CHAPTER 5: MATERIALS AND EQUIPMENT

5.1 GENERAL

Normal day-to-day pavement maintenance requires only hand tools, but some maintenance necessitates specialized equipment. For example, cleaning out joints in PCC pavements is best accomplished with hand-operated, motor-driven machines especially designed for the task. Specialized sawing equipment may be required to establish the proper joint sealant shape dimension when sealing cracks in HMA pavement. Equipment to apply nontoxic herbicides may be necessary to prevent weeds from growing until sealant materials can be applied. Expedient plow-type devices also aid in removing old joint material. Joint sealing can be accomplished by hand pouring from kettles with narrow spouts, but some sealing materials require pressure application with specialized equipment. Most normal maintenance projects, however, require the following:

a. Mechanical Hammers.

Mechanical hammers can be used to break PCC pavement slabs for easy removal. These hammers can also drill slabs. When using mechanical hammers, maintenance staff should take precautions to avoid damaging adjacent slabs.

b. Trailer-Type Asphalt Kettles.

The use of trailer-type asphalt kettles can expedite patching and spot sealing. Kettles equipped with a powered hand-spray bar are valuable maintenance and repair items.

c. Compaction Equipment.

Compaction of HMA patches and sub-base repairs can be accomplished with hand tampers, but small vibrating compactors produce better and more-uniform results. These vibrating compactors are easy to operate, are transportable in small vehicles, work well in confined areas, and do an excellent job.

d. Distributors.

A large-scale project such as seal coating an extensive area requires specialized equipment, including pressure distributors for bitumen, aggregate spreaders, and rollers. Generally, contractors or others organized for such large-scale activities should perform this type of work.

e. Work Crew.

Two to six people, trained in the various techniques of repairing and familiar with the tools available to them, can perform the routine maintenance required by pavement surfaces. If the work requires more staff, it will probably be a major repair and require methods, materials, and equipment beyond those used for normal maintenance.
5.2 COMMON MATERIALS FOR MAINTENANCE AND REPAIR

The materials listed below are commonly used for maintenance and repair of pavements.

5.2.1 Hot-Mix Asphalt.

HMA is a blend of asphalt binder and well-graded, high-quality aggregates. The materials are mixed in a plant and placed and compacted while hot. HMA is used for construction of new aerodrome pavement and patching and overlay of aerodrome pavements.

5.2.2 Tack Coat.

A tack coat, usually a light application of emulsified asphalt, is applied to an existing pavement to provide a bond with an overlying course, such as a HMA overlay. A tack coat is also used on the sides of an existing pavement that has been cut vertically before patching. Asphalt emulsions are manufactured in several grades and are selected by the desired setting time.

5.2.3 Prime Coat.

A prime coat of emulsified or cutback asphalt is applied to an aggregate base course for the following purposes:

- To waterproof the surface of the base
- To plug capillary voids
- To promote adhesion between the base and the surface course

5.2.4 Fog Seal.

A fog seal is a light application of emulsified asphalt used to rejuvenate the surface of a HMA pavement.

5.2.5 Aggregate Seal.

This process is used to seal the surface of weathered pavements. Aggregate seals consist of sprayed asphalts that are immediately covered with aggregate and rolled to seat the aggregate in the asphalt coating. The aggregate seals or surface dressing are not recommended for aerodrome pavements because of the potential for propeller and engine damage caused by loose aggregates.

5.2.6 Slurry Seal.

A slurry seal is a mixture of asphalt emulsion, fine aggregate, mineral filler, and water. The mixture is prepared in slurry form and applied in a film approximately 1/8 inch (3 mm) thick. Slurry seals are used to seal small cracks, correct surface conditions, and improve the skid resistance of pavement surfaces.
5.2.7 Crack and Joint Sealing Material for Flexible Pavement.

Material for sealing cracks should meet designated and approved standards for the type of pavement and service for which the pavement is intended. Some aerodromes have used silicone sealants to seal cracks and joints in bituminous pavements. Proper use of silicone sealants requires that the material modulus be matched to the application.

5.2.8 Crack and Joint Sealing Material for Rigid Pavement

Material for sealing joints in Portland cement concrete pavement may be hot- or cold-applied compounds, as long as they meet the following prescribed standards:

5.2.9 Crack Filler Material for Flexible or Rigid Pavement.

Material for filling cracks in rigid or flexible pavement should meet the prescribed standards as appropriate.

5.2.10 Concrete

Concrete is a blend of Portland cement, fine and coarse aggregate, and water, with or without additives. Concrete is used to repair a distressed Portland cement concrete pavement so it may be used at its original designed capacity.

5.2.11 Epoxy Grouts and Concretes

There are many types of epoxy resins; the type to be used depends on the intended application. Under normal conditions, mixed resins may be workable up to 1 hour after mixing. Repairs with epoxy materials are costly, so their use should be limited to small areas and their application left to experienced personnel.

5.3 EQUIPMENT USED FOR PAVEMENT MAINTENANCE.

There are many different types and models of equipment aerodromes can use for pavement maintenance. Maintenance crews commonly use the equipment listed below for the following types of projects:

5.3.1 Pavement Removal.

a) Power Saws. A pavement power saw is usually a one-person-operated, dolly-mounted unit with an abrasive circular blade. This type of saw can cut a straight line through flexible or rigid pavements and leave vertical sides.

b) Cutting Disks. A cutting disk is a circular, heavy-duty steel plate with a sharpened edge. The disk is usually attached to a motor grader or other piece of equipment capable of pushing the disk through a bituminous pavement. It is limited to approximately 3 inches (8 cm) in cutting depth. Since the cutting disk is much faster than a saw, its use should be considered when larger areas must be removed.
c) **Jackhammers.** Jackhammers with a chisel head are commonly used for cutting pavement surfaces.

d) **Pavement Grinders.** A pavement grinder may be a one-person-operated, dolly-mounted unit with an abrasive cylindrical head 4 inches (10 cm) or more wide, or it may be variable-width diamond grinding equipment. Diamond grinding is a common rehabilitation technique used for tasks as varied as paint removal and pavement texturing.

e) **Cold Milling Machines.** Cold milling machines use an adjustable rotating mandrel with cutting bits to remove various depths of pavement material. Bits can be added or removed to vary the cutting width and roughness. Advantages of cold milling include speed of removal, precision of removal, and grade control.

f) **Hand Tools.** Hand tools can be used to make vertical cuts through pavements and to break up deteriorated pavement. Chisels, sledgehammers, shovels, pry bars, and picks fall into this category of equipment.

g) **Front-end Loaders and Skid-steer Loaders.** Front-end loaders are useful when loading trucks with removed pavement. Skid-steer loaders are small versatile loaders that can be equipped with numerous attachments. Their small size and maneuverability make them ideal for maintenance activities.

h) **Dump Trucks.** Dump trucks are used to haul removed pavement and repair materials.

5.3.2 **Maintenance Equipment.**

5.3.2.1 **Asphalt Kettle.**

Asphalt kettles are usually small-tractor-mounted units that have the capacity to heat and store 40 to 500 gallons (150 – 2000 liters) of bituminous material. A pump forces the liquid material through spray nozzles located on a hand-held hose. These units are used for priming and tacking on small jobs and for crack or surface sealing of HMA surfaces.

5.3.2.2 **Aggregate Spreaders.**

Aggregate spreaders can be either truck-mounted or separate units. They are used to evenly place a controlled amount of sand or aggregate on an area.

5.3.2.3 **Hand Tools.**

Rakes, lutes, and other such hand tools are used to move and level material placed in a patch area.

5.3.3 **Compaction Equipment.**

**Vibratory Plate Compactors.**
Vibratory plate compactors are hand-operated units used to compact granular base or HMA plant-mix materials.

**Vibratory and Non Vibratory Steel-Wheel Rollers.**

Steel-wheel rollers are used to compact material, including HMA in patchwork areas. Smaller rollers can be hand operated, while large rollers are self-powered.

**Rubber-Tired Rollers.** Rubber-tired rollers are self-powered and used to compact HMA pavement.

### 5.3.4 Crack and Joint Sealing Equipment.

a) **Joint Plow.** A joint plow is used to remove old sealer from joints. This is usually a specially made tool attached to a skid-steer loader.

b) **Joint Router.** A joint router is used to clear existing cracks or joints to be resealed. A router is usually a self-powered machine operating a rotary cutter or revolving cutting tool. A rotary routing tool with a V-shaped end can be used for cleaning out random cracks. Rotary cutting tools for PCC pavements are not recommended due to excessive fracturing of aggregates. The use of a random crack saw is preferred.

c) **Random Crack Saw.** A random crack saw is designed to follow irregular crack patterns in concrete and asphalt surfaces. The crack saw utilizes small diameter, dry-cut diamond blades in standard widths to create smooth sided cuts to prepare surfaces for proper crack filling. Maximum straight line cutting depth is 38 mm. A center mounted blade configuration allows that crack saws to pivot about its own axis to more exactly follow random crack patterns easily.

d) **Power Brush.** A power-driven wire brush may be used to clean joints after all of the old joint sealer has been removed.

e) **Air Compressor and Sand Blasting.** Sand blasting may be used for final removal of old joint sealant, and the it is recommended as the final cleaning method for PCC surfaces prior to application of new sealant. Joints and cracks should be blown out with clean compressed air immediately before applying new sealer. Air compressors should be equipped with oil and moisture traps to prevent contaminating the cleaned surface.

f) **Pavement Sweeper.** A pavement sweeper can be used for cleaning the pavement surface and removing excess aggregate. Cleaning operations are necessary in preparation for seal coating and crack filling.

g) **Heating Kettle.** A heating kettle is a mobile, indirect-fired double boiler used to melt hot-applied joint sealing material. It is equipped with a means to agitate and circulate the sealer to ensure uniform heating and melting of
the entire charge in the kettle. Sealants may be applied to joints with a pressure base attached directly to a pump unit on the kettle.

h) Pouring Pot. A pouring pot is hand carried or mounted on a hand-pushed pot dolly and used to pour hot sealing materials into a previously prepared crack or joint.

i) High-pressure Water Sprayer. A water sprayer can be used to clean out joints prior to resealing and to clean vertical faces of pavement to be patched.

j) Hot Air Lance. A hot air lance enhances adhesion by drying and heating cracks in existing bituminous material while removing debris prior to crack sealing.

5.3.5 Removal of Pavement Markings.

a) High Pressure Water Jet. A high-pressure water jet, with proper selection of spray nozzle and pressure, can be highly effective in removal of pavement markings.

b) Abrasive Blasting. Pavement markings can be removed by the impact of edged particles accelerated by pressurized air, although care must be exercised to avoid damage to the pavement surface.

c) Solvent Cleaning. Chemical agents can be employed to remove markings from pavement, but proper attention must be paid to environmental concerns and cleanup.