

# Road Construction and Maintenance

## Level III

Based on September, 2023 Curriculum Version 2



**Module Title:- Pavement Recycling Operations**

**Module code: EIS RCM3 12 0923**

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## ACRONYM

AASHTO	American Association of State Highway and Transportation Officials
FHWA	Federal Highway Administration
NCHRP	National Cooperative Highway Research Program
PPE	Personal protective equipment
RAP	Reclaimed Asphalt Pavement
CPR	Central plant recycling
EMP	Environmental management plan
VOCs	Volatile organic compounds

## INTRODUCTION TO MODULE

This module covers the knowledge, attitude and skills required to understand the required Pavement Recycling Operations. The trainees will develop the skill on Conduct and Monitor Pavement Recycling Operations. Including Pavement Recycling Operations Requirement, profile planer pre-operation, Profile Planer and Cleaning Up, Attachments, Relocation of Profile Planer, Equipment Performance.

### This module covers the units:

- Requirements of Pavement Recycling Operation
- pre-operation and operation of profile planer
- Profile planer Attachments
- Relocation of Profile Planer
- Equipment Performance

### Learning Objective of the Module

At the end of this session, the trainee will able to:

- Identify Pavement Recycling Operation Requirements
- Check pre-operation & Operate profile planer
- Select, remove and fit attachments
- Relocate the profile planer
- Check equipment performance

### Module Instruction

For effective use this modules trainees are expected to follow the following module instruction:

1. Read the information written in each unit
2. Accomplish the Self-checks at the end of each unit
3. Perform Operation Sheets which were provided at the end of units
4. Do the “LAP test” giver at the end of each unit and
5. Read the identified reference book for Examples and exerc

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## Unit one: Requirements of Pavement Recycling Operation

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

- Over view of pavement recycling operation
- Compliance documentation.
- Safety requirement and Signage
- Plant, tools and equipment
- Environmental protection requirements

This unit will also assist you to attain the learning outcomes stated in the cover page.

Specifically, upon completion of this learning guide, the trainee will be able to:

- Access, interpret and apply compliance documentation
- Obtain, confirm, and apply safety and signage requirement
- Select, check and report of plant, tools and equipment
- Identify, confirm and apply environmental protection requirements

## 1.1 Compliance Documentation

In Ethiopia, for pavement recycling operations are subject to strict compliance documentation, which includes legislative, organizational, and site requirements and procedures. These documents outline the safety, environmental protection, and overall compliance of pavement recycling operations. They help operators make informed decisions and execute operations in line with legal requirements. Organizational and site requirements outline specific protocols for safe and efficient operations. Manufacturer's guidelines and specifications provide detailed instructions on operating and maintaining stabilizer equipment, ensuring operators follow manufacturer's recommended guidelines for optimal performance and longevity.

Employment and workplace relations legislation govern aspects such as working hours, wages, and occupational health and safety, and employee rights. Operators must ensure compliance with these regulations to foster a safe and fair working environment for employees. Equal Employment Opportunity and Disability Discrimination legislation promote equitable treatment of employees without bias or discrimination based on factors such as gender, race, age, disability, and religion. In conclusion, compliance documentation in Ethiopian pavement recycling operations includes legislative requirements, organizational procedures, manufacturer's guidelines, Ethiopian standards, employment regulations, and Equal Employment Opportunity and Disability Discrimination legislation. Operators must access, interpret, and apply these documents to ensure safe, efficient, and legally compliant execution.

The relevant documents for pavement recycling operations:

- AASHTO M 323: Standard specification for recycled asphalt pavement (RAP)
- FHWA-RD-05-017: Pavement recycling: A guide for state highway agencies
- NCHRP Report 549: Guide for the use of recycled asphalt pavement in highway construction.

These documents provide more detailed information on the materials, equipment, and methods used in pavement recycling operations.

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## 1.2 Safety requirement and Signage

### 1.2.1 Safety for Pavement Recycling Operations

Safety is the state of being safe from harm or danger. It is important to be safe in all aspects of life, but it is especially important when working with machinery or equipment. Pavement recycling operations can be dangerous if proper safety precautions are not taken. Pavement recycling operations involve a number of potential hazards, including:

- Heavy machinery
- Sharp objects
- Hot asphalt
- Volatile fumes
- Traffic

#### A. Comprehensive Safety Program

To protect workers and the public, it is important to implement a comprehensive safety program elements:

- Pre-planning: Before any work begins, the site should be inspected for hazards and a safety plan should be developed. The plan should identify the specific hazards and the steps that will be taken to mitigate them.
- Personal protective equipment (PPE): All workers should be required to wear appropriate PPE, such as hard hats, safety glasses, gloves, and steel-toed boots.
- Traffic control: The work area should be properly marked and barricaded to keep traffic away.
- Excavations: Any excavations should be properly shored up to prevent collapse.
- Hot asphalt: Hot asphalt can cause serious burns. Workers should be careful not to come into contact with it and should wear protective clothing, such as long sleeves and pants, and gloves.
- Volatile fumes: Asphalt fumes can be harmful to breathe. Workers should work in a well-ventilated area and avoid breathing the fumes.
- Emergency procedures: In the event of an accident, workers should know the emergency procedures and how to evacuate the area safely.

Pavement recycling operations will vary depending on the specific project. However, the principles outlined above should be followed to ensure the safety of all workers and the public.

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Tips for safety in pavement recycling operations are:

- Make sure all workers are trained in the safe operation of the equipment being used.
- Inspect the equipment regularly for any defects that could cause a hazard.
- Keep the work area clean and free of debris.
- Follow all applicable safety regulations.

## B. Safe parking practices

To prevent accidents and injuries in pavement recycling operations by following these safety tips, Safe parking practices for pavement recycling operations are:


- Park vehicles in designated areas away from the work zone.
- Turn off the engine and set the parking brake.
- Engage the parking pawl or wheel chocks.
- Leave the headlights on low beam.
- Do not leave any tools or equipment in the vehicle.
- Lock the doors and windows.

### 1.2.2 Signage requirement


Signage is the use of signs and symbols to communicate a message. A sign is any visual graphics created to display information to a particular audience. It can be used to promote, identify, provide information, and give directions or to raise safety awareness.

The signage requirements for pavement recycling operations vary depending on the jurisdiction.

**Table 1-1 Safety signs**

<p><b>Warning signs:</b> These signs should be used to warn motorists and pedestrians of the presence of pavement recycling operations. They should be placed in a conspicuous location and should be clearly visible.</p>	
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<p><b>Directional signs:</b> These signs should be used to direct motorists and pedestrians around the work area. They should be placed in a way that minimizes traffic congestion and prevents accidents.</p>	<p>(a)     </p> <p>(b)     </p> <p>  </p>
<p><b>Hazard signs:</b> These signs should be used to warn motorists and pedestrians of specific hazards, such as exposed machinery or uneven surfaces. They should be placed in a way that minimizes the risk of injury.</p>	<p> </p> <p><b>Know your GHS symbols</b></p> <ul style="list-style-type: none"> <li>Flammable</li> <li>Corrosive</li> <li>Oxidizing</li> <li>Explosive</li> <li>Compressed Gas</li> <li>Harmful irritant</li> <li>Dangerous for the Environment</li> <li>Health hazard</li> <li>Toxic</li> </ul> <p> </p> <p></p> <p></p>
<p><b>Traffic control signs:</b> These signs should be used to control traffic in the work area. They should be placed in a way that ensures the safety of all road users.</p>	<p> </p> <p> </p> <p> </p>

<p><b>Work zone signs:</b> These signs should be used to indicate that a work zone is present. They should be placed in a way that motorists and pedestrians can see them well in advance.</p>	 <p>Figure 0-1. Work zone signs</p>
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In addition to these common signs, there may be other specific requirements depending on the jurisdiction. It is important to consult with the local authorities to determine the specific signage requirements for pavement recycling operations in your area.

Tips for ensuring that signage is effective in pavement recycling operations:

- Use bright, contrasting colors that are easy to see.
- Use clear and concise language.
- Place signs in a conspicuous location where they will be seen by motorists and pedestrians.
- Update signs as needed, such as if the work area changes or the hazards change.
- Keep signs clean and free of debris.

## 1.3 Plant, tools and equipment

### 1.3.1 Plant

The plant can be either a batch plant or a continuous plant. A batch plant mixes the Reclaimed Asphalt Pavement (RAP) and other materials in batches, while a continuous plant mixes the materials continuously.

Pavement recycling plants are used to reduce the amount of waste generated from road construction and maintenance. They also help to conserve natural resources by reducing the need for virgin aggregate.

#### A) Types of pavement recycling plants:

- Hot-in-place recycling (HIR): This method involves heating the existing pavement and then mixing it with Reclaimed Asphalt Pavement (RAP) and asphalt binder. The recycled mixture is then placed back in the same location.

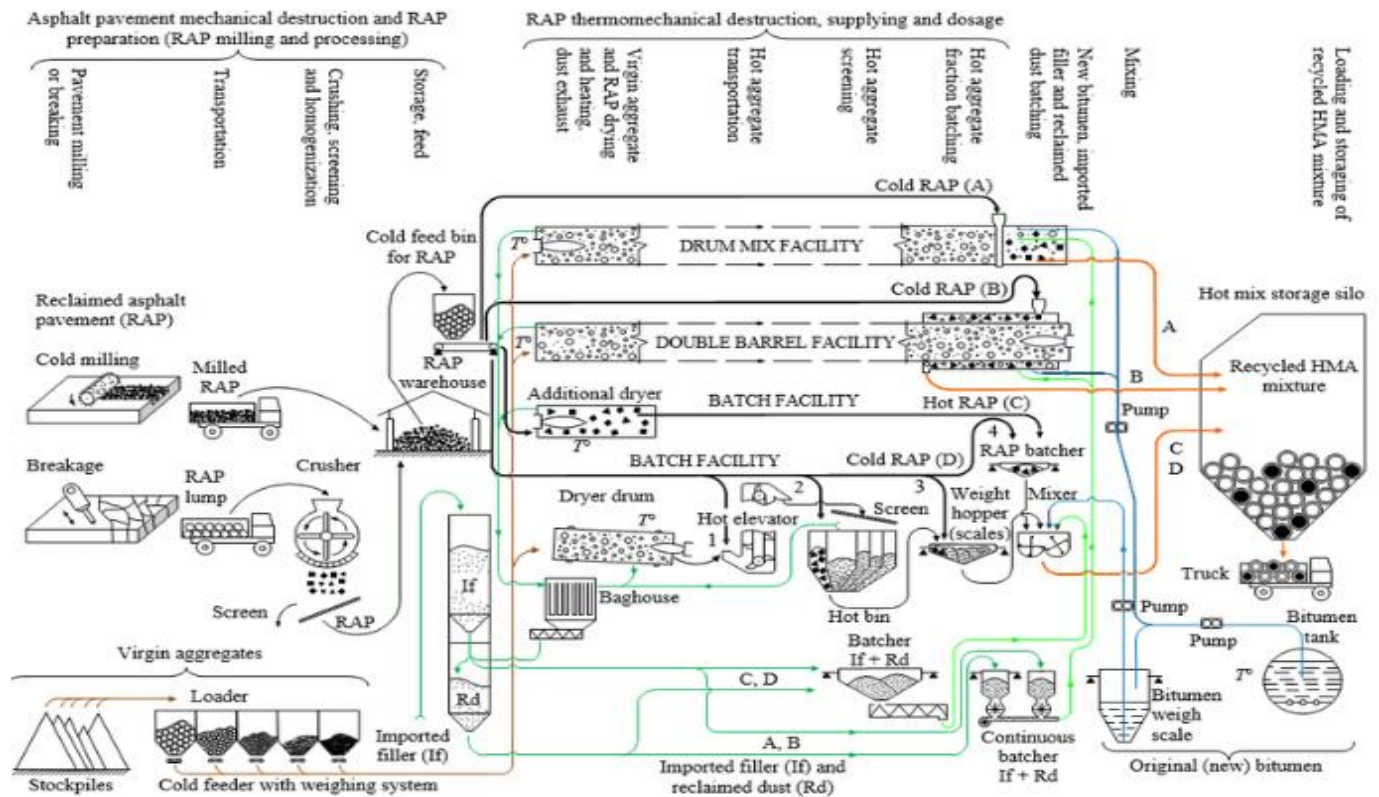


- Cold-in-place recycling (CIR): This method does not involve heating the existing pavement. The Reclaimed Asphalt Pavement (RAP) is simply milled and then mixed with virgin aggregate, asphalt binder, and water. The recycled mixture is then placed back in the same location.
- Central plant recycling (CPR): This method involves transporting the Reclaimed Asphalt Pavement (RAP) to a central plant where it is mixed with virgin aggregate, asphalt binder, and water. The recycled mixture is then transported to the construction site and placed.

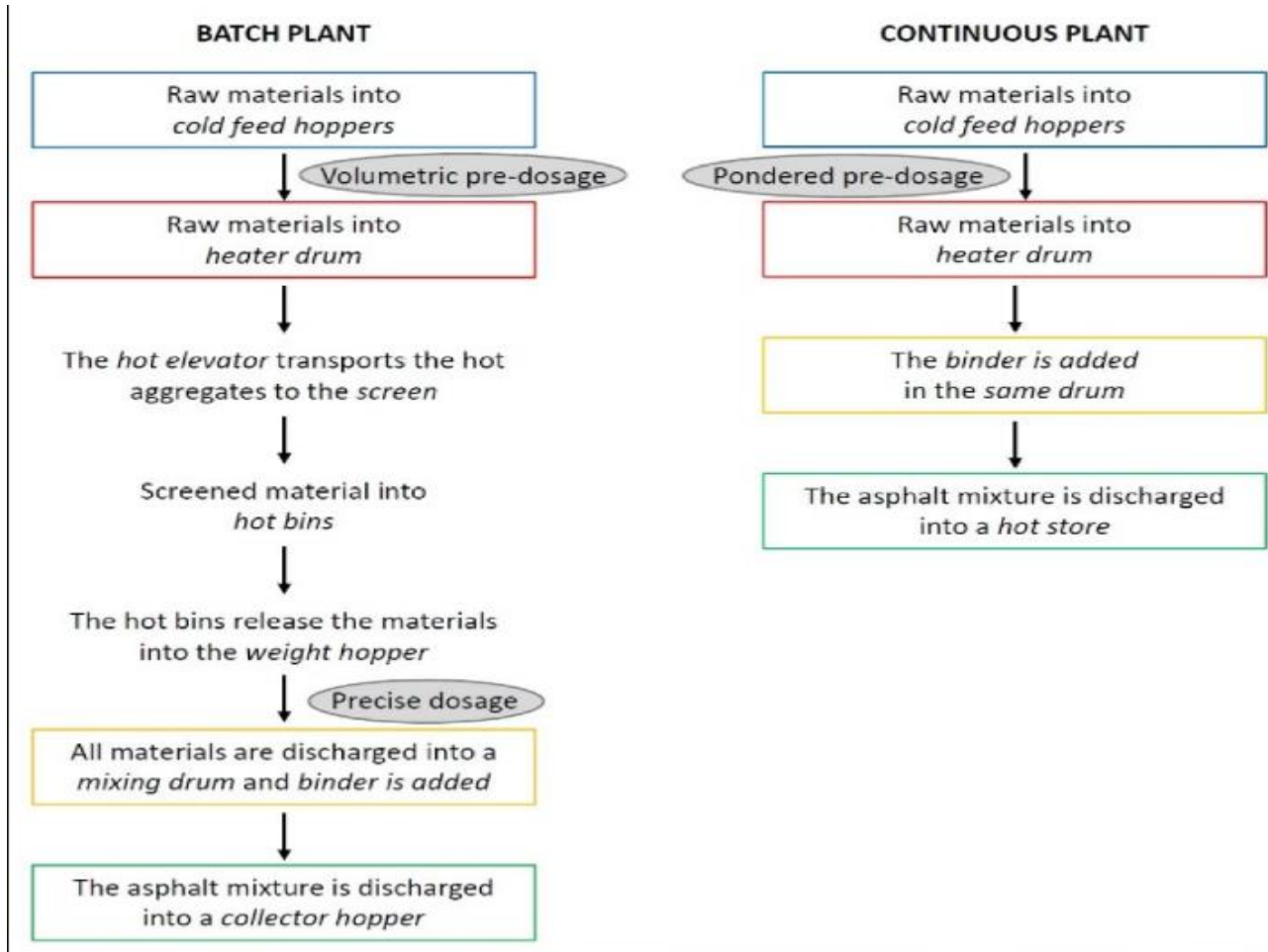
A plant for pavement recycling operations is a facility that uses reclaimed asphalt pavement (RAP) to produce new asphalt mixtures.

### B) The components of plant

- Batch plants: These plants are used to mix the RAP with new materials. They have a hopper for the RAP, a hopper for the aggregate, a tank for the asphalt cement, and a mixer. The materials are mixed together in the mixer and then discharged out of the plant.








- Continuous plants: These plants are similar to batch plants, but they mix the materials continuously. They are typically used for larger projects.



### 1.3.2 Tools

There are a few hand tools that are commonly used in pavement recycling operations. These include:

<b>Shovels:</b> Shovels are used to remove the old pavement material and to mix the recycled material with new aggregate and binder.	
<b>Pickaxes:</b> Pickaxes are used to break up the old pavement material.	
<b>Rakes:</b> Rakes are used to level the recycled material and to remove any large rocks or debris.	
<b>Wheelbarrows:</b> Wheelbarrows are used to transport the recycled material to the mixing area.	
<b>Hand tampers:</b> Hand tampers are used to compact the recycled material.	

### 1.3.2 Equipment

The equipment used for pavement recycling operations can be divided into three main categories:




- **Removal and sizing:** This includes equipment used to remove the old pavement, such as ripping machines, milling machines, and excavators. The old pavement is then crushed to

a specific size, which is typically determined by the type of recycling process that will be used.





- **Reprocessing:** This includes equipment used to mix the reclaimed asphalt pavement (RAP) with new materials, such as aggregate, asphalt cement, and water. The most common type of reprocessing equipment is a batch plant, but continuous plants are also used.
- **Laydown and compaction:** This includes equipment used to place the recycled asphalt mixture (RAP) and compact it into a new pavement. The most common types of laydown equipment are pavers and spreaders, and the most common types of compaction equipment are rollers and vibratory plates.

The specific pieces of equipment that are commonly used in pavement recycling operations are:

**Table 1-2 Equipment for pavement recycling operations**

<p><b>Ripping machines:</b> These machines are used to tear up the old pavement. They have a large blade that is attached to a rotating drum. The blade cuts through the pavement and the drum then lifts the pieces of pavement up and out of the way</p>	
<p><b>Milling machines:</b> These machines are used to remove the old pavement in a thin layer. They have a rotating drum that is fitted with milling blades. The blades cut through the pavement and the material is then collected in a hopper.</p>	
<p><b>Excavators:</b> These machines are used to load the old pavement into trucks or trailers. They have a bucket that can be used to scoop up the material.</p>	



<p><b>Crushers:</b> These machines are used to reduce the size of the old pavement. They have a rotating drum that is fitted with hammers or teeth. The material is crushed as it passes through the drum.</p>	
<p><b>Pavers:</b> These machines are used to place the recycled asphalt mixture. They have a screed that is used to level the material and a spreader that is used to distribute the material evenly.</p>	
<p><b>Rollers:</b> These machines are used to compact the recycled asphalt mixture. They have a large drum that is rolled over the material, forcing it down.</p>	
<p><b>Vibratory plates:</b> These machines are also used to compact the recycled asphalt mixture. They have a plate that vibrates, causing the material to compact more efficiently.</p>	

## 1.4 Environmental protection requirements

The environmental protection requirements for pavement recycling operations vary depending on the location and the specific materials being recycled. The general requirements include:

- Preventing dust emissions. Dust from pavement recycling can be a nuisance and a health hazard. It can also contribute to air pollution. To prevent dust emissions, operators should use water suppression systems, dust covers, and other dust control measures.
- Controlling storm water runoff. Storm water runoff from pavement recycling operations can carry pollutants into waterways. To control storm water runoff, operators should install silt fences, sediment traps, and other erosion control measures.

- Managing hazardous materials. Some pavements may contain hazardous materials, such as lead or asbestos. Operators must carefully remove and dispose of these materials in accordance with applicable regulations.
- Protecting wildlife. Pavement recycling operations can disturb wildlife habitats. Operators should take steps to minimize the impact on wildlife, such as avoiding work during sensitive times of the year and providing temporary shelter for displaced animals.

There may be specific requirements imposed by local, state, or federal regulations. Operators should consult with the appropriate authorities to ensure that they are in compliance with all applicable laws and regulations.

Recycling pavement can help to protect the environment by reducing the amount of waste sent to landfills and incinerators. It can also conserve natural resources and reduce pollution.

By following the environmental protection requirements, operators can help to ensure that pavement recycling is done in a way that minimizes its impact on the environment.

There are ways that recycling can protect the environment:

- Reduces greenhouse gas emissions. The production of new materials requires energy, which can generate greenhouse gases. Recycling helps to reduce the need for new materials, which can help to reduce greenhouse gas emissions.
- Conserves water. The production of some materials, such as concrete, requires a lot of water. Recycling can help to conserve water by reducing the need for new materials.
- Protects natural resources. Recycling helps to protect natural resources such as trees, minerals, and fossil fuels. These resources are essential for our economy and our way of life.

Recycling is a win-win for the environment. It helps to reduce waste, conserve resources, and protect the planet.

### 1.4.1 Environmental management plan

An environmental management plan (EMP) for pavement recycling operations should address the following key areas:

- **Dust control:** Dust control is important to prevent the spread of pollutants into the air and water. This can be achieved by using water sprays, dust suppressants, or enclosures to contain the dust.
- **Water quality:** Pavement recycling operations can generate runoff that contains pollutants such as oil, grease, and heavy metals. This runoff can pollute waterways if it is not properly managed. Best practices for water quality protection include using silt fences, sediment traps, and oil/water separators.
- **Noise control:** Pavement recycling operations can generate noise that can disturb nearby residents and businesses. This can be mitigated by using quiet equipment, scheduling operations during off-peak hours, and installing noise barriers.
- **Air quality:** Pavement recycling operations can generate emissions of pollutants such as dust, volatile organic compounds (VOCs), and heavy metals. These emissions can contribute to air pollution and respiratory problems. Best practices for air quality protection include using enclosed equipment, dust suppression, and emission controls.
- **Waste management:** Pavement recycling operations generate a variety of waste materials, including concrete, asphalt, and soil. These waste materials should be disposed of properly to prevent environmental contamination. Best practices for waste management include recycling materials whenever possible, and disposing of hazardous materials in accordance with regulations.
- **Emergency response:** Pavement recycling operations should have a plan in place for responding to spills and other emergencies. This plan should include procedures for notifying the appropriate authorities, containing the spill, and cleaning up the contamination.

In addition to these key areas, the EMP should also address the specific environmental concerns of the project site. For example, if the site is located near a sensitive wetland or endangered species habitat, additional measures may be needed to protect these resources.

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The EMP should be developed in consultation with environmental experts and should be reviewed and updated on a regular basis to ensure that it remains effective.

Here are some additional tips for developing an effective EMP for pavement recycling operations:

- Start by conducting an environmental assessment to identify the potential environmental impacts of the project.
- Involve stakeholders in the development of the EMP to ensure that their concerns are addressed.
- Use the best available technology to control environmental impacts.
- Monitor the effectiveness of the EMP and make adjustments as needed.

By following these tips, you can help to ensure that pavement recycling operations are conducted in an environmentally responsible manner.

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Self-Check 1	Written test
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Name..... ID..... Date.....

### Part I: True or False question

**I. Instruction: Say true if the statement is correct and false if the statement is incorrect.**

1. Volatile fumes in Pavement recycling operations is one kinds of potential hazards harmful to breathe.
2. A self-propelled wheeled pavement recycling plant is a machine that can recycle asphalt pavement in place.
3. Pavement recycling plants are used to reduce the amount of waste generated from road construction and maintenance.
4. Hot-in-place recycling (HIR) involves heating the existing pavement and then mixing it with RAP and asphalt binder.
- 5 Crusher machine is the machine used to remove the old pavement in a thin layer.

### Part II: Matching

**Instruction: Match Terms in column A with its meanings in column B.**

<u>A</u>	<u>B</u>
1 Standard Specification for Recycled Asphalt Pavement (RAP)	A) AASHTO M 323
2 Used to warn motorists and pedestrians	B) Warning sign
3 Pavement recycling plants	C) Used to reduce the amount of waste generated from road construction and maintenance.
4 Pavers	D) Machine used to place the recycled asphalt mixture
5 Equipment used to remove the old pavement	E) Ripping machines, milling machines

### Part III: Short Answer Questions

1. List the relevant standard specification document for pavement recycling operations.
2. Write down the comprehensive safety program that are used to protect workers and the public.
3. Mention some common signage that are used for pavement recycling operations.
4. Mention the equipment that are commonly used for pavement recycling operations.

## Unit Two: pre-operation and operation of profile planer

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

- Overview of Profile planer
- Pre-start, start-up, and park and shutting down procedures
- Profile planer controls and functions
- Hazard identification
- Profile planer operating techniques.
- Profile planer operation.
- Material remove and Clear work area

This unit will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, the trainee will be able to:

- Ensuring pre-start, start-up, and park and shutting down procedures.
- Checking profile planer controls and functions
- Identify hazard and safe operating techniques
- Identify and apply Profile planer operating techniques
- Operate profile planer
- Operate material removing and Clearing work area



## 2.1 Overview of Profile planer

A profile planer is a machine used to level and smooth asphalt pavement. It has a blade that is attached to a carriage that moves back and forth across the pavement. The blade cuts away any high spots or uneven areas, leaving a smooth, level surface.

Profile planers are typically used in the following applications:

- **Milling:** This is the process of removing a layer of asphalt pavement. Profile planers can be used to mill a specific depth of asphalt, or they can be used to mill the entire pavement surface.
- **Patching:** This is the process of repairing damaged asphalt pavement. Profile planers can be used to remove the damaged asphalt and prepare the surface for patching.
- **Edge forming:** This is the process of creating a smooth, even edge on an asphalt pavement. Profile planers can be used to edge form the pavement before or after it is milled.
- **Straight work:** This is the process of leveling and smoothing asphalt pavement that is already in place. Profile planers can be used to straight work the pavement to correct any uneven areas.

Profile planers can be either towed or self-propelled. Towed planers are typically used for smaller projects, while self-propelled planers are used for larger projects.

The blade on a profile planer can be either a drag blade or a rotary blade. Drag blades are more common and are used for general-purpose work. Rotary blades are used for more precise work, such as edge forming.

The depth of cut on a profile planer can be adjusted to meet the specific needs of the project. The typical depth of cut is 1.25 cm, but it can be as much as 5 cm.

Profile planers are a versatile machine that can be used for a variety of applications in asphalt pavement maintenance and construction.



The benefits of using a profile planer in asphalt pavement are:

- It can level and smooth asphalt pavement quickly and efficiently.
- It can remove any high spots or uneven areas.
- It can create a smooth, even edge on the pavement.
- It can be used for a variety of applications, including milling, patching, edge forming, and straight work.

Drawbacks to using a profile planer are:

- It can be noisy and disruptive.
- It can create dust and fumes.
- It can be dangerous if not operated properly.

Overall, profile planers are a valuable tool for asphalt pavement maintenance and construction. They can be used to level and smooth asphalt pavement quickly and efficiently, and they can be used for a variety of applications. However, it is important to be aware of the potential drawbacks of using a profile planer before using it.



Fig: Profile planer

## 2.2 Pre-start, start-up, and park and shutting down procedures

A **pre-start** is a safety procedure that is conducted before starting a machine or piece of equipment. The purpose of a pre-start is to ensure that the machine is in safe operating condition and that the operator is familiar with the controls and procedures.

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The above procedures for a profile planer are:

### 2.2.1 Pre-start procedures:

- Inspect the machine for any damage or defects.
- Make sure that all guards and safety devices are in place and operating properly.
- Check the oil level and coolant level.
- Adjust the feed rate and depth of cut.
- Secure the work piece to the table.

**The startup** of equipment is the process of bringing a piece of equipment from an inoperative condition to an operational condition.

### 2.2.2 Start-up procedures:

- Turn on the power switch.
- Start the engine.
- Allow the machine to warm up for a few minutes.
- Slowly engage the feed rate.

**Shutting down** equipment is the process of stopping a piece of equipment from operating.

### 2.2.3 Parking and shutting down procedures:

- Slow down the feed rate and disengage it.
- Turn off the engine.
- Turn off the power switch.
- Remove the work piece from the table.
- Clean the machine and store it in a safe place.

## 2.3 Profile Planer Controls and Functions

The operator of a pavement recycling profile planer must be familiar with the controls and functions of the machine in order to operate it safely and effectively. The operator must also be aware of the potential hazards associated with the machine, such as the risk of injury from the rotating drum or the water spray.

The steps to check the controls and functions of a profile planer:

- Inspect the machine for any damage or defects.
- Make sure that all guards and safety devices are in place and operating properly.

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- Check the oil level and coolant level.
- Operate each control to make sure that it is functioning properly.
  - The feed rate control should allow you to adjust the speed of the planer.
  - The depth of cut control should allow you to adjust the amount of material that is removed with each pass.
  - The table tilt control should allow you to tilt the table to a desired angle.
  - The power switch should turn the machine on and off.

### 2.3.1 Profile Planer Attachments

Pavement recycling profile planer attachments are devices that are mounted on excavators, backhoes, or skid steers to remove and recycle the surface layer of an asphalt pavement. The attachments typically have a rotating drum with cutting teeth that can be adjusted to remove a specific amount of material or to create a specific profile. The milled material is collected in a hopper and transported to a recycling facility.

There are many different profile planer attachments available, each designed for a specific purpose.

#### A) Common attachments

- Straight-fluted drums: These are the most common type of drum and are used for general-purpose planning.
- Turbo drums: These drums have a spiral pattern of flutes that help to create a smoother finish.
- Slot drums: These drums have a series of slots that are used for cutting grooves or slots in the material.
- Diamond drums: These drums are coated with diamond grit and are used for rough planning or removing concrete.
- Edger drums: These drums are used for planning the edges of materials.
- Contour drums: These drums are designed to follow a specific contour or shape.

The type of attachment that you need will depend on the specific task that you are trying to accomplish. For example, if you are planning a concrete driveway, you would use a diamond drum. If you are planning a piece of wood, you would use a straight-fluted drum.

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## B) Factors choosing a profile planer attachment

- The type of material that you will be planning.
- The depth of cut that you need.
- The finish that you want to achieve.

## C) Safety tips

- Always wear safety glasses and gloves when operating the machine.
- Keep your hands away from the cutting area.
- Do not operate the machine if it is damaged or defective.
- Be aware of your surroundings and make sure that there are no people or obstacles in the work area.



Fig: profile planer attachments

## 2.4 Hazard identification

Hazard identification is the process of identifying potential hazards associated with a particular activity or operation. It is an important step in risk management, as it allows the trainee to take steps to control or mitigate the risks.

### 2.4.1 Asphalt pavement milling

- Fire and explosion hazards. Asphalt is a flammable material, so there is a risk of fire or explosion if it comes into contact with an ignition source. This is especially a concern when milling asphalt that is hot or that has been mixed with other flammable materials.
- Health hazards. Asphalt fumes can irritate the eyes, nose, throat, and lungs. They can also cause headaches, dizziness, nausea, and vomiting. Long-term exposure to asphalt fumes can increase the risk of cancer.
- Skin burns. The hot asphalt used in milling can cause severe skin burns.

- Noise and vibration. The milling equipment can be very noisy and create vibrations that can be harmful to the ears and other parts of the body.
- Traffic hazards. The milling operation can create a traffic hazard, as workers and equipment will be moving around in a busy area.
- Falling hazards. The milling equipment can create holes and uneven surfaces, which can increase the risk of falls.

### **Appropriate safety measures**

- Using proper personal protective equipment (PPE), such as gloves, goggles, and a respirator.
- Keeping the work area clean and free of debris.
- Using a fire extinguisher and other fire safety equipment.
- Monitoring the air quality and taking steps to reduce exposure to fumes.
- Controlling noise and vibration levels.
- Traffic control measures to keep people and vehicles safe.
- Proper training for workers on safety procedures.

### **2.4.2 Edge planning and straight work**

The hazards associated with asphalt pavement edge planning are:

- Falling hazards. The edge planning equipment can create holes and uneven surfaces, which can increase the risk of falls.
- Traffic hazards. The edge planning operation can create a traffic hazard, as workers and equipment will be moving around in a busy area.
- Electrical hazards. The edge planning equipment may be powered by electricity, so there is a risk of electric shock if the equipment is not properly grounded.
- Mechanical hazards. The edge planning equipment can have sharp blades and moving parts, which can cause cuts and other injuries.
- Heat stress. The edge planning equipment can generate heat, which can lead to heat stress in workers.
- Dust and fumes. The edge planning process can create dust and fumes, which can irritate the eyes, nose, and throat.

## 2.5 Profile planer operating techniques

Profile planer operating techniques are the methods used to operate a profile planer safely and effectively.

### Important techniques

- Planning and preparation. Before operating a profile planer, it is important to plan and prepare the work area. This includes securing the work piece, setting the cutting depth, and selecting the correct cutting tool.
- Safe operation. Always wear safety glasses when operating a profile planer. Keep your hands away from the cutting tool and be aware of the direction of the cutting tool. Do not operate the profile planer if it is damaged or malfunctioning.
- Proper feed rate. The feed rate is the speed at which the work piece is moved past the cutting tool. The feed rate should be slow enough to ensure a clean cut and avoid damaging the work piece.
- Light pressure. Apply light pressure to the work piece as it is moved past the cutting tool. This will help to prevent the cutting tool from binding or breaking.
- Inspection. Inspect the work piece frequently to make sure that the desired profile is being achieved. If the cutting tool becomes dull, stop the profile planer and replace the cutting tool.

### A. Tips for operating a profile planer safely:

- Always be aware of your surroundings and watch out for people and vehicles in the work area.
- Never operate the planer if you are tired or under the influence of drugs or alcohol.
- Be sure to follow all safety procedures, including wearing PPE and using traffic control devices.
- Inspect the planer regularly for damage or defects.
- Keep the planer clean and free of debris.



## B. The operating techniques

**Straight line planning:** This is the most common type of planning and is used to create a straight line on a surface. To do this, you will need to align the planer with the desired line and then slowly move it forward.

- **Edge planning:** This is used to create a smooth edge on a surface. To do this, you will need to position the planer so that the cutting edge is just outside of the desired edge. Then, slowly move the planer forward.
- **Contour planning:** This is used to create a curved or irregular surface. To do this, you will need to use the planer's controls to adjust the cutting depth and angle.
- **Milling:** This is a more aggressive type of planning that is used to remove a large amount of material from a surface. To do this, you will need to use a milling attachment on the planer.

The specific operating techniques that you use will vary depending on the type of profile planer you are using and the task at hand. It is important to read the manufacturer's instructions carefully and practice the techniques before you start operating the machine.

## 2.6 Profile planer operation

A profile planer is a machine tool that is used to remove material from a surface to create a desired profile. The planer has a cutting head that is mounted on a carriage that moves back and forth across the surface. The cutting head can be adjusted to vary the depth and angle of the cut.

### A) The steps on how to operate a profile planer:

- **Plan and prepare the work area.** This includes setting up traffic control devices, barricades, and warning signs to keep people and vehicles away from the work area. You will also need to wear personal protective equipment (PPE), such as hard hat, safety glasses, gloves, and hearing protection.
- **Inspect the profile planer.** Before you start operating the machine, you need to inspect it for any damage or defects. You should also check the fluid levels and make sure the machine is properly powered.
- **Start the profile planer.** Once you have inspected the machine, you can start it up. Follow the manufacturer's instructions for starting the machine and operating the controls.

- Operate the profile planer. Use the controls to guide the planer over the surface and remove the desired amount of material. Be careful not to go too deep, as this could damage the underlying surface.
- Shut down the profile planer. When you are finished operating the planer, shut it down properly. Follow the manufacturer's instructions for shutting down the machine and securing it.



Fig: profile planer equipment

The specific operating techniques that you use will vary depending on the type of profile planer you are using and the task at hand. It is important to read the manufacturer's instructions carefully and practice the techniques before you start operating the machine.

#### A) Safety tips for operating a profile planer

- Do not operate the planer if the cutting blades are damaged or dull.
- Be careful not to overload the planer.
- Do not operate the planer in wet or icy conditions.
- Be aware of the clearances around the planer.
- Do not operate the planer near overhead power lines

## 2.7 Material removing and work area clearing

### 2.7.1 Material removing

Material removing operating for profile plane is a process of removing material from a work piece to create a desired profile. The profile plane is the imaginary plane that the profile of the work piece is created on. The material removal operation can be performed using a variety of tools and machines, such as lathes, mills, and grinders.

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### The steps to remove material for profile planer operating

- Secure the work piece. The work piece must be securely fastened to the worktable of the profile planer. This can be done using clamps, vises, or other holding devices.
- Set the cutting depth. The cutting depth is the amount of material that will be removed from the work piece. It is important to set the cutting depth carefully to avoid removing too much material or damaging the work piece.
- Select the correct cutting tool. The cutting tool must be sharp and properly aligned. The type of cutting tool used will depend on the material being machined and the desired profile.
- Start the profile planer. Once the work piece is secure and the cutting tool is in place, start the profile planer.
- Move the work piece past the cutting tool. The work piece should be moved slowly and smoothly past the cutting tool. The speed of the work piece will depend on the material being machined and the desired profile.
- Repeat steps 4-5 until the desired profile is achieved. Once the desired profile is achieved, stop the profile planer and remove the work piece.

Safety tips to keep in mind when removing material for profile planer operating:

- Always wear safety glasses when operating a profile planer.
- Keep your hands away from the cutting tool.
- Be aware of the direction of the cutting tool.
- Do not operate the profile planer if it is damaged or malfunctioning.

Tips for operating a profile planer

- Use a slow feed rate to avoid overloading the machine.
- Be careful not to apply too much pressure, as this could damage the work piece.
- Inspect the work piece regularly for damage.
- When you are finished operating the planer, clean it thoroughly and store it in a safe place.

Safety tips to keep in mind when clearing a work area for pavement recycling operations:

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- Always wear personal protective equipment (PPE), such as hard hat, safety glasses, gloves, and boots.
- Be aware of the traffic patterns in the area and take steps to protect workers and motorists.
- Follow all safety regulations and procedures.

## A) Soil types and characteristics

### Types of soil

The best soil types for pavement recycling operations are those that are sandy or gravelly, with a low clay content. These soils have good drainage and are less likely to shrink and swell, which can cause damage to the pavement. Some of the specific soil types that are commonly used in pavement recycling operations include:

- **Sand:** Sand is a good choice for pavement recycling because it is strong, durable, and has good drainage. It is also relatively inexpensive and easy to find.
- **Gravel:** Gravel is similar to sand, but it also contains larger particles, such as pebbles and rocks. This makes it even stronger and more durable than sand.
- **Loam:** Loam is a mixture of sand, silt, and clay. It is a good choice for pavement recycling because it has good drainage and is relatively easy to compact.
- **Sandy loam:** Sandy loam is a type of loam that is high in sand content. This makes it even stronger and more durable than loam.
- **Gravelly loam:** Gravelly loam is a type of loam that is high in gravel content. This makes it even stronger and more durable than sandy loam.

### B) Characteristics of soil

The following are the characteristics of soil for pavement recycling operations:

- **Grain size distribution:** The grain size distribution of the soil affects its strength, stiffness, and permeability. Soils with a wide range of grain sizes are typically the best for pavement recycling, as they provide a good balance of strength and flexibility.

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- **Plasticity:** The plasticity of the soil affects its ability to be compacted. Soils with high plasticity are more difficult to compact and are more likely to shrink and swell, which can cause damage to the pavement.
- **Compressibility:** The compressibility of the soil affects its ability to support loads. Soils that are highly compressible can deform under load, which can lead to pavement failure.
- **Porosity:** The porosity of the soil affects its ability to drain water. Soils with high porosity are more likely to drain water quickly, which can help to prevent frost heave and other types of damage.
- **Chemical composition:** The chemical composition of the soil can affect its durability. Soils that are high in salts or other harmful chemicals can corrode the pavement and shorten its lifespan.
- **The amount of asphalt:** The amount of asphalt in the soil affects its strength and durability. Soils with a high asphalt content are typically stronger and more durable than soils with a low asphalt content.
- **The presence of contaminants:** The presence of contaminants such as oil, grease, or other chemicals can damage the pavement and shorten its lifespan.
- **The moisture content:** The moisture content of the soil affects its ability to be compacted. Soils that are too wet are difficult to compact and are more likely to shrink and swell.

### C) Principles of soil compaction

The principles of soil compaction for pavement recycling operations are **based on the Proctor compaction test**. The Proctor compaction test is a laboratory test that is used:

➤ To determine the maximum dry density of a soil.

- The maximum dry density is the highest density that the soil can be compacted to without causing it to shrink or swell.
- The Proctor compaction test is conducted by compacting the soil in a mold of known volume. The soil is compacted in layers, and the moisture content of the soil is adjusted between layers. The compaction effort is applied by a plunger, and the amount of compaction effort is recorded.
- The results of the Proctor compaction test are plotted on a graph of dry density versus moisture content. The point on the graph that represents the maximum dry density is called the Proctor optimum.

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The principles of soil compaction for pavement recycling operations are based on the following factors:

- The moisture content of the soil: The moisture content of the soil affects its ability to be compacted. Soils that are too wet are difficult to compact, and soils that are too dry are not as strong.
- The compactive effort: The compactive effort is the amount of force that is applied to the soil during compaction. The higher the compactive effort, the denser the soil will be.
- The type of soil: Different types of soil have different compaction characteristics. Sandy soils are easier to compact than clay soils.
- Use the right type of equipment. The type of equipment used for compaction will depend on the specific project.
- Inspect the compacted soil. The compacted soil should be inspected to ensure that it has been compacted properly.
- The amount of asphalt in the soil: The amount of asphalt in the soil affects its strength and durability. Soils with a high asphalt content are typically stronger and more durable than soils with a low asphalt content.

The goal of soil compaction for pavement recycling operations is **to achieve the maximum dry density of the soil**. This will help to ensure that the pavement is: strong, durable, and resistant to damage.

### 2.7.2 Clearing work area

The steps on how to clear a work area for pavement recycling operations:

- Evacuate the area. Make sure that all people and vehicles are clear of the work area. This is important to ensure the safety of everyone involved.
- Remove any obstacles. This includes signs, light poles, traffic cones, and other objects that could interfere with the operations. This will also help to create a clear path for the heavy equipment that will be used.
- Drain any standing water. This could create a safety hazard and make it difficult to operate the equipment. It is also important to remove any loose debris, such as leaves or gravel that could also be a hazard.
- Loosen the pavement. This can be done with a scarifier or other heavy equipment. This will help to break up the pavement so that it can be removed more easily.

- E. Remove the old pavement. This can be done by breaking it up with a jackhammer or other demolition equipment. The old pavement will then be loaded onto trucks or trailers and taken to a disposal site.
- F. Prepare the subgrade. This is the layer of soil that supports the pavement. It should be compacted to ensure that the new pavement is stable. This can be done with a roller or other compacting equipment.
- G. Place the new pavement. This can be done by spreading asphalt or concrete. The new pavement will then be compacted to ensure that it is smooth and level.
- H. Stripe the new pavement. This is done to mark the lanes and other features.

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### Part I: True or False question

#### I. Instruction: Say true if the statement is correct and false if the statement is incorrect

1. List the hazards associated with profile planer operations
2. Contact with moving parts are a type of Profile planer operations hazards.
3. Proper feed rate is the speed at which the work piece is moved past the cutting tool.
4. Diamond drums are a Profile planer attachments coated with diamond grit and are used for rough planning or removing concrete.
5. Type of attachments are depend on the specific task that you are trying to accomplish.
6. When choosing a profile planer attachment, the depth of cut is important

### Part II: Matching

#### Instruction: Match Terms in column A with its meanings in column B.

<u>A</u>	<u>B</u>
1 The operating techniques	A) Edge planning
2 Steps to remove material for profile planer operating	B) Set the cutting depth
3 Clearing work area	C) Drain any standing water
4 plane that the profile of the work piece is created on	D) Profile plane
5 Pre-start procedures	E) Adjust the feed rate and depth of cut
6 Safety tips for profile planer attachments	F) Keep your hands away from the cutting area
7 Profile planer attachments	G) Turbo drums
8 Inspect the machine	H) Controls and functions of a profile planer

### Part III: Short Answer Questions

1. List the Profile planer operations hazards.
2. Write at least five Profile planer operating techniques.
3. Mention the safety tips for operating a profile planer.
4. List the steps of clearing work area to operate a profile planer.
5. Mention the Pre-start procedures of Profile planer equipment.
6. How to check the controls and functions of a profile planer.
7. List the attachments of Profile planer.
8. What considerations can you follow when choosing a profile planer attachment?

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## Unit Three: Profile planer Attachments

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

- Select attachment task
- Remove and fit requirement
- Test attachment
- Use of attachment
- Clean and store removed attachments.

This unit will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Select attachment task
- Remove and fitting requirement
- Test and fitting operation
- Use of attachment
- Clean and store removed attachments.



### 3.1 Selecting attachment task

There are many different attachment tasks that can be used for pavement recycling operations. The specific task that is best for a particular project will depend on the type of pavement, the condition of the pavement, and the desired outcome of the recycling operation.




#### 3.1.1 The criteria for selecting an attachment

- The type of material being machined. Different materials require different types of cutting tools.
- The desired profile. The type of attachment will depend on the desired profile. For example, a straight-fluted cutter is used to create a flat surface, while a helical-fluted cutter is used to create a curved surface.
- The size of the work piece. The size of the attachment will need to be compatible with the size of the work piece. For example, a large attachment would not be able to be used on a small work piece.
- The depth of cut. The depth of cut will need to be compatible with the capabilities of the attachment. For example, a deep-cut attachment would not be able to be used on a thin work piece.
- The cost. The cost of the attachment will need to be considered, as well as the budget for the project.

Different Attachment tasks for pavement recycling operations

**Pavement milling:** This attachment is used to remove a layer of pavement, typically 5-10 cm thick. The milled material can then be recycled or disposed of.



<p><b>Pavement pulverizing:</b> This attachment is used to crush the pavement into small pieces. The pulverized material can then be recycled or used as aggregate.</p>	
<p><b>Pavement coring:</b> This attachment is used to remove cores of pavement. The cores can then be analyzed to determine the condition of the pavement.</p>	
<p><b>Pavement sawing:</b> This attachment is used to cut the pavement into strips. The strips can then be removed and recycled or disposed of.</p>	

### Factors to consider planning a pavement recycling operation

- The type of pavement material
- The condition of the pavement
- The desired outcome of the recycling operation
- The cost of the operation
- The environmental impact of the operation

### 3.2 Removing and fitting requirement

The removing and fitting requirements for pavement recycling operations will vary depending on the specific attachment task being used.

General requirements that apply to all pavement recycling operations are:

- The pavement must be properly prepared. This includes removing any loose material, such as dirt or debris, and making sure that the surface is level.

- The attachment must be properly aligned. This is important to ensure that the attachment is removing the desired amount of material and that it is not damaging the underlying pavement.
- The attachment must be operated safely. This includes following all safety procedures, such as wearing protective gear and using caution around power lines.

#### **Things to keep in mind when removing and fitting pavement for recycling operations:**

- The type of pavement material will affect the removal process.
  - For example, asphalt pavement is typically easier to remove than concrete pavement.
- The condition of the pavement will also affect the removal process.
  - For example, pavement that is heavily cracked or damaged may require more aggressive removal methods.
- The desired outcome of the recycling operation will also affect the removal process.
  - For example, if the goal is to recycle the pavement material, then the removal process will need to be carefully controlled to minimize damage to the material.
- The cost of the operation will also be a factor in the removal process. More aggressive removal methods may be more expensive, but they may also be more efficient.
- The environmental impact of the operation is also an important consideration. More aggressive removal methods may produce more dust and noise, which could have a negative impact on the environment.

### **4.3 Testing and fitting operation**

Testing and fitting operations are performed on a profile planer to ensure that the desired profile is being achieved and that the work piece is meeting the required specifications. These operations are typically performed by a skilled machinist or technician.

#### **A) The most common testing and fitting operations performed on a profile planer are:**

- Surface profiling: This operation is used to check the surface finish of the work piece. A surface profilometer is used to measure the height of the surface irregularities.
- Dimensional checking: This operation is used to check the dimensions of the work piece. A micrometer or caliper is used to measure the dimensions of the work piece.
- Radius checking: This operation is used to check the radius of the work piece. A radius gauge is used to measure the radius of the work piece.

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- Angle checking: This operation is used to check the angle of the work piece. A protractor is used to measure the angle of the work piece.
- Fit checking: This operation is used to check the fit between two work pieces. A feeler gauge is used to measure the clearance between the two work pieces.

## B) Tips for performing testing and fitting operations on a profile planer

- Use the correct tools and instruments for the job.
- Be careful not to damage the work piece.
- Take your time and be accurate.
- Document the results of the tests.

## 3.4 Use of attachment

The use of attachments for pavement recycling operations can be a beneficial way to improve the efficiency, reduce the environmental impact, and improve the quality of the recycled material. However, it is important to carefully consider the costs and benefits before making a decision.

### Factors to consider when selecting an attachment

- The type of pavement material: The type of pavement material will affect the type of attachment that can be used. For example, asphalt pavement can be recycled with a pavement milling attachment, while concrete pavement can be recycled with a pavement pulverizing attachment.
- The condition of the pavement: The condition of the pavement will also affect the type of attachment that can be used. For example, a pavement that is heavily cracked or damaged may require a more aggressive attachment, such as a pavement sawing attachment.
- The desired outcome of the recycling operation: The desired outcome of the recycling operation will also affect the type of attachment that can be used. For example, if the goal is to recycle the pavement material, then a different attachment will be needed than if the goal is to remove the pavement material and replace it with new material.
- The cost of the operation: The cost of the operation will also be a factor in the selection of the attachment. More expensive attachments may be more efficient and produce a better quality recycled material, but they may also be more difficult to operate and maintain.

- The environmental impact of the operation: The environmental impact of the operation is also an important consideration. More aggressive attachments may produce more dust and noise, which could have a negative impact on the environment.

### 3.5 Cleaning and storing removed attachments

The best way to select an attachment for pavement recycling operations is to consult with a qualified engineer or contractor. The engineer or contractor will be able to assess the specific needs of the project and recommend the best attachment for the job.

#### Tips on how to clean and store removed attachments

- Remove all debris from the attachment. This includes dirt, rocks, asphalt, and concrete. You can use a broom, shovel, or air compressor to remove the debris.
- Clean the attachment with a mild detergent and water. Be sure to rinse the attachment thoroughly to remove all of the detergent.
- Dry the attachment with a clean cloth. This will help to prevent rust and corrosion.
- Lubricate the moving parts of the attachment. This will help to keep the attachment operating smoothly.
- Store the attachment in a clean, dry place. This will help to protect the attachment from the elements.

Additional things to keep in mind when cleaning and storing removed attachments for pavement recycling operations:

- Use the appropriate cleaning solution for the type of attachment. For example, you should use a solvent-based cleaner for an asphalt attachment and a water-based cleaner for a concrete attachment.
- Be sure to wear personal protective equipment (PPE) when cleaning the attachment, such as gloves, goggles, and a dust mask.
- Store the attachment in a location that is accessible but also protected from theft.

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### Part I: True or False question

**I. Instruction: Say true if the statement is correct and false if the statement is incorrect**

1. One of the most common testing and fitting operations performed on a profile planer is surface Profiling.
2. The desired outcome of the recycling operation is a factors to consider planning a pavement recycling operation.
3. The pavement must be properly prepared to removing and fitting requirement'

### Part II: Matching

**Instruction: Match Terms in column A with its meanings in column B.**

A	B
1 The criteria for selecting an attachment	A) The depth of cut
2 Used to crush the pavement into small pieces	B) Pavement milling
3 Factors to consider planning a pavement recycling operation	C) The cost of the operation
4 Performing testing and fitting operations	D) Use the correct tools and instruments for the job.

### Part III: Short Answer Questions

1. Mention the criteria for selecting an attachment.
2. List the most common testing and fitting operations performed on a profile planer.
3. List the factors that you consider when selecting an attachment.
4. List the tips on how to clean and store removed attachments.



## Unit Four: Relocate the profile planer

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

- Move Profile planer safely
- Relocate profile planer

This unit will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Observe Moving Profile planer safely
- Preparing relocate profile planer

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## 4.1 Move Profile planer safely

A profile planer is a machine used to remove a specific depth of material from a surface. It is commonly used in pavement recycling operations to remove the existing pavement and prepare the surface for new asphalt or concrete.

The safe procedures for moving a profile planer for pavement recycling operations:

- Disconnect the power. Before moving the profile planer, always disconnect the power cord from the electrical outlet. This will prevent accidental energization of the machine, which could pose a serious safety hazard.
- Lower the blade. Once the power is disconnected, lower the blade of the profile planer to its lowest position. This will help to prevent the blade from coming into contact with anything during the move.
- Block the wheels. To prevent the profile planer from rolling during the move, block the wheels with wooden wedges or chocks.
- Use a forklift or crane. The safest way to move a profile planer is to use a forklift or crane. These machines can lift and move the profile planer with minimal risk of injury.
- Move the profile planer slowly and carefully. When moving the profile planer, always move it slowly and carefully. This will help to prevent the machine from tipping over or causing damage to itself or its surroundings.
- Reinstall the blade. Once the profile planer has been moved to its new location, reinstall the blade and reconnect the power cord.

Safety tips to keep in mind when moving a profile planer:

- Always wear safety glasses and gloves when working with a profile planer.
- Be aware of the weight of the profile planer and make sure that you have the necessary manpower to move it safely.
- Do not move the profile planer over uneven or slippery surfaces.
- Make sure that the area around the profile planer is clear of people and obstacles before moving it.

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## 4.2 Relocate profile planer

Profile planer relocation refers to the process of moving a profile planer from one location to another. This can be done for a variety of reasons, such as:

- To move the profile planer to a new job site.
- To repair or maintain the profile planer.
- To store the profile planer in a different location.

The steps to prepare to relocate a profile planer are:

- A. Disconnect the power. Make sure to disconnect the power to the profile planer before you begin any work. This will prevent any accidental injuries.
- B. Drain the fuel tank. If the profile planer is equipped with a fuel tank, you will need to drain it before you move it. This will help prevent any spills.
- C. Remove the cutting blades. The cutting blades are sharp, so you will need to wear gloves and safety glasses when removing them.
- D. Lower the cutting head. The cutting head is heavy, so you will need to use a hoist or crane to lower it.
- E. Disconnect the hoses and cables. There are a number of hoses and cables that connect the profile planer to other equipment. You will need to disconnect these before you move the planer.
- F. Secure the profile planer. Once all of the loose components have been removed, you will need to secure the profile planer to a trailer or flatbed truck. This will help prevent it from shifting during transport.
- G. Transport the profile planer to the new location. Once the profile planer is secured, you can transport it to the new location. Be sure to follow all applicable safety regulations when transporting the planer.
- H. Reinstall the cutting blades. Once the profile planer has arrived at the new location, you can reinstall the cutting blades.
- I. Connect the hoses and cables. You will also need to connect the hoses and cables that connect the profile planer to other equipment.

J. Raise the cutting head. Once all of the connections have been made, you can raise the cutting head.

K. Turn on the power. Finally, you can turn on the power to the profile planer and begin working.

Safety tips to keep in mind when relocating a profile planer:

- Always wear gloves and safety glasses when working with the profile planer.
- Be careful not to overload the trailer or flatbed truck when transporting the planer.
- Secure the planer to the trailer or flatbed truck using tie-downs or chains.
- Follow all applicable safety regulations when transporting the planer.

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### Part I: True or False question

**I. Instruction: Say true if the statement is correct and false if the statement is incorrect**

1. A profile planer is a machine used to remove a specific depth of material from a surface.
2. Profile planer relocation refers to the process of moving a profile planer from one location to a new job site.
- 3.

### Part II: Matching

**Instruction: Match Terms in column A with its meanings in column B.**

A	B
1 To repair or maintain the profile planer	A) Relocate profile planer
2 Safety tips to keep in mind when moving a profile planer	B) Be aware of the weight of the profile planer
3 The profile planer before you begin any work	C) Disconnect the power
4 Secure the planer to the trailer	D) Safety tips

### Part III: Short Answer Questions

1. Write the steps of safe procedures for moving a profile planer for pavement recycling operations.
2. Write the variety of reasons for relocate profile planer.
3. Write the steps to prepare to relocate a profile planer.

## Unit Five: Equipment performance

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

- Prepare, park safely, and shutdown.
- Fault inspection.
- Defective parts.

This unit will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, the trainee will be able to:

- Prepare, park safely, and shutdown.
- Conduct fault inspection.
- Maintain, remove, and replace defective parts.



## 5.1 Prepare, park safely, and shutdown

The performance of pavement recycling equipment can vary depending on a number of factors, including the type of equipment, the condition of the existing pavement, the desired quality of the recycled material, and the environmental conditions.

The steps to prepare, park safely, and shutdown pavement recycling equipment performance are:

### 2. Prepare the equipment:

- Check the oil level and coolant level.
- Inspect the tires for wear and tear.
- Make sure that all of the safety guards are in place.
- Activate the parking brake.

### 3. Park the equipment safely:

- Choose a level surface.
- Engage the parking brake.
- Chock the wheels.
- Turn off the engine.
- Remove the keys from the ignition.

### 4. Shutdown the equipment:

- Follow the manufacturer's instructions for shutting down the equipment.
- Disconnect the battery.
- Secure the equipment.
- Dispose of waste materials properly.

Safety tips for pavement recycling equipment performance are:

- Always wear personal protective equipment (PPE), such as hard hat, safety glasses, gloves, and long sleeves.
- Be aware of your surroundings and watch out for traffic.
- Do not operate machinery if you are tired or under the influence of drugs or alcohol.
- Follow all safety procedures outlined by your employer.

Things to keep in mind when preparing, parking safely, and shutting down are:

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- The specific procedures may vary depending on the type of pavement recycling equipment being used.
- It is always a good idea to consult with a safety professional or your employer for specific instructions.
- Be sure to follow all applicable laws and regulations.
- Regularly inspect and maintain the equipment.
- Use the correct type of equipment for the job.
- Operate the equipment at the correct speed and settings.
- Keep the equipment clean and free of debris.
- Dispose of waste materials properly.

## 5.2 Conduct fault inspection

The steps to conduct a fault inspection for pavement recycling equipment are:

- Prepare the equipment. Make sure that the equipment is turned off and that the keys are removed.
- Inspect the exterior of the equipment. Look for any signs of damage, such as cracks, dents, or missing parts.
- Inspect the electrical system. Check the wiring for any signs of damage or corrosion.
- Inspect the hydraulic system. Check the hoses and fittings for any leaks or damage.
- Inspect the engine. Check the oil level and coolant level.
- Inspect the drive train. Check the belts and chains for any wear and tear.
- Inspect the tires. Check the tires for wear and tear and make sure that they are properly inflated.
- Inspect the brakes. Check the brake pads and rotors for wear and tear.
- Test the equipment. Once you have inspected the equipment, start it up and test all of the functions.

The common faults that you may find during a fault inspection for pavement recycling equipment:

- Damaged tires: Pavement recycling equipment can put a lot of stress on tires, so it is important to inspect them regularly for wear and tear.

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- Leaking hydraulic system: A leaking hydraulic system can be a safety hazard, so it is important to repair it immediately.
- Engine problems: Engine problems can cause the equipment to stall or not start, so it is important to have them repaired by a qualified mechanic.
- Drive train problems: Drive train problems can cause the equipment to lose power or not move, so it is important to have them repaired by a qualified mechanic.
- Brake problems: Brake problems can cause the equipment to not stop properly, so it is important to have them repaired by a qualified mechanic.

By conducting regular fault inspections, you can help to prevent major repairs and keep your pavement recycling equipment in good working condition.

Fault inspection tips for pavement recycling equipment:

- Use a checklist to help you remember everything you need to inspect.
- Take pictures of any damage or defects that you find.
- Keep a record of all of your inspection findings.
- Repair any faults immediately.

## 5.3 Maintenance, removal and replacement of defective parts

### 5.3.1 Maintenance

Maintenance is the upkeep of equipment and structures to keep them in good working order. It is a critical part of any operation, as it can help to prevent breakdowns, extend the lifespan of equipment, and improve safety.

Pavement recycling equipment is a complex machine with many moving parts. As with any machine, it is important to maintain it properly to ensure its longevity and safety.

To maintain pavement recycling equipment,

- Regularly inspect and maintain the equipment. This includes checking the tyres, hydraulic hoses, belts, bearings, engine parts, electrical components, and structural components for wear and tear or damage. Any defective parts should be repaired or replaced as soon as possible to prevent further damage to the equipment.
- Use the correct type of equipment for the job. Using the wrong type of equipment can put unnecessary stress on the components and lead to premature failure.

- Operate the equipment at the correct speed and settings. Operating the equipment at too high of a speed or with too much weight can also put unnecessary stress on the components.
- Keep the equipment clean and free of debris. Debris can damage the components and cause them to fail.
- Store the equipment properly. Storing the equipment in a cool, dry place will help to prevent corrosion and other damage.
- Follow the manufacturer's maintenance instructions. The manufacturer will have specific instructions on how to maintain their equipment.
- Have the equipment serviced by a qualified mechanic regularly. A qualified mechanic will be able to identify and repair any potential problems before they cause major damage.

The trainee can help to extend the lifespan of your pavement recycling equipment and prevent costly repairs.

Things to keep in mind when maintaining pavement recycling equipment:

- The specific maintenance requirements will vary depending on the type of equipment and the operating conditions.
- It is important to use the correct type of lubricants and fluids.
- The equipment should be cleaned and inspected after each use.
- Any damaged or worn parts should be repaired or replaced immediately.
- The equipment should be stored in a cool, dry place when not in use.

### **5.3.2 Removal and replacement of defective parts**

Removing and replacing parts is a common maintenance task that can be performed on a variety of equipment. The specific steps involved will vary depending on the type of equipment and the part that is being removed or replaced.

Pavement recycling equipment is a complex machine with many moving parts. As with any machine, some parts are more likely to fail than others.

The steps to remove and replace defective parts of pavement recycling equipment are:

- Prepare the equipment. Make sure that the equipment is turned off and that the keys are removed.

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- Locate the defective part. Use the operator's manual or a parts diagram to locate the defective part.
- Disconnect the power. If the defective part is electrically powered, disconnect the power before you begin working on it.
- Remove the defective part. Use the appropriate tools to remove the defective part.
- Install the new part. Use the appropriate tools to install the new part.
- Reconnect the power. If the defective part was electrically powered, reconnect the power.
- Test the equipment. Once you have replaced the defective part, start up the equipment and test all of the functions.

When removing and replacing defective parts of pavement recycling equipment,

- Always wear personal protective equipment (PPE), such as hard hat, safety glasses, gloves, and long sleeves.
- Be aware of your surroundings and watch out for traffic.
- Do not operate machinery if you are tired or under the influence of drugs or alcohol.
- Follow all safety procedures outlined by the equipment manufacturer.
- Use the correct tools for the job.
- Be careful not to damage the surrounding components.
- Follow the manufacturer's instructions for removing and replacing the defective part.
- Test the equipment after you have replaced the defective part.

Common defective parts that the trainee need to remove and replace in pavement recycling equipment are:

- Tyres: Pavement recycling equipment can put a lot of stress on tyres, so they are a common part that needs to be replaced.
- Hydraulic hoses: Hydraulic hoses can become brittle and crack over time, so they are another common part that needs to be replaced.
- Belts: Belts can wear out over time and need to be replaced.
- Bearings: Bearings can become damaged and need to be replaced.
- Engine parts: Engine parts can wear out over time and need to be replaced.

Self-Check 5	Written test
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Name..... ID..... Date.....

### Part I: True or False question

#### I. Instruction: Say true if the statement is correct and false if the statement is incorrect

1. The desired quality of the recycled material and the environmental conditions are factors for Performance of pavement recycling equipment.
2. Inspecting the exterior part of the equipment are one of the fault inspections for pavement Recycling operations.
3. Hydraulic hose checking are one of the common defective parts that the trainee must know.

### Part II: Matching

#### Instruction: Match Terms in column A with its meanings in column B.

A	B
1 Prepare the equipment	A) Check the oil level and coolant level
2 Use the operator's manual	B) To locate the defective part of equipment
3 Have the equipment serviced by a qualified mechanic regularly	C) To maintain pavement recycling equipment
4 Be aware of your surroundings and watch out for traffic	Safety tips for pavement recycling equipment

### Part III: Short Answer Questions

1. Write the steps to prepare, park safely, and shutdown pavement recycling equipment operations.
2. Write steps to conduct a fault inspection for pavement recycling equipment operations.
3. Write a note for maintenance, removal and replacement of defective parts for pavement recycling equipment operations.



## Reference

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