engine the intake pipe/sump of the spray machine must be placed in the 210 litter drum of emulsion and the shut-off valve on the spray lance must be closed.
- If the machine has not been used for a number of weeks the machine must be primed.
- This is done by removing the white cone shaped filter and adding just sufficient oil in the filter cap so that it will not spill when fixing it in place on the engine.
- The engine will not start if the shut-off valve on the lance is open.
- To start the engine, pull the starter rope.
- Set the pressure to read between 200 and 300kPa and lock the pressure adjustment screw.

- When there is difficulty in starting the engine in cold weather, remove the rubber cap on the top of the engine, put + 5ml of the oil in the tube and replace the rubber cap.

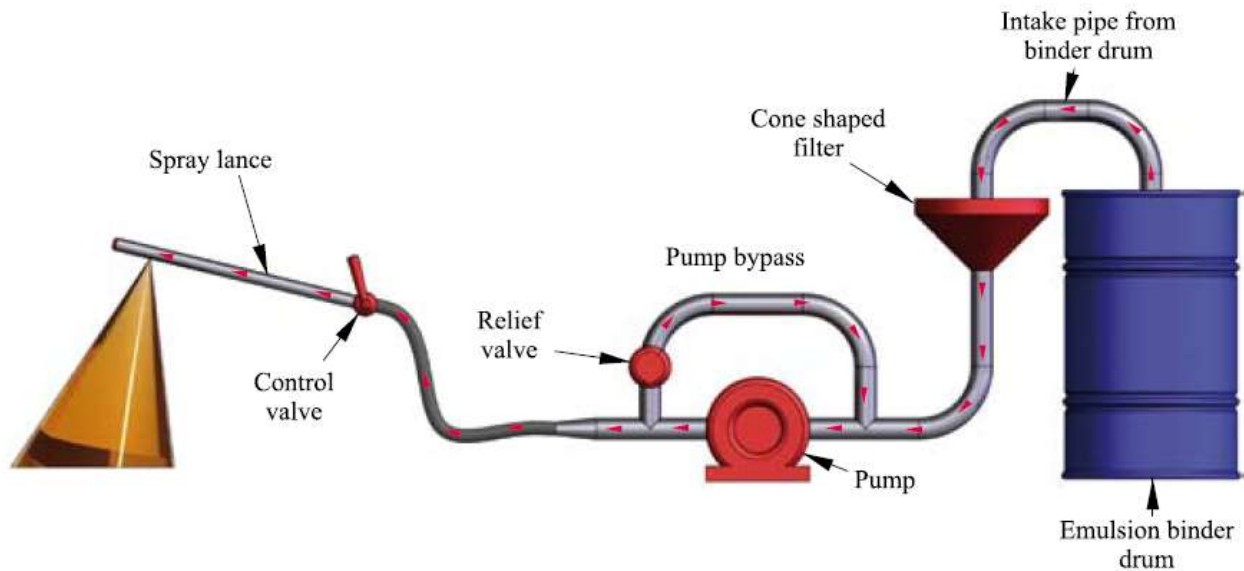


Figure 2: Schematic layout of motorized hand sprayer

1.2.6 Heating of binder/emulsion

On the top of the gas cylinder there is a valve which controls the flow of gas in the system. This valve is usually open when spray work is being done.

There is a flexible tube/pipe connecting the cylinder with the burner.

The valve controlling the gas pressure is close to the top of the cylinder and controls the intensity of the flame from the burner (i.e. the second valve)

Once this valve has been set for the day's work it should not be re-adjusted every time the machine is used unless the flame is too weak or too strong.

The third valve is on the gas pipe near the burner at the bottom of the spray machine. It is the valve that is to be opened for lighting the burner and adjusting the flame to the size required.



Figure 2.3 spraying of tack coat with a motorized hand sprayer

1.2.7 Maintenance of the machine

- Always keep the machine in a clean condition – not only externally but internally too.
- By using Tar Solve with diluted paraffin (4 parts paraffin to 1 part Tar Solve), and applying with a brush or spray, the equipment can be washed off with a hose. The process should be done at the end of each shift, to keep the equipment clean.

1.2.8 Safety precautions

- Always use protective clothing when operating spray equipment, i.e. gloves, boots and overalls.
- Use a flint gun and not matches to light the burner
- Make sure all valves are closed on the gas cylinder when finished spraying.
- Store the gas cylinder in a safe place on completion of spraying.
- Do not use diesel for cleaning spray equipment or hands.

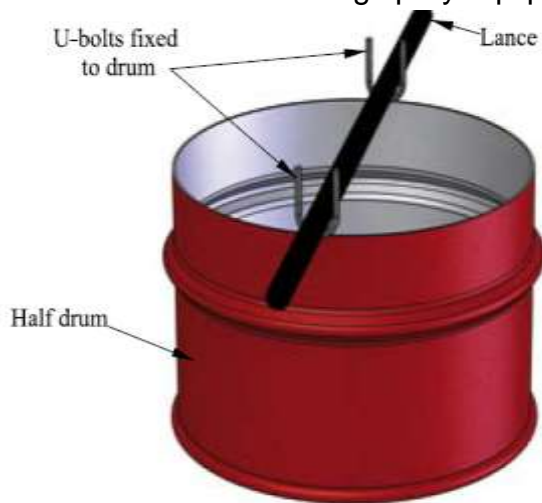


Figure 2.4 Rack for spray lance



Figure2.5 Motor powered pump and hand-Lance sprayer

12th The third ½ drum is used for checking the rate of delivery of the pump. The rate of delivery of the pump must be known/determined before surfacing work commences.



Figure2.6 Motorized hand sprayer

Before spraying of the binder commences the following checks must be done:

Ensure that there is sufficient emulsion, aggregate and diesel fuel and paraffin on site to complete the work.

- To do this the area to be surfaced and the rate of application of the binder and aggregate must be established;
- The delivery rate of the pump must be established as described;
- Ensure that the aggregate has been correctly supplied and spotted;
- Ensure that the surface to be sealed is clean and any repairs required properly attended to;
- Ensure that the area to be surfaced has been correctly set out;
- Ensure that arrangements to protect the Krebs etc are in place;
- Reinforced paper has been placed at the start and finish joints;

Ensure that all members of the team are at their posts and ready for action, i.e. labour for spreading the chips and moving the spray screens, and recording operators are in position



Figure2.7 spraying operate

1.2.9 Operating and applying binder using the non-motorized hand sprayer

Spot the heaps of aggregate accurately along the length of the road, at the spacing determined by the engineer, based on the determined application rate in m^3/m^2 of the aggregate, as this will assist in obtaining a uniform rate of application of the aggregate. The aggregate should be placed on plastic sheets of 1,5m x 1,5m to reduce wastage.



Figure 2.8 spotting of aggregate

Each labour unit is responsible for applying the two heaps of aggregate to the area applicable for these two heaps, as determined by the engineer, (he must not wander off to adjacent areas). This will ensure uniform, correct application of aggregate.

A shovel of aggregate is taken and pitched into the air and in the process the shovel twisted rapidly and in so doing the chips are sprayed uniformly over the area to be covered. In this way the stone will fall onto the wet tack coat while the dust, if any, will fall onto the top of the stone or if there is a breeze will be blown across the road away from the surface.

Once sufficient stone has been applied so that one can walk on the surface without coming into contact with the wet binder, the bare spaces can be filled with more stone. The aggregate must be placed shoulder to shoulder but care must be taken not to have double layers of stone.

Gently broom the surface and distribute any loose stone forming double layers. The better this process is done the better and more efficient the seal will be.

Once the surface has been covered with the aggregate, without bare patches of binder showing, rolling, with the pedestrian roller, can commence.

After the surface has been rolled once (i.e. a complete coverage of the roller) attention must be given to again covering bare patches or removing by booming any double layers of aggregate to obtain a single layer.

The first roll must be done without vibration but subsequent rolling, when the aggregate is properly placed with full coverage obtained, can be done with intermediate vibration of the roller switched on.

The rolling must be done in straight lines parallel to the centre line or edges of the road. It is essential that rolling is uniformly done across the width of the road surface. Typically three passes should be sufficient to seat the aggregate.



Figure2.9 Compaction of the aggregate

1.2.10 Dense-graded – refers to a continuously graded aggregate blend typically used to make hot-mix asphalt concrete (HMA) pavements with conventional or modified binders

1.2.11 Open-graded – aggregate gradation that is intended to be free draining and consists mostly of 2 or 3 nominal sizes of aggregate particles with few fines and 0 to 4 percent by mass passing the No. 200 (0.075 mm) sieve. Open grading is used in hot-mix applications to provide relatively thin surface or wearing courses with good frictional characteristics that quickly drain surface water to reduce hydroplaning, splash and spray.

1.2.12 Stone Mastic (Matrix) Asphalt Pavement (SMA)

SMA is product that is relatively new in America. It was developed by contractors in central Europe who are subject to giving warranties for their work against rutting. SMA optimizes stone on stone contact in the mix. It is a gap graded, hot mix asphalt with a large proportion of coarse aggregates with amounts retained above 2- mm (0.08”) size at approximately 80 percent and a rich asphalt cement/filler mastic. The coarse aggregates form a strong structural matrix. Asphalt cement, fine aggregate, filler and stabilization additive form a mastic that binds the structural matrix together. The coarse aggregates form a strong structural matrix. Asphalt cement, fine aggregate, filler and stabilization additive form a mastic that binds the structural matrix together.

Filler may be silt. The coarse aggregates are highly fractured and roughly cubical stone. Relatively

High asphalt contents (about 6.5% of the total mix) provide for a durable pavement. A stabilizing additive, usually 0.3% cellulose from ground newspapers is included in SMA to prevent hot asphalt cement from draining down during hauls.

The Scandinavians found that SMA pavements resist studded tire wear better than dense graded pavements. They found that the major factor in studded tire wear resistance of SMA is the quality of coarse aggregate. Several new tests have been developed to test aggregate and mix for studded tire wear resistance. The materials laboratories in Anchorage and Juneau have Ball-Mill testers that apply impact loading to coarse aggregates under aqueous conditions in order to rate the wear resistance.





Information Sheet-2

Placing Asphalt

2.1 Placing Asphalt Pavement

Before the paving operation starts, an asphalt distributor is used to spray asphalt on the unpaved surface. This film of asphalt serves as the prime and tack coats. The coats are then allowed to cure before the actual paving resumes. The purpose of having these coats is to prevent any slippage between the surface and overlay during or after the compaction.

2.2 Placing the Asphalt Mix

To start the paving operation, the paver is positioned properly onto the road. The screed of the paver is lowered onto a block of the same depth of the loose asphalt mat that is going to be laid on the road. (The screed is responsible for setting the depth of the asphalt mix.) After that, the block can be removed and paving can start. As soon as the haul truck arrives at the job site, the paving inspector must check that the asphalt delivered must be in a satisfactory condition. The paving inspector usually checks for these criteria listed below:

1. Blue smoke - blue smoke indicates that the mix is too hot.
2. Stiff appearance
3. Mix slumped in truck.
4. Lean, dull appearance - this indicates that the mix has insufficient asphalt.
5. Rising steam - too much moisture.
6. Segregation.
7. Contamination.

If there is any of the signs above observed, the mix will be sent back to the batch plant to be reprocessed. After all conditions are satisfied, the haul truck can load the mix into the receiving hopper of the paver.

When loading the mix into the receiving hopper, the haul truck is placed carefully in front of the paver. The rear wheels of the truck should be in contact with the truck roller of the paver to avoid any misalignment with the paver. The paver will push the truck forwards as it paves the road. If skew nests happen, the whole process will be delayed because they have to reposition the truck in front of the paver. Most pavers used are self-propelled pavers. Each of them consists of two main units:

- tractor unit. -it includes the receiving hopper, slot conveyor, flow control gates, spreading crew, power plant, transmission, operator control for use on either side, and operator's seat. This unit will move the whole system forward.
- Screed unit. -it is attached to the tractor unit by long screed arms on both sides of the machine. It consists of screed plate, vibrators or tamper bars, thickness control, crown control, and screed heater.

As soon as the first load of asphalt mix has been spread, the uniformity of the asphalt texture should be checked. Operators will adjust the appropriate adjustment points to correct any non



uniformity. Any segregation of materials also should not be allowed. Operation should be stopped immediately if any segregation is detected. The operators should also be aware of is the crown control. Pavement with crown has to be redone all over again. In addition to that, operators should continuously loosen the mix that clings to the sides of the hopper and push it back into the active mix. If the asphalt mix grows cold, it cannot be properly compacted and thus, loses its strength.

The last process of paving is compaction. This process is highly influenced by major mix proportion; (1) asphalt content: aggregate size, shape texture and distribution gradation; (2) filler content, and; (3) mix temperature. Appropriate rollers and rolling methods should be used in accordance with these proportions. There are several roller combinations used for maximum results:

1. steel-tired static and pneumatic-tired rollers,
2. vibratory and steel-tired static rollers, or
3. Vibratory rollers used in vibrating and static modes.

These combinations are highly recommended by the asphalt institute. Rollers should be moved in a slow but uniform speed to achieve the best result. These rollers should also be in good conditions. Any irregularities in the rollers' performances will result in poor compaction of the asphalt; thus, the pavement will not last long. The rollers should not reverse suddenly while compacting because this action can displace the mix. If displacement happens, the whole mat should be loosened with lutes or rakes and restored to the original grade before rolling can restart. A pattern that is economical and provides the maximum compaction result should be established.



Self-Check -2

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

- 1. The last process of paving is _____ .(3 points)
 - A. compaction
 - B. Local maps
 - C. Spread
 - D. vibrators

- 2. -----is responsible for the setting the depth of the asphalt mix. (4 points)
 - A. screed
 - B. Segregation
 - C. Lean
 - D. shoulder

- 3. Operation should be stopped immediately if any segregation is. (3 points)
 - A. moisture
 - B. detected
 - C. asphalt
 - D. paver

Note: Satisfactory rating - 10 points **Unsatisfactory - below 5 points**

Answer Sheet

Name: _____

Score = _____
Rating: _____
Date: _____

Short Answer Questions

- 1. -----
- 2. -----
- 3. -----

Information Sheet-3	Constructing joints
----------------------------	----------------------------

3.1 Asphalt Joints are typically defined as longitudinal or transverse, cold or hot.

3.1.1 Longitudinal joints are most likely to be cold joints. Butt joints are most typical and the practices presented apply to those. Some agencies have adopted wedge joints and/or skewed joints that are not discussed in this Guide; there may be some issues with using wedge joints for RAC mixes. To provide a good bond with the adjacent pavement, remove any loose material and tack the vertical edge prior to placing hot mix. To minimize need for raking, it is important to set both the screed overlap and height carefully on the adjacent pass. The screed should overlap the cold material by about 1 to 1.5 inches. The screed should be set above the elevation of the cold side approximately ¼-inch for each inch of compacted pavement thickness being placed.

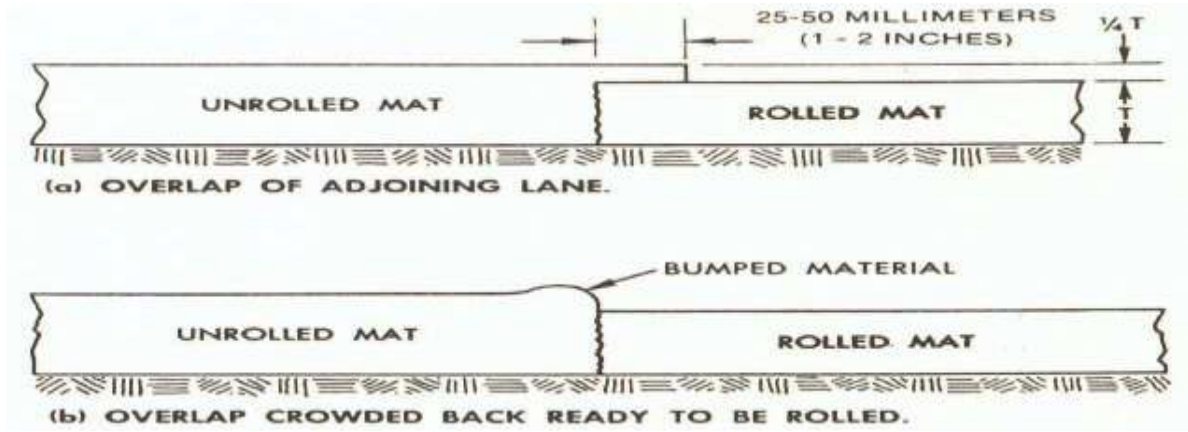


Figure 3-1 Longitudinal Joint

3.1.2 Transverse joints may be hot or cold. Hot joints should be treated the same as for conventional DGAC, but the RAC mix will stiffen more quickly. Cold joints should be treated as described for longitudinal joints. Most often, transverse joints are constructed at the end of the paving day or when a lane is finished, using a bulkhead or Kraft paper to provide a vertical butt joint. If the paver runs out the mix, the joint should be constructed where the full compacted thickness is available, and the rest of the mix placed past that point should be removed and wasted. Ideally, transverse joints should be rolled in a transverse direction, but this is usually not practical and rarely done.

Transverse joints are generally rolled longitudinally. With the move to the coarser Superpave mixes, the longitudinal joint is where many pavement surfaces naturally fail. Most often this is due to segregation of the mix at the joint and improper compaction. This problem is not new, but the move to the coarser mixes makes it easier to segregate at the joint, and the problem manifests itself more often. To produce a good paving joint, the material needs to be as close to the same consistency as possible, not segregated, and compacted to as close to the same density as the mat itself.

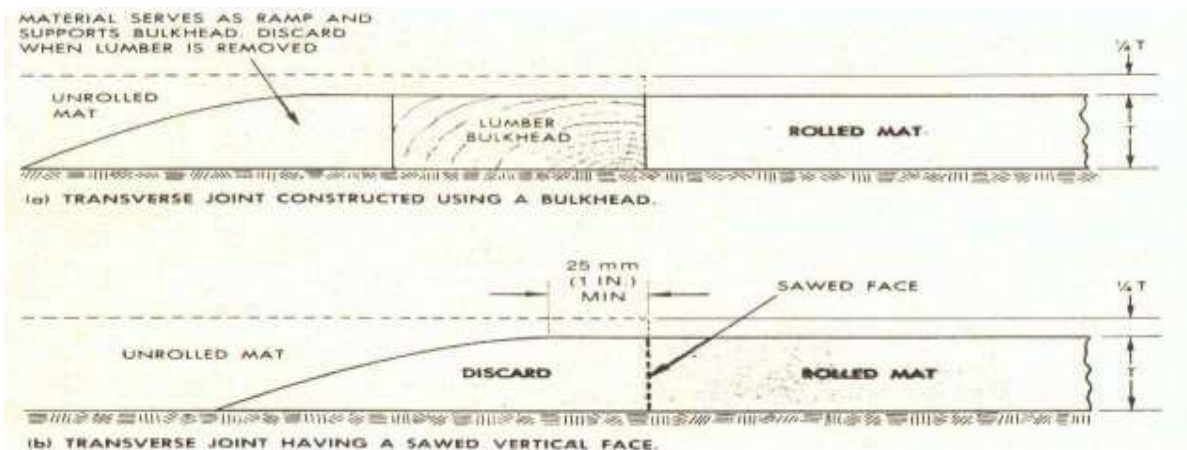


Figure 3-2 Transverse Joint Construction

Many rankers work very hard to push back the material at the edge of the joint and fling it on to the hot mat.

This is a poor procedure, which will result in a weak joint and an open surface texture along the joint. If the raker does not pile up the correct amount of asphalt at the joint the asphalt at that point will be of lower density than the rest of the mat. The breakdown roller then “pinches” the longitudinal joint with a small part of the drum on the old mat and part of the drum on the new mat. Rollers should operate in static mode, as for transverse joints. The joint should be pinched before the breakdown rolling on the rest of the mat. If two pavers are working in adjacent lanes a hot longitudinal joint may be formed. In this case the rollers behind the first paver should leave the edge of the mat un compacted. The rollers behind the second paver compact this edge along with the second strip as shown in Figure 3-3.

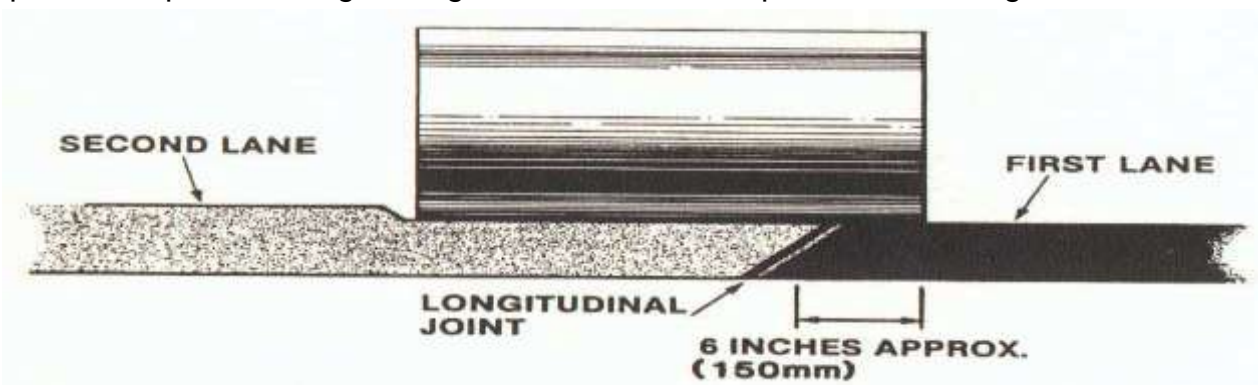


Figure 3-3 Rolling a Hot Longitudinal Joint

Surface smoothness tolerances are the same at joints as everywhere else in the mat. It is a good idea to check joints with a straightedge while the material is still hot; if there is a problem the rankers can often correct it.



Self-Check -3

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

1. _____ are most likely to be cold joints. Butt joints are most typical and the practices presented apply to those. **(2.5 points)**

- A. Wedge joint
- B. Longitudinal joints
- C. Overlapping
- D. Cracking

2. -----are constructed at the end of the paving day or when a lane is finished, using a bulkhead or Kraft paper to provide a vertical butt joint. **(2.5 points)**

- A. Transverse joints
- B. paving joints
- C. wedge joints
- D. Cracking

Note: Satisfactory rating – 5 points Unsatisfactory - below 2.5 points
You can ask you teacher for the copy of the correct answers.

Answer Sheet

Name: _____
1. _____
2. _____

Date: _____

Score = _____
Rating: _____



4.1 Repair of road surface defects

To the road user the immediate evidence of an inadequately maintained road network is the ubiquitous pothole, a cause of genuine concern and a source of much indignation.

Potholes are a symptom of underlying deficiencies in the road inadequate drainage being the most common, a road pavement being badly fatigued through overloading or lack of renewal or as is a common cause roads of minimal construction depth built for light traffic being subjected to repeated heavy axle loadings. It is probably a measure of the effectiveness of road repair techniques that so many roads are still capable of functioning albeit at a low serviceability while carrying loads far in excess of their structural capacity.

4.1.1 The following points deserve to be highlighted briefly –

- Repairing road surface defects is an expensive operation, the operating costs of a conventional truck mounted patching unit run to €2500 per day, regardless of the
- Effectiveness of the repairs carried out. Quality control of the materials used is critical – use of incorrect or substandard materials
- will result in poor quality work which will rapidly disintegrate.
- There are many different methods of carrying out road surface repairs varying with the machinery used and material-also employed. The CCEA document sets out an indication of suitable methods for use on different types of road construction, the choice of method depending more on the construction of the existing road than its classification into National, Regional or Minor road.
- Repair of road surface defects is wasted effort unless drainage problems are attended to, repairs to roads which are either waterlogged or may be expected to be so will not last for any length of time.
- Repair crews must be adequately trained and skilled in the techniques they are using, they should understand not only the “hows” but also the “whys” of what they are doing, their efforts should be directed at achieving effective and durable repairs.
- The two most common causes of repair failure are inadequate compaction and failure to seal the repair surface and perimeter allowing subsequent water penetration and pavement disintegration.
- All repair techniques depend on the compaction of the repair material – this will not be achieved by the back of a shovel or a lorry wheel– suitable portable compaction equipment is an essential tool in surface repairs, similarly the repaired area and its surrounds must be waterproof.
- Effective repairs will be carried out if the repair crews are directed by



engineers with a thorough understanding of the methods, machines and materials being used, and the ability to encourage the crews to develop their skills in a worthwhile manner. Information on methods of repair is available on www.coldchon.ie

4.2.1 Surface defects

Asphalt Bleeding or flushing is the upward movement of asphalt to the pavement surface. This results in a pavement with a smooth, black, shiny appearance Cornell Local Roads Program Paving Principles The most common causes of bleeding are the loss of stone cover in a chip seal and the over-compaction of a tender HMA mix by heavy traffic.

Overly rich asphalt mixes and application of a very heavy tack coat or excessive crack seal materials are other possible causes. A bleeding surface is very smooth and almost as slippery as ice when wet. Since most bleeding occurs in the wheel paths, it is a serious safety hazard that must be dealt with immediately



Finger 4.1 Compaction is essential surface



Finger 4.2 Macadam repair sealed with dressing

Finger 4.1 Chip-seal-chip



4.2.3 Segregation

Bitumen macadam repairs Particle size segregation may be difficult to identify in some coarse gap-graded mixtures. There are few fines present and that can sometimes make the RAC

appear segregated even if it is not. Identify the affected truck loads and corresponding placement areas, take samples and test gradation and binder content to verify. It is also recommended that, if possible, samples of RAC that do not appear segregated should be taken from the same truckload, for comparison. Temperature segregation (hot or cold spots) may be checked with a heat gun or with an infrared camera. The primary concern is differences rather than exact values.





Self-Check -4

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

1. _____ is the upward movement of asphalt to the pavement surface..

(2 points)

- A. compaction
- B. asphalt Bleeding or flushing
- C. linkage of facility
- D. heavy traffic

2. ----- is an expensive operation, the operating costs of a conventional truck mounted patching (3 points)

- A. Repairing road surface defects
- B. compaction
- C. segregation
- D. joint

3. ----- is very smooth and almost as slippery as ice when wet. (3 points)

- A. defect
- B. repairs
- C. bleeding surface
- D. spread

4. -----are a symptom of underlying deficiencies in the road inadequate drainage being the most common (2 points)

- A. road
- B. repairs
- C. bleeding surface
- D. Potholes

Note: Satisfactory rating – 10 points

Unsatisfactory - below 5 points

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

Answer Sheet

Score = _____

Rating: _____

Name: _____

Date: _____

- 1. -----
- 2. -----
- 3. -----
- 4. -----



5.1 Reporting and control

Reporting and control is an essential part of the management system in civil works projects. A proper reporting system enables the project to objectively monitor the progress and quality of work, even at an early stage, and assess whether defined targets are being reached. It is then possible to revise plans and take remedial action at an early stage to improve performance and secure the original set targets.

Reporting and monitoring also form the basis for developing and improving planning figures, used for preparing future civil works projects.

Slow progress is caused by a number of factors and is not necessarily the fault of anyone particular in the project. It may be due to wrong assumptions made at the planning stage, bad weather, delays in securing equipment and materials, delays caused by the slow performance of other contractors involved in the project or many other reasons. The main intention of works monitoring is to keep track of progress from an early stage and be in a position to take remedial action at an early stage when delays occur.

With good follow-up of site activities, it is possible to deal with problems before they become un-manageable or result in serious cost implications. Monitoring of works is the reform an essential part of project management and constitutes an important input to the continuous planning activities required on a construction site.

Work activities and all the resources used are monitored in detail; however, reports are produced to varying levels of detail depending on its purpose and audience. A site supervisor needs to know the detailed performance of each of the work gangs while senior management staff is more concerned with overall progress on a work site.

Different types of control procedures exist, including quality control, production control and cost control.

At the work site, the production and quality controls are the most important. Reporting and control also forms a central part of contracts management. Contractors engaged on civil works projects are paid at regular intervals. In most civil works contracts the services of the contractor are paid on the basis of quantities of completed works. Before the contractor is paid, the completed work is controlled to verify that it is has actually been carried out and that it has been delivered to the prescribed quality standards. Monitoring work progress involves keeping track of:

- The inputs, i.e. the number of workers allocated to each activity, amount of tools and materials and usage of equipment. Inputs also include overheads such as running a site camp, supervisory staff, insurances, etc.
- The output which is essentially the quantity of completed work. The main unit of measurement is obviously the length of completed road sections; however, it is also useful to measure progress on each of the detailed works activities, such as square meters of clearing, cubic meters of excavation and completed culvert and bridge works.

Tabel.5.1 The purpose of a reporting system is to:



- measure performance of ongoing works,
- provide a uniform method of collecting production data,
- ensure the correct and efficient use of funds, machines, materials and labor,
- identify weak components of the production chain,
- enable the management to effectively re-plan and reschedule remaining works,
- calculate payment of completed works,
- provide reliable information to others about the project activities, and
- Collect experience data to improve planning of future new projects.



Self-Check -5

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

1. _____ is caused by a number of factors and is not necessarily the fault of anyone particular in the project. **(3 points)**

- A. Slow progress
- B. controls
- C. report
- D. linkage of facility

2. ----- is an essential part of the management system in civil works projects. **(2 points)**

- A. Reporting and control
- B. monitoring
- C. contractor
- D. working

Note: Satisfactory rating – 5 points **Unsatisfactory - below 2.5 points**
You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____

Date: _____

- 1. -----.
- 2. -----.

**Techniques to Asphalt Spray procedure**

- Step 1-** Prepare three clean half drums (105 liters) available on site. Half fill one drum with water and the second with $\frac{1}{2}$ paraffin.
- Step 2-** check the contents to establish if there has been settlement of the bitumen in the emulsion in the bottom of the drum.
- Step 3-** Start the engine and check the pressure gauge. Only now spraying can commence.
- Step 4-** switch the engine off *when* the contents of one drum have been depleted
- Step 5-** Replace the empty drum with a full drum of tested emulsion.
- Step 6-** Start the engine and proceed with spraying.
- Step 7-** At the end of a shift or at lunch break, clean drum
- Step 8-** place the sump in the $\frac{1}{2}$ drum of paraffin and circulate the paraffin through the system back into the drum.
- Step 9-** If the containers of water and paraffin are not ready switch off the engine until the containers are ready.
- Step 10 -**The water must be replaced for each daily shift.



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

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 5 hour.

Task 1 - Prepare three clean half drums (105 liters) available on site. Half fill one drum with water and the second with $\frac{1}{2}$ paraffin.

Task 1 - check the contents to establish if there has been settlement of the bitumen in the emulsion in the bottom of the drum.

Task 3- Start the engine and check the pressure gauge. Only now spraying can commence.

Task 4- switch the engine off *when* the contents of one drum have been depleted

Task 5- Replace the empty drum with a full drum of tested emulsion.

Task 6- Start the engine and proceed with spraying.

Task 7- At the end of a shift or at lunch break, clean drum

Task 8- place the sump in the $\frac{1}{2}$ drum of paraffin and circulate the paraffin through the system back into the drum.

Task 9- If the containers of water and paraffin are not ready switch off the engine until the containers are ready.

Task 10 -The water must be replaced for each daily shift.



List of Reference Materials

Asphalt Emulsion Handbook, Suit-Kote Corp., Cortland, New York
The Asphalt Handbook, The Asphalt Institute, MS-4, 1989 Edition
Asphalt Overlays for Highway and Street Rehabilitation, The Asphalt Institute, MS-17
Basic Asphalt Recycling Manual, Asphalt Recycling & Reclaiming Assoc., January 2001
Basics of a Good Road, Cornell Local Roads Program, CLRP # 04-4, 2004
Cold In-place Recycling – State of the Art, Kearney, E. J., Proceedings of the Fifth ASCE Materials Engineering Congress, Cincinnati, Ohio, May 1999
Cold Mix Recycling: State-of-the-Practice, Kearney, E. J., Association of Asphalt Paving Technologists, Journal Vol. 66, 1997
Comprehensive Pavement Design Manual, New York State Department of Transportation, 2000
Distress Identification Manual, Strategic Highway Research Program, SHRP-P-338, 1993
Drainage of Asphalt Pavement Structures. The Asphalt Institute, MS-15, 1996 Edition
Full Depth Reclamation, Asphalt Recycling & Reclaiming Association, January 2001
The Full Depth Recycling Process, Kearney, E. J. and Huffman, J. E., Transportation Research Board, Research Record 1684, 1999



BASIC INFRASTRUCTURE OPERATIONS

NTQF Level I

Learning Guide-58

Unit of Competence: Spread Asphalt by Hand

Module Title: Spreading Asphalt by Hand

LG Code: CON BIOM14 LO –L3G-58

TTLM Code: CON BIO M14 TTLM 0919v1

LO 3: Clean up



Instruction Sheet

Learning Guide # 58

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

- Safe keeping of equipment's
- Clean and check tools and equipment
- Maintain and store 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:

- Clear work area and dispose of or recycle *materials* in accordance with project environmental management plan
- Clean, check, maintain and store tools and equipment

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 6.
3. Read the information written in the information "Sheet 1, Sheet 2, Sheet 3, Sheet 4 and Sheet 5".
4. Accomplish the "Self-check 1" in **page -9**.
5. If you earned a satisfactory evaluation from the "Self-check" proceed to "Operation Sheet 1," in **page -10**.
6. Do the "LAP test" in **page – 11** (if you are ready).

Information Sheet-3

Safe keeping of equipment's



1.1 Clean and check tools and equipment

Power tool cleaning to produce a bare metal surface and to retain or produce a surface profile.

Power Tool Cleaning requires complete removal of all visible

- oil,
- grease,
- dirt,
- mill scale,
- rust,
- paint,
- oxide,
- corrosion products, and
- Other foreign matter.

Slight residues of rust and paint may be left in the lower portions of pits if the original surface is pitted.

If the surface is to be roughened, the surface profile produced shall be not less than 1 mil (25 μ) and shall be to a degree suitable for the specified paint system.

The substrate will be darker if damp. If moisture is found, substrate is too damp to coat with solvent-based coatings.

If moisture persists, substrate cannot be coated. Very dense, non-porous, or finished concrete must be acid etched, or abrasive blasted, to assure proper coating penetration. Determine porosity by pouring about one ounce of water onto the substrate. If water soaks in, the concrete is porous enough for coating. If it beads up on the surface, the concrete is not porous enough, and treatment is warranted.

All surfaces must be free of grease, oil, wax, salt, dirt, and other contaminants.

Remove with one of the chemical cleaning methods.

- Hammerheads should firmly secure to the handle.
- Trowel, saws, chisels, and other tools should not be left lying on scaffolds, when not used.
- All ropes and chains for lifting should be inspected before use they should not be loaded beyond the limit recommended by the manufacturer.
- Nails or bolts used in construction scaffold should be of adequate size
Sufficient number at each connection to develop the designed strength of
structure
- The preliminary site works for construction project usually begin after the site facilities are set up.
- Clearing the site is essential. First, all Vegetation such as bushes and scrub should be removed. The roots of trees and bushes must be dug out and cleared away.
- The building site and surrounding areas should be inspected for termites as part of the process of clearing the site.



- A constructor will dig trial holes as part of the preliminary site works.
- These holes provide information about the best methods of excavation.
- To work safely, you should always:
- Wear a hard hat to protect your head in case some thing is accidentally thrown or dropped in to the hole.
- Put supports against the sides of the excavation so that the soil cannot fall on you.

1.1.1 Maintain and store materials

In road construction works the use of tools is inevitable though the construction is equipment intensive. Therefore, it is necessary to use the tools properly and maintain using appropriate methods like sharpening.

- The fine cutting edges of axes, bush knives And grass cutters are normally maintained by sharpening with whetstones.
- The edges of earthworks tools, such as hoes, pickaxes, mattocks, shovels And spades should be sharpened with a grinding stone or by filing.
- The cutting Edge of a hoe or a mattock should be sharpened on the side facing the operator of the tool.
- If the blade has been chipped or pieces broken off, the hoe should not be used until it is repaired.
- The repair can be done by cutting or filing off the edges to re-establish a straight edge and then sharpening it. When the length of the blade is less than 150mm, the hoe is no longer efficient for digging. However, it can still be useful for other purposes, such as grubbing and leveling works.
- The blade of a good shovel will not bend or crack but will wear.
- The edge of the blade will eventually be so worn that it becomes blunt and for this reason difficult to push into the soil.
- To improve the worn blade it can be cut and sharpened so that the shovel can be used effectively again. This requires ver y strong tools and should be done in a workshop.
- After reshaping the blade edge, the final sharpening is carried out using a whetstone. When applied by skilled workers, this final process puts a razor sharp edge on the blade. Finally, it is useful to coat the blade with oil or wax to protect it from rusting. When axes and other tools used for earthworks have been severely blunted, it may be necessary to grind a new cutting edge. A manual or treadle operated grinding wheel, which is continuously moistened with water, is the best tool when axes, mattocks, pickaxes, bush knives and similar tools need major reshaping works. Avoid using electric grinders, as it will most probably draw the temper from the steel, leaving it too soft to hold an edge. A grinding wheel is slow enough to avoid removing too much and as long as it is moistened with water, maintains cool temperatures. If a grinding wheel is not available, the sharpening should be carried out using files. Light

sharpening can be carried out with the tool held in the hand, but removal of heavier burrs is best done with the assistance of a workbench and a vice. A whetstone is used to provide the final sharpness to the edge. It is useful to equip bush clearing gangs with a whetstone so they can maintain the sharpness of their cutting tools while they are in the field.

1.1.2 Using Files

Files for sharpening tools come with a single or a double cut pattern. A single cut file has one set of parallel teeth with an angle of 60 to 80 degrees from the edge. Double-cut files have two series of parallel teeth set 45 degrees to each other. The double-cut file is used for restoring the shape of an edge, while the single-cut File is used for the final finishing work. Rounded blades require files with a round Surface. In general, it is more effective to use large files, however, some tools, such as saws, need smaller files to fit into the grooves of the blade. Files only sharpen on the push stroke. It should be lifted away from the surface on the return stroke. When applying a “sawing” motion with the file, it will fill with metal particles and not cut well. Files should be protected from each other and other tools when stored and transported

Storage

- Tools are issued to the workers every morning by the storekeeper, and returned in the afternoon after completion of Works. The supervisors need to ensure that the workers are issued the correct Type of tools according to the work Activities they will be carrying out.
- The Storekeeper is responsible for keeping full records of the tools and controlling the issue of tools to the workers. The total number of tools on site needs to be Counted and reported regularly back to project management. The size of the store depends on the quantity of tools to be stored. When the work site is very isolated, the store has to be well stocked and will therefore be larger. Tools should be stored in a dry and secure place. They should be stacked neatly so that they can easily be counted. Stack different items and items of different sizes separately. Employ a watchman to guard the stores when the storekeeper is off duty.

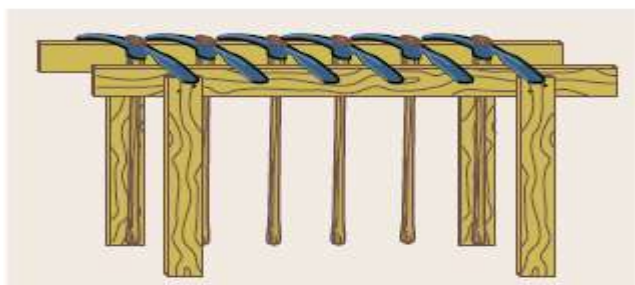


Figure 1.1 storing tools properly

1.1.3 Proper Use of Equipments

Mechanized equipments are the result of modern technology and they are widely being used in the construction industry in general and in road construction in particular. The application of the outcome of this technology that is using the



equipment has highly facilitated the development of construction sector. Though the usage of the has made easy of construction activity, their ownership as well as maintenance is very expensive. Therefore, an efficient and effect utilization of the equipment is a crucial factor that determines profitability of the construction companies and timely completion of construction projects.

The following equipments are mainly used in road construction especially in gravel road construction :

- Excavators
- Dozers
- Loaders
- Graders
- Rollers
- Water trucks
- Dump trucks
- Lobed,



Self-Check -1

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

1. ----- responsible for keeping full records of the tools and controlling the issue of tools to the workers.

A. cutting edge

B. Water trucks

C. Driver

D. Storekeeper

2. Slight residues of rust and paint may be left in the lower portions of pits if the original surface is-----.

A. Train

B. Storekeeper

C. pitted

D. Guard

3. -----are the result of modern technology and they are widely being used in the construction industry in general and in road construction in particular

A. Train

B. Mechanized equipments

C. Hand Toole

D. bush knives

Note: Satisfactory rating - 10 points

Unsatisfactory - below 10 points

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

Answer Sheet

Score = _____

Rating: _____

Name: _____

Date: _____

1.-----

2.-----

3.-----



Techniques of determining the type of Maintain tools and equipment.

Step 1- Identify gravel road construction equipments:

Step 2- Identify appropriate information about maintains

Step 3- Prioritize maintain using appropriate methods



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

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within --- hour.

Task 1- Determine types of gravel road construction equipments

Task 2- Prepare the referral by providing appropriate information about service providers



List of Reference Materials

- Rural Road Maintenance Handbook, TRANSPORT PUBLISHING HOUSE Ha Noi - 2003
- Gravel Roads, Maintenance and Design Manual”, US Department of Transportation, Federal
- “Overseas Road Note 2: Maintenance Techniques for District Engineers (2nd Edition)”,
- ASPHALT INSTITUTE (June 1983). Manual Series No. 17 (MS-17). Asphalt Overlays
- for Highway and Street Rehabilitation. The Asphalt Institute, Lexington, Kentucky.
-
- 12. BCEOM (1998). Pavement Management System. Draft Final Report. Appendix II/2/1 to
- Part II. Road Dictionary and Data Acquisition. *VIZIR Method for Quality Evaluation of Paved Roads*.
-
- 13. LOUIS BERGER AND ASSOCIATES, INC. (1994). *Non-Destructive Testing of Roadway Pavements – Equipment Used to Derive Inputs for Pavement Management Systems*. From Proceedings of the 8th Annual Road and Bridge Conference and
- Exposition, Rosemont, Illinois, December 1994.
-
- 14. AASHTOWare® DARWin® 3.1 (1997). Pavement Design and Analysis System.



Answer Sheet		Learning Guide #56,57,58	
Self-Chack-1	Self-Chack-1	Self-Chack-1	
1. <u>B</u>	1. <u>C</u>	1.D	
2. <u>C</u>	2. <u>D</u>	2.C	
Self-Chack-2	3. <u>A</u>	3.B	
1. <u>A</u>	4. <u>B</u>		
2. <u>A</u>			
3. <u>Google</u>	Self-Chack-2		
1. <u>a. plasters</u>	2. <u>A</u>		
<u>b. bandage</u>	3. <u>A</u>		
<u>c. ointment</u>	4. <u>B</u>		
<u>d. disinfectant</u>			
Self-Chack-3	Self-Chack-3		
1. <u>C</u>	1. <u>B</u>		
Self-Chack-4	2. <u>A</u>		
1. <u>B</u>			
2. <u>B</u>	Self-Chack-4		
3. <u>C</u>	1. <u>B</u>		
4. <u>D</u>	2. <u>C</u>		
Self-Chack-5	3. <u>A</u>		
<u>D</u>	4. <u>D</u>		

No	Name	Level	Emil
1	GirumTadesse	B	Girumtadesse2011gmail.com
2	Wegderesfwkadu	B	Meherete2009@gmail/com
3	Begnakumsa	B	Begnakumsa5@gmail/com
4	MohammedNurgeba	B	mnurgeba@yahoo.com
5	Tihtenatadele	B	



