Much Asphalt

Together We Can

HAND-LAID

HOT MIX ASPHALT

Best Practice Guide For: Driveways | Tennis Courts Parking Areas | Sidewalks | Patching and Repairs

60 YEARS OF SERVICE 1965 – 2025

SPRAYPAVE

CONTENTS

1. Contract preparation 5
2. Site preparation 7
3. Edging 9
4. Base 10
5. Primer and tack coats 13
6. Hot mix asphalt 17
7. Patching and repairs 24
8. Quality control 30
9. Ordering hot mix asphalt/Branches 31

PURPOSE AND VALUES

Much Asphalt enables the creation of safe and convenient transport infrastructure resulting in sustainable wealth creation and community upliftment.

- **CARE**
  Care for our customers, our people, ourselves, our reputation, our plant, our equipment, our products, our environment and our shareholders. Custodians of the business for those to come.
- **INTEGRITY**
  Honest and trustworthy in our conduct with all business stakeholders. Our word is our bond.
- **RESPECT**
  We value our surroundings. Appreciate, acknowledge and understand our differences. Accept diversity and treat our people with dignity.
- **ACCOUNTABILITY**
  Taking responsibility and being answerable for our actions.
- **COMMITMENT**
  We deliver what we promise.

Much Asphalt is southern Africa's largest commercial supplier of an extensive range of hot and cold asphalt products to the road construction economy. Much Asphalt owns and operates more than 15 static plants in the major centres of South Africa and is the majority shareholder in East Coast Asphalt which operates another two plants in East London and Mthatha.

Remote projects in South Africa and further afield are supplied from our fleet of more than five mobile plants, providing comprehensive coverage from coast to coast and into neighbouring countries.

Together all these plants have a manufacturing capacity of 3060 tonnes of asphalt per hour, equating to more than 5.4 million tonnes per year.

Much Asphalt is proud to have been the supplier of choice on many different types of asphalt contracts across southern Africa for more than 50 years. Today we continue to supply a comprehensive range of generic and customised products to a multitude of clients in the formal and informal sectors.

Much Asphalt is a recognised industry leader in the development of new and improved products that help to improve the safety and durability as well as decreasing the long term cost of maintaining South Africa's road network.

SCOPE AND RANGE

This Best Practice Guide has been sponsored and produced by Much Asphalt in the interests of establishing a uniform, industry-wide standard for high quality hand-laid hot mix asphalt.

It is designed to ensure that supervisors and foremen working with established contractors, as well as newly established and emerging contractors, have access to state-of-the-art knowledge of those products and processes that have been proven in practice to produce durable, cost effective asphalt surfaces with a high standard of finish.

This guideline draws on the technological know-how and extensive experience of leaders in the field of hand-laid hot mix asphalt and may also help clients to understand what specification is being worked to and what may be expected from the finished product in terms of appearance, performance and cost.

The information contained in the following Southern African Bitumen Association (Sabita) technical publications was invaluable in the compilation of this guideline:

Manual 5 | Guidelines for the Manufacture and Construction of Hot Mix Asphalt.

Manual 12 | Methods and Procedures: Labour-enhanced Construction for Bituminous Surfacings.

Much Asphalt especially acknowledges the contribution of consultant Dave Wright, whose expertise and unstinting efforts ensured the accuracy and technical relevance of this publication.

1. CONTRACT PREPARATION

1.1 ESTIMATING AND PRICING

A vital element of successful contracts – those in which the client receives a high-quality, cost effective product from a contractor who makes a reasonable, market-related profit – is accurate assessment of material quantities and production capacity by the contractor.

Because contractors may have wide variations in production capacity, this guideline will focus exclusively on the calculation of material quantities and their ordering procedures.

(A) Base Material

Material type and cost should be discussed with supplier before quoting. Recommended base material grade and application thicknesses are listed in Table 2, page 8.

Quantity:
Determination of the required quantity of base material in cubic metres is a straightforward calculation involving the multiplication of length, width and thickness, making allowance for compaction. Note, however, that material should be ordered according to the following rough guideline:

LOOSE THICKNESS = COMPACTED THICKNESS + 33%

EXAMPLE:
For a driveway 25 m long and 6 m wide, requiring a base of 150 mm compacted thickness, calculate required quantity (Q) as follows:

Q = 25 x 6 x (0.150 + 33%)
= 150 x (0.150 + 0.050)
= 150 x 0.200
= **30 m³** (loose)

(b) Primer/tack coat

Primer/tack coat should be applied to compacted and fully prepared base or existing surfacing, according to manufacturer's specifications. Specified preparation conditions, temperatures, application rates and curing times should be strictly adhered to.

Guidelines for the selection of primer and tack coat are listed in Table 4 on page 14 and Table 5 on page 14. Calculation of requirements should be based on the application rates quoted in Table 6 on page 15, and supplier's price should be ascertained before quoting.

(c) Hot mix asphalt

Pricing:
The price of hot mix asphalt should be established with Much Asphalt before quoting on any contract. Price is most easily confirmed by contacting your nearest Much Asphalt branch (see list on page 31).

Quantity:
The required tonnage of hot mix asphalt for a particular job may be calculated using the figures in Table 1 below. This also shows the raking (pre-compaction) thicknesses for different thicknesses of finished surfacing.

Table 1: Hot mix asphalt coverage (spread rate)

Compacted thickness	Pre-compaction thickness	Coverage
20 mm	25 mm	20m^2/tonne
25 mm	30 – 35 mm	16m^2/tonne
30 mm	40 mm	14m^2/tonne
35 mm	40 – 50 mm	12m^2/tonne
40 mm	50 – 55 mm	10m^2/tonne

NOTE: Asphalt orders should be tendered by fax or email, specifying delivery sequence, batch sizes, temperatures and any other information critical to the success of each job.

2. SITE PREPARATION

2.1 ESTABLISH AND MARK OUT WORK AREA

The working area — whether tennis court, driveway, sidewalk, patch or parking area — should be carefully measured and marked out using pegs and line before any work begins. This pegging out should make allowance for site access, stockpile areas for base material, asphalt and excavated waste material awaiting removal, and also for a site office and equipment store if the contract is large enough to warrant this.

Contractors should take care to consult the client/owner before using site space outside the designated work area. In residential areas, the contractor may need to get permission from the local authority to use sidewalk space for plant and materials where space is not available on site.

2.2 REMOVE EXISTING VEGETATION

Within the demarcated working area, remove all existing vegetation including roots. Where trees, shrubs or bushes grow outside but close to the pegged out work site, roots which have penetrated into the work area should be excavated and cut away to prevent lifting of the asphalt surface in the future. Because this activity may damage or destroy plants, consult with the client/owner before proceeding.

2.3 EXCAVATE SUBGRADE TO REQUIRED DEPTH

The area to be surfaced should be excavated to the depth dictated by the required thickness of base plus surface material. The depth of excavation should be as consistent as possible to avoid material wastage. Excavation should include the removal of material for concrete footings to accommodate edging, whether this is designated to be concrete or brick.

The excavation of subgrade should establish levels and falls to existing or proposed drainage systems. It is assumed that the contractor is familiar with these processes, so they will not be described here.

When required excavation depth is achieved, compact the top of the subgrade thoroughly, mixing in water to obtain optimum moisture content (OMC). The compacted density of the subgrade may need to be laboratory tested to ensure conformity with the engineer's specification.

Figure 1 below, showing a cross section of a typical cambered driveway, gives an indication of a standard construction profile.

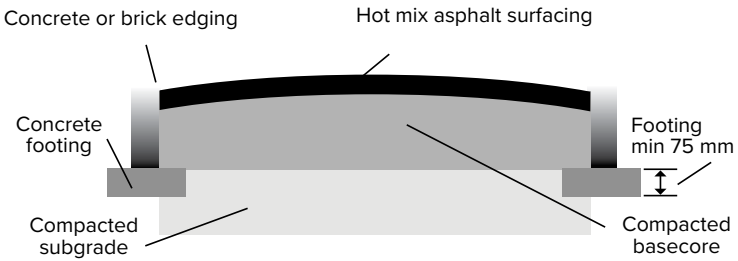


Figure 1: Cambered driveway (cross section)

The thickness of base will vary depending on the loading the finished pavement is required to carry. If the contract involves no engineering design, Table 2 below gives an indication of minimum compacted thicknesses and base material types for different applications. Where heavy vehicle traffic is anticipated or ground conditions are known to be difficult, consult a specialist pavement engineer.

Table 2: Minimum base thicknesses

Application	Base thickness (compacted)	Material type
Sidewalk	75 – 100 mm	G5
Tennis court	75 – 100 mm	G5
Parking area	100 – 150 mm	G3 – G4
Driveway	100 – 150 mm	G3 – G4
Patches	100 – 150 mm	G4 or better

3. EDGING

3.1 MARKING OUT AND PREPARATION

Neat and accurately installed edging in concrete, brick or other material is critical to the appearance of the finished contract. The edging may be used to control the levels of the pavement layers. This demands that the edging be accurately measured and marked out before installation.

All edging, including brick or precast concrete, should be mounted on a suitable concrete footing or foundation. In driveways and parking areas this footing should be a minimum of 75 mm to 100 mm thick to ensure that it can support the weight of any motor vehicle that may inadvertently drive over it.

Once the subgrade has been excavated to the required depth and levels and falls have been established, excavate further for the footings as indicated in Figure 1, page 8.

As in establishing levels and falls, it is assumed that the contractor is familiar with the methods and processes required to achieve a neat, professional edging. These processes will therefore not be described in this guideline, which focuses mainly on achieving the best possible hot mix asphalt surface.

A neat, professional edging in concrete, brick or other material is critical to the appearance of the project.

While the strength and durability of an asphalt surface depends on good professional practice, customer satisfaction depends on a finished product that looks good.

4. BASE

4.1 PREPARATION OF SUBGRADE

(a) Compaction

When the subgrade has been excavated to the required depth, excess material has been disposed of, the required levels and falls have been established, and edging installed, mix water into the subgrade to obtain optimum moisture content (OMC) and compact well. This may require several passes with a roller, vibrator or “pogo” compactor.

The density of the compacted subgrade should conform to engineer’s specifications. If the contract is being executed without engineer’s assistance, the contractor may need to employ a consultant or carry out his own density tests.

Note that if optimum compaction of the subgrade is not achieved, there is increased potential for failure of the completed pavement.

(b) Weed eradication

The compacted subgrade should be thoroughly sprayed with an approved herbicidal weed-killer to ensure that seeds still in the subgrade do not germinate.

Rigorous safety precautions should be taken when using weed-killer, including the use of protective clothing, to prevent inhalation, skin contact or excessive environmental pollution. Care should be taken to ensure that co-workers do not come into contact with herbicide if spraying takes place in windy conditions.

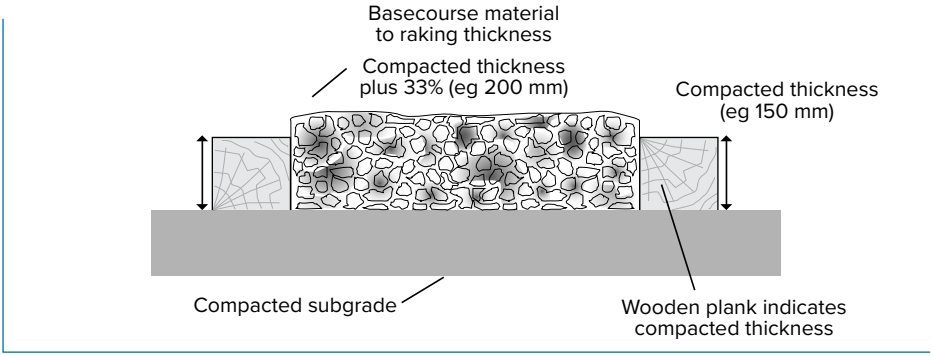
4.2 SPREADING AND COMPACTION OF BASE

The contractor should designate dumping sites within the work area for the supplier to offload base material. These dumpsites should be staggered to minimise material movement from the stockpile to work area.

Material may be moved from stockpile to work area by wheelbarrow or front-end loader, after which it should be raked to the required thickness using rakes or lutes. Various methods are used in the industry to control the thickness of base material before compaction. One of these is illustrated in Figure 2 below. Other methods may include the use of pegs and builder's line drawn tight at the correct height (pre-compaction depth), or working to pre-marked lines on concrete or brick edgings.

It is most important to allow enough loose thickness to ensure good compaction.

Figure 2: Method to achieve even thickness of uncompacted base.



During compaction of the base, care should be taken to achieve an even depth with variation no more than 10 mm over a distance of 3,0 m, measured with a straight-edge. Water should be mixed into the base to achieve OMC. Note that if the base is already too wet it cannot be satisfactorily compacted and should be allowed to dry out. Compaction by pedestrian or driven roller, vibrator plate or "pogo" compactor should be repeated several times until the layer is at the required compacted thickness. This will ensure that the required base density is achieved. For base thicknesses in excess of 100 mm, the base should be laid in two stages, fully compacting each time. Where necessary (eg, for a driveway), the base should be shaped to achieve the required camber.

4.3 FINAL PREPARATION AND INSPECTION

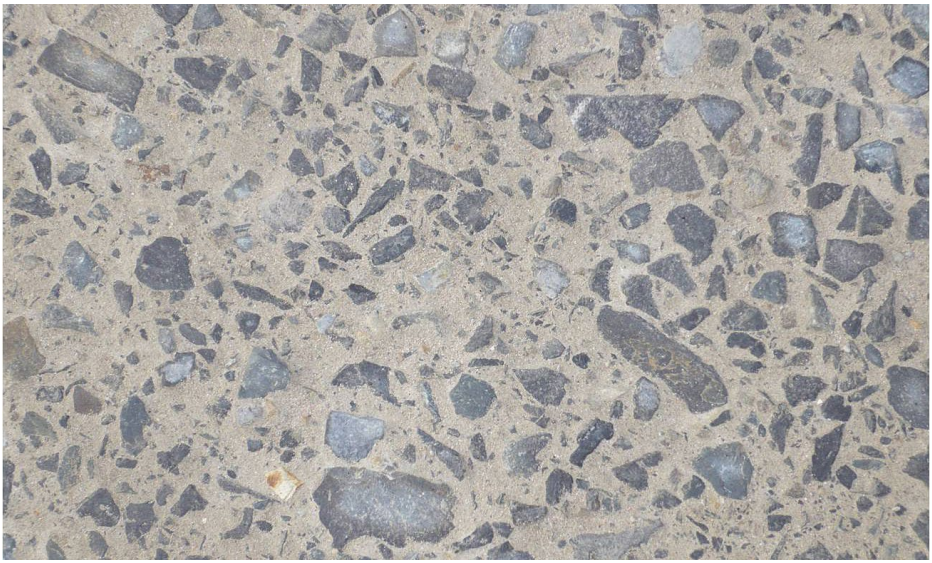
Base material includes a proportion of “fines”– very small particles of gravel that fill the voids between the larger particles.

When roller compaction of the base has been completed, a final compaction run should be made with a vibratory roller or plate vibrator, which will lift a proportion of the fines to the surface.

This surface material should then be broomed off thoroughly to expose the mosaic of larger aggregate particles. Removal of fines and other loose material in this way ensures optimum penetration of the primer into the base. Care should be taken to avoid over-brooming, which can alter or damage the base surface by dislodging aggregate.

It is recommended that the base surface should be sprayed lightly with water immediately before priming to break the surface tension of the base material. Finally, the surface should be rolled with a heavy steel-wheel roller to ensure an even, sound and hard base surface ready for priming.

The surface should be smooth and free of roller track marks.



Prepared base showing the exposed mosaic.

5. PRIMER AND TACK COATS

A primer ensures optimum adhesion between the granular base and a hot mix asphalt surface. Most primers are cutback, solvent-based bitumen or bitumen emulsion with sufficient viscosity to penetrate the top 3 mm to 8 mm of the base. Tack coats, on the other hand, are diluted bitumen emulsions which are lightly applied to old bituminous surfaces to ensure a good bond with the new hot mix asphalt surfacing and to prevent slippage.

Historically tar products were used as primers, but in South Africa this is no longer allowed because of their carcinogenic properties.

5.1 SELECTION OF TACK COAT OR PRIMER

(a) Tack coats – applied to existing bituminous surfaces

Tack coat for application to existing bituminous surfaces — such as SS60, also available from SprayPave — is readily diluted with water and dries more quickly (30 minutes), which makes it easy to handle. Although SS60 can be diluted 1:1 with water, the same cannot be done with primes, including emulsion based primes.

Tack coats are applied at a much lighter rate than primers. This is because they are not required to penetrate into the underlying surface. Thus their final application may present a speckled appearance rather than an even black/brown colour.

(b) Primers – applied to newly constructed bases

Hot mix asphalt will not adhere directly to a granular base without an intervening “bond coat” of bituminous primer or bitumen emulsion. There are distinct bituminous products with differing properties and applications.

For granular bases the most widely recommended product is a primer such as the SprayPave products MC30, SP1i or OptiPrime. The prime can take time to break or cure, depending on a number of factors such as the type of prime and base as well as weather conditions. This could cause problems for contractors working under tight deadlines.

Table 3: Tack coat

Product	Description	Application	Advantages
SS60	Stable grade 60% anionic bitumen emulsion.	Slurry, tack coat, stabilisation.	Reliable, easy to handle.

Table 4: Primers

Product	Description	Application	Advantages
MC30	Cutback bitumen primer.	Standard primer for road surfacing.	Widest possible application. Able to cope with varying granular materials.
SP1i	Inverted bitumen emulsion primer.	Primer for road surfacing.	Better performance in poor weather.
OptiPrime	Bitumen emulsion primer.	Primer for road surfacing.	Reduced drying time.

5.2 APPLICATION RATES

Table 5: Tack coat application rates

Tack type	Application rate*		Application temperature (°C)
	Lean, dry surface	Tight, fatty surface	
60% emulsion	0,3 l/m^2	0,2 l/m^2	Ambient - 60

*At 60°c a 60% emulsion diluted 1:1 with water and applied at 1,0l/m^2 will give an application of 0,3l/m^2 net binder.

Table 6 gives approximate primer application rates for a range of conditions. To optimise the application rate the following procedure is suggested: Mark out three squares (1 m by 1 m), measure the recommended amount of primer and paint evenly onto the surface of the first square.

Decrease the recommended amount of primer by 0,1 l/m^2 and paint the second square. Increase the recommended amount of primer by 0,1 l/m^2 and paint the third square. Allow the primer to dry and compare the three squares. The square with an even appearance indicates the correct application rate.

(Note: A speckled appearance is too dry, pools of primer indicate it is too wet.)

Table 6: Primer application rates

Primer Type	Application rate			Application temperature (°C)
	Gravel surfaces (l/m^2)	Crusher run (l/m^2)	Stabilised surfaces (l/m^2)	
MC30	0,8 - 1,2	0,7	0,6	45-65
SP1i	0,8 - 1,2	0,7	0,6	ambient - 60
OptiPrime	0,7	0,7	0,7	ambient

Note: Experience has shown that primer does not easily penetrate stabilised materials, especially emulsion treated materials. A tack coat should be used instead.

To accommodate variations in base material, adjustments to the application rate should be made.

Table 7: Variations to application rates

Situation	Application rate (l/m^2)
Coarse or open base	Recommended rate + 0,1
Fine or dense base	Recommended rate - 0,1

The use of small drum sprayers with hand lances is not recommended as it is difficult to achieve an even application using this equipment.

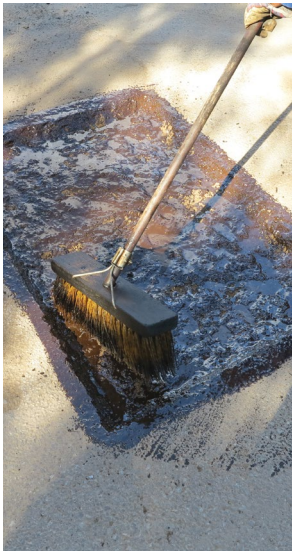
Primer could be applied by hand as follows: Measure the area to be primed. Divide the area into rectangles not more than 2 m by 2 m. Measure out the required volume of primer for each rectangle and pour as evenly as possible over the area. Work the primer back and forth over the rectangle with a stiff bristle broom or squeegee until an even appearance is obtained.

Because a tack coat is applied more lightly than primers, instead of “painting” it into the rectangles it should be sprinkled onto the surface using a whitewash brush and a flicking action.

While the base may be slightly damp when primer is applied, this should be measured with care. If rain is imminent, priming should be delayed because the primer will float on the water surface and will not penetrate the base. Primer should not be applied to base which has a moisture content of more than 50% of OMC. For example, if the OMC during compaction is 8%, the base should be allowed to dry out to 4% before application of primer.

Curing time for primers depends on prevailing conditions and ambient temperatures and may vary from 24 to 72 hours. Primer should be allowed to dry thoroughly before applying hot mix asphalt. It will be matt black in appearance when properly dry.

To ensure a neat and professional finish, all edgings (brick, concrete or other material), gulleys, catchpits and other “furniture” on or near the worksite should be thoroughly protected with plastic sheet to prevent spotting or staining by bituminous products during construction.



Applying and spreading primer and tack coat.

6. HOT MIX ASPHALT

6.1 SELECTION

While a wide range of hot mix asphalt products is available to cater for every requirement in the blacktop industry, smaller contractors producing hot mix asphalt surfaces without the aid of mechanised paving equipment will usually find that two types of finer grade asphalt satisfy their needs.

There are many parameters that differentiate high quality hot mix asphalt — which will ensure a strong, durable and good looking surface – from inferior products.

These factors include:

- Manufacturer's selection of high grade aggregates and bitumen;
- Rigorous control of temperature, cleanliness and binder content during the asphalt manufacturing process;
- The installation and maintenance of superior plant and equipment;
- Good administration from receipt of order through to dispatch of product to the client.

Much Asphalt prides itself on ensuring that clients receive the highest quality product possible, delivered at the right price and at the right time. Together with best practice application, this ensures that contractors are able to deliver a finished product of a very high standard, at cost effective rates.

Most application requirements encountered by contractors laying hot mix asphalt will be more than adequately served by two grades of asphalt – either a 9,5 mm Continuous Medium or SABS Continuous Medium and a 6,7 mm Continuous Fine asphalt.

For most hand-laid applications where the layer thickness is 30 mm or less, it is suggested that a 6,7 mm fine mix should be used. The fine mix has certain properties that are well suited to handwork. The asphalt can be hand spread with less segregation than for coarser mixes and with less effort. The fine mix contains slightly more bitumen and is easier to compact. The final surface of the asphalt is tightly knit and more uniform that that of coarser mixes.

The 9,5 mm mix should not be used where the layer thickness is less than 25 mm.

6.2 SCHEDULING AND ACCEPTANCE

Hot mix asphalt cannot be effectively compacted if its temperature drops below 100°C. It is therefore essential that this factor be closely and conscientiously monitored throughout the manufacturing, delivery, acceptance and application processes.

Much Asphalt's stringent quality controls are carried through to the delivery process and hot mix asphalt is dispatched from Much plants at temperatures in the range 140°C to 160°C. Depending on seasonal and weather conditions, as well as the distance from plant to construction site, the temperature of the asphalt will drop by varying amounts. The following procedures are thus critical:

- Deliveries should be staggered according to production capacity to ensure that material is always at workable temperature.
- The temperature of every delivery must be checked when it arrives on site. Every contractor should have, on site, a steel probe-dial gauge thermometer capable of measuring in the range 0 – 240°C. *
- Stockpiles should be sited for minimum movement of material and therefore minimum heat loss during distribution from stockpile to work area.
- If possible, stockpiles should be offloaded onto a tough plastic sheet or thin sheet steel plates to retain temperature and avoid contamination.
- Hot mix asphalt should be covered with tarpaulins at all times except when removing material.
- Hot mix should be removed from at least two sides of the stockpile, working towards the centre.
- Weather conditions must be closely monitored.

**** These thermometers will be verified by Much Asphalt at no additional cost.***

Note: Any load which falls below workable temperature will have to be discarded, at considerable financial loss to the contractor. Once a load of asphalt has been accepted and offloaded, all risk associated with the loss of that load, through temperature loss or any other cause, lies with the contractor. It is therefore very important that contractors maintain full control of all quality aspects throughout the contract.

6.3 APPLICATION OF HOT MIX ASPHALT

Good handwork is critical to a successful paving project. Skilled and experienced shovel hands, barrowmen, rake hands and finishers are vital to achieving a high quality finish.

It is also important that clothing, tools and equipment remain clean. Tools (shovels, barrows, rakes, trowels, stampers, etc) and clothing (shoes, gloves) on site can be kept free of asphalt with a light application of paraffin, but care should be taken not to drop solvents onto the pavement or other clean surfaces.

Spreading of asphalt using a lute.

(a) Movement from stockpile

- For large pavement areas the use of a rubber-wheeled front-end loader will improve efficiency of distribution from stockpile to working area.
- If wheelbarrows are used, barrowmen should not duplicate as loaders from the stockpile. This is the job of shovel hands, who should work smoothly with the barrowmen to ensure a steady and constant flow of material from the stockpile to the rake hands.
- If distribution stops for any reason, the stockpile should be covered with a tarpaulin to minimise temperature loss.

(b) Raking

This term is in general use throughout the industry, but refers to the operation rather than the tool. Conventional rakes with prongs or metal teeth are unsuitable for spreading asphalt because the teeth segregate the mix. A flat-edged “lute” is the preferred tool.

A lute uses the reverse (flat side) of a metal rake to spread asphalt to the correct depth, with an even surface, before compaction.

Some contractors weld a strip of angle-iron onto the flat of the rake to extend the usable length of the rake “head”. Trial and error will establish a length of extension to achieve optimum distribution efficiency without tiring the rake hand.

Note: A "rule of thumb" is that raking should be kept to the minimum needed to achieve the required thickness and evenness of distribution. Slow or excessive raking may segregate the mix and promote cooling.

- Asphalt should be dumped from wheelbarrows as evenly as possible to minimise the work of the rake hand and to disturb the consistency of the mix as little as possible.
- An even thickness of asphalt may be achieved by working to pegs and builder's line pre-set to the required thickness, or by using wooden planks (or steel reinforcing bars) as described for setting up the thickness (see Figure 2, page 11).
- Experienced rake hands may judge the raking thickness of asphalt accurately by eye, but levels should be checked using a straight edge from time to time.
- The supervisor should monitor the stockpiled asphalt at all times to detect mix which has cooled to the critical 100°C cut-off point, below which it can no longer be successfully compacted. Under no circumstances should asphalt colder than this be used. Material at temperatures lower than this should be discarded.

Spreading of asphalt must be completed before it has cooled to 100°C.

- Where the base is shaped, for example cambered for a driveway, the asphalt spreading and raking operations should start at the low side and work towards the higher side. This is because hot asphalt tends to spread towards the lower side of the mat under the action of the roller, a movement which becomes more pronounced if spreading (and therefore rolling) is started on the high side.
- A finisher should hand-spread asphalt into tight corners or around catchpits, gulleys, etc, where the action of the rake may not be accurate enough. This work should be done at the same time as the rake work and not at the end using cold asphalt.

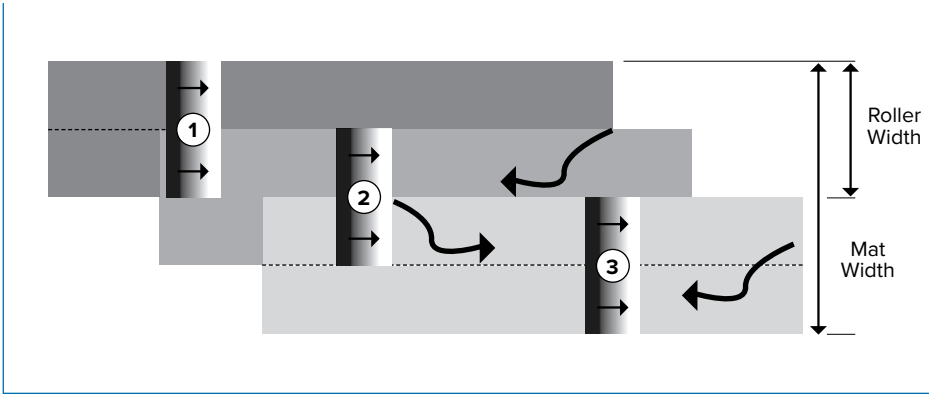
(c) Compaction

Compaction should begin immediately after the distribution of hot mix asphalt has started. The first compaction operation, called “breakdown rolling”, is best achieved with steel wheeled rollers of a minimum 2 tonne weight. These may be tandem or three- wheeled rollers. Pedestrian rollers are also acceptable for smaller areas.

For optimum compaction and professional finish, the following should be noted:

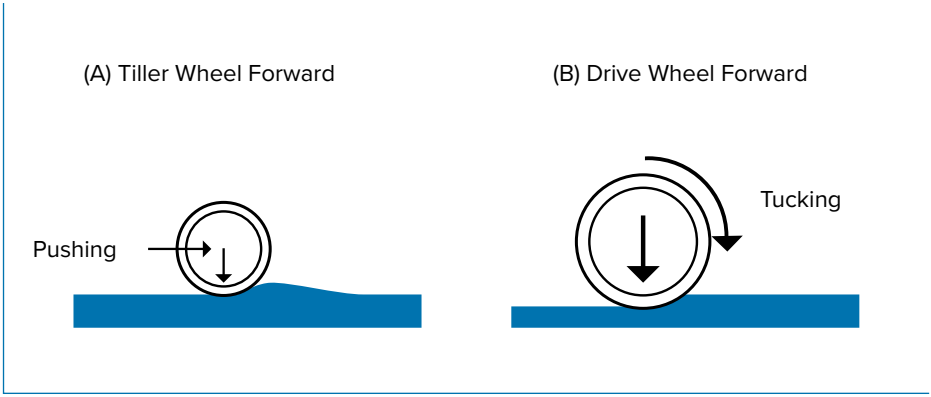
- Steel-wheeled rollers should be free of backlash when switching from forward to reverse.
- Roller drum surfaces should not be pitted or worn.
- The driver/operator should be trained and aware of required roller compaction patterns (see Figure 3, page 22).
- Sudden changes in the line of rolling should be avoided and should never be allowed to occur on hot material still in the plastic state.
- Changes in the direction of rolling (forward and reverse) should be made evenly.
- Rollers should move at a slow but uniform speed, which should not exceed 5 km/hr for steel wheeled rollers, 8km/hr for pneumatic-tyred rollers, and 4 km/hr for high frequency vibratory rollers.
- Rollers, heavy plant and any equipment which may exert point loadings should not be allowed to stand on asphalt which has not yet cooled and set thoroughly.
- Rolling should start on the low side of the mat and progress by half-widths to the highest point (eg, cambered driveway).
- Frequent checks should be made to detect low spots in the rolled mat. Deviation should not exceed 10 mm under a 3,0 m straight-edge.
- To avoid asphalt pick-up, roller wheels should be kept moist with a minimum amount of water. Too much water will accelerate cooling and prevent optimum compaction, leading to brittleness, ravelling, water ingress and eventual failure of the base, surfacing, or both.
- A rolling pattern that covers the compaction area in the most uniform way is vital. The best way to achieve this is by rolling with half the roller width always on the previously rolled mat, and only half on new mat.

Figure 3: Half-width rolling pattern



- Sufficient passes should be made with the roller (this will depend on roller mass, ambient temperature and other factors) to ensure compaction to required density.
- Vibratory compaction equipment (intermediate compaction) should not be used until breakdown rolling has been completed and the mat is approaching optimum compaction.
- The most uniform surface (eg, on parking areas or tennis courts) may be achieved through initial longitudinal passes with the roller, followed by transverse rolling to eliminate surface blemishes.
- The initial pass with the roller should, wherever possible, be made with the drive wheel forward in the direction of compaction. This ensures that the asphalt material is tucked under the wheel by the turning force before it is compacted, as shown in Figure 4 on the next page.

Figure 4: Forces imposed by roller (with acknowledgements to Sabita)



- Tight corners and catchpit/gulley surrounds need the skill of an experienced finishing hand, who may apply the hot mix asphalt using a shovel and roller, and complete the compaction using a stamper or “pogo” compactor.

The final passes with the roller, termed finish rolling, achieve little compaction and are carried out primarily to produce a surface free of roller marks and irregularities. Tandemsteel-wheeled rollers are ideal for this operation, but a regular rolling pattern is required to achieve full coverage and uniformity of finish.

Compaction should begin with breakdown rolling immediately after distribution of the hot mix asphalt, followed by finish rolling to achieve uniformity.

7. PATCHING AND REPAIRS

Distress in asphalt pavements is a worldwide problem and is caused by heavy traffic loading, ingress of water and the wear and tear associated with ageing. Although this distress may take many forms, it is usually manifested in the initial stages as cracking — which itself may take as many as nine different forms. Unless repaired at an early stage, cracking (of whatever kind) will allow rainwater to penetrate to the base layer and perhaps even further into the layerworks, resulting in failure of the base and accelerated breakdown of the asphalt surfacing.

For the purposes of this Best Practice Guide, the process of patching and repair will be restricted to crocodile cracks, random cracks, potholes and pavement failures. The repair of these cracks is different from that applied to active cracks, many of which may be sealed using a variety of sealants and procedures.

7.1 CROCODILE CRACKS

These cracks appear in a polygon pattern resembling the skin of a crocodile. The average diameter of the polygons is generally less than 300 mm, and they can occur directly as a result of fatigue in the surface due to the action of traffic. (Ref. Sabita Manual 20: Sealing of active cracks in road pavements.)

An example of crocodile cracking on a road surface.

7.2 RANDOM CRACKS

These cracks occur as single isolated cracks, usually in old asphalt surfaces. The cracks can be open and several mm wide. The surrounding road surface shows no signs of distress or water ingress.

7.3 POTHOLES

Potholes, normally less than 500 mm in diameter, usually occur at isolated places on the road surface, possibly where it has been damaged or there is a weakness. The surrounding pavement appears sound and there are no other signs of distress.

Following failure of the surfacing and exposure of the base, the upper part of the base is worn away by traffic (accelerated by wet conditions) to form a hole. Apart from being dangerous for traffic, the exposed layerworks of the road quickly absorb rainwater, accelerating the total break-down of the road surface. The patching of potholes and surface cracks should be considered a high priority.

7.4 PAVEMENT FAILURE

Pavement failure usually occurs in vehicle wheel tracks and is caused by the action of vehicles, cracking and the ingress of water. Typical signs of pavement failure are crocodile cracks, pumping of loose fines onto the surface, rutting, and finally displacement causing a wave-like form in the road surface (often evidenced by a wiggle in the yellow shoulder line).

This type of distress is caused by problems in the underlying pavement layers, usually in the base. Once the surfacing breaks up in this manner, it becomes a danger to traffic.

Repairs to potholes (above) and pavement failures (below) require different techniques.

7.5 SURFACE REPAIRS

7.5.1 CROCODILE CRACKING

Where the crocodile cracking is limited in extent and there are no other signs of distress, the cracking can be sealed with a geotextile such as Kaymat. This is a short term measure and should be protected by a grit armouring layer, reseal or overlay.SprayPave's SC-E1 cold sealant can be used for this purpose.

Alternatively the cracked surfacing can be removed and, provided the base is sound, replaced with hot mix asphalt (see 7.7 Patching).

7.5.2 RANDOM CRACKS

While these cracks may have existed for a long time and do not appear to be affecting the pavement, it is recommended that they should be treated as follows before carrying out a reseal or overlay: Clean out the crack using compressed air, prime it with a suitable diluted primer and seal using a soft cold sealant such as SprayPave's SC-E1.

SprayPave's SC-E1 can be used for cracks of 2mm to 4mm wide.

7.6 POTHOLE REPAIRS

Mark out a neat shape (preferably rectangular) as closely as possible around the pothole. Chip out the surfacing to form a neat edge, using the broad end of a pick. Clean out the hole, removing any loose base material, until the compacted base is exposed. It is not necessary to remove sound compacted base. Prepare the exposed base and sides of the hole by painting on emulsion. Do not over-apply primer to the base of the hole, and remove or "blot up" pools of primer.

Fill the hole with fine hot mix asphalt. If the pothole is deeper than 50 mm, fill the hole in two layers. Level off the loose asphalt to a height of one-third the thickness of the compacted top layer above the surrounding road surface. Compact each layer well and continue compaction of the top layer until the repair is flat and level with the old surface. Cold mix asphalt may be used, but study carefully the comments and recommendations for surfacing in section 7.7.

Note: When patching potholes on public roads, set out and retrieve traffic control signs and warning cones according to nationally accepted road signs manuals.

7.7 PAVEMENT FAILURE REPAIRS (PATCHING)

(a) Preparation

Carry out the following:

- Mark a square or rectangular shape using chalk around the edges of the failure.
- Make sure that the edges of the patch are in sound material (check for rutting).
- Cut neatly along the marked chalk lines, trimming the sides to an angle of 90°C to the horizontal.
- Excavate to the bottom of the base layer using either picks or a pavement breaker.

Remove all loose material and stockpile excavated material in separate piles for each layer. If suitable, stockpiled material may be used in the lower layers (not for the base).

- If there is free water or even excessive dampness, drain and allow to dry. If there is a water problem, backfill the hole with granular material as a temporary measure and call for expert help.
- Inspect the subbase and check if it is sound and compact. If this is not the case. excavate this layer as well. Check the underlying material. Replace the subbase with compacted gravel material (the old base may be suitable).

(b) Gravel base

Where the patch can be left open for more than a day, replace the base using approved base material (crusher run mixed with 1% cement and 2% diluted stable-grade bitumen emulsion). Add water as required to bring mixture to optimum moisture content. Finally backfill the base in equal layers not thicker than 100 mm (loose) each, and compact to achieve a uniformly hard surface. Compact the top layer to 30 mm below the existing surface.

(c) Asphalt base

Where the patch has to be completed on the same day, sweep the surface of the subbase and prime the sides and floor of the patch. Do not leave pools of primer on the floor of the patch. Replace the layers with hot mix asphalt. Where convenient the base asphalt may be of the same fine mix used for the surfacing. Compact the asphalt in equal layers not thicker than 60 mm (loose). Compact the top of the base to 30 mm below the existing road surface using procedures described in 6.3c.

(d) Priming

Where the patch has been backfilled with gravel base, the edges of the patch and the surface of the base should be swept clear of any loose gravel or other material, and then thoroughly primed as detailed on page 16.

(e) Surfacing

The procedures for selecting, ordering, handling and applying hot mix asphalt are described on pages 5 – 27 of this guide and should abe followed during the patching process described below.

- Place hot mix asphalt in the hole and use an inverted rake or lute to screed the material to about 10 mm above the existing surface (see page 19).
- Use a straight edge to check that the loose asphalt follows crossfall or camber of the existing surface.
- Compact the new asphalt, ensuring that the joint between old and new asphalt is neat and clean (see page 21).
- After compaction, check with a straight edge that there are no bumps or slacks in the completed patch. If there are slacks, add more asphalt and compact; if there are bumps, continue compacting until the patch is level.
- When the patch conforms to the existing pavement surface in all directions it may be sealed around the edges using a suitable seal treatment.
- If the supervisor is satisfied that the repaired area/s comply with required quality standards, all loose material, tools and other equipment should be removed and the site thoroughly cleaned as detailed on page 30.
- When hot mix asphalt is not available or quantities are so small that it is not practical to use hot mix, a cold mix asphalt may be used. However cold mix asphalt requires a careful balance between binder content and cutter (to keep the mix soft when cold) and are prone to failure for the following reasons. Typically the cold mix is:
    - Too stiff and difficult to compact. It will thus be stable under traffic but will be open and permeable. As a result during the rainy season it will wet up and fail;
    - Or it is soft and compactible. The mix will then deform under early traffic and shoves under traffic during hot weather;
    - Single size aggregate with a little sand and binder ends up being porous.
- Of the three conditions, the stiff mix is preferred as it gives a stable surface. However the high permeability needs to be dealt with by one or more treatments, ie Viaseal diluted 1:1 with water until the surface and mix become impermeable.

(f) Small quantities of hot mix

Where hot mix is available and only small quantities are required, there is a problem keeping the mix hot for several hours. The following points should be considered to improve the situation:

- Speak to your Much contact about ordering as small a quantity as possible – eg, a bakkie load.

- Consider protecting the load against heat loss. Innovative contractors have devised a number of ways to do this, such as

  - ***Preparing a number of patches sufficient to use up the smallest load;***
  - ***Having more than one surfacing team;***
  - ***Using special double skinned tarpaulins filled with a proprietary insulation material to protect the load in the vehicle and in stockpile;***
  - ***Constructing a number of small insulated "hot boxes" with floating lids.***

Hand-laid hot mix asphalt training by Much Asphalt in Mthatha.

8. QUALITY CONTROL

8.1 FINAL INSPECTION

(a) Asphalt base

The completed asphalt surface should be carefully inspected for rough or low spots, surface irregularities, untidy edges, incomplete compaction or other faults. These should all be corrected before the contractor hands over to the client.

(b) Loose and excess material

All loose or excess asphalt, base material, excavated subgrade and other waste material should be removed from site, together with plastic or metal sheeting and other construction aids.

(c) Tools

All tools should be thoroughly cleaned in solvent such as diesel or paraffin at the conclusion of each day's work and at the conclusion of the contract. This is best done by placing a wheelbarrow containing solvent on the thin steel or plastic sheet laid to receive hot mix asphalt deliveries.

A "barrier" of dry sand, 200 mm wide and 50 mm thick should be spread around the wheel to catch solvent which spills out of the wheelbarrow during the cleaning operation.

All cleaning materials should be removed from the site at the conclusion of the contract.

Solvents are chemicals which could be flammable. Please take special care when handling them. The solvents should be carefully controlled during use and should be removed from site and dumped only at approved sites.

9. ORDERING HOT MIX ASPHALT

9.1 MUCH ASPHALT BRANCHES

Branch	Telephone	Email
BENONI	+27 87 997 1101	info@muchasphalt.com
BLOEMFONTEIN	+27 87 997 1110	
COEDMORE	+27 87 997 1102	
CONTERMANSKLOOF	+27 87 997 1104	
EERSTE RIVIER	+27 87 997 1100	
EIKENHOF	+27 87 997 1108	
EMPANGENI	+27 87 997 1111	
GEORGE	+27 87 997 1112	
PIETERMARITZBURG	+27 87 997 1105	
POLOKWANE	+27 87 997 1109	
GQEBERHA (PORT ELIZABETH)	+27 87 997 1106	
ROODEPOORT	+27 87 997 1107	
eMALAHLENI (WITBANK)	+27 87 997 1113	

9.2 EAST COAST ASPHALT BRANCHES

Branch	Telephone	Email
EAST LONDON	+27 43 745 2016	Francois.meyerhoff@muchasphalt.com
MTHATHA	+27 87 997 1130	Luvo.hlaba@muchasphalt.com

9.3 SPRAYPAVE BRANCHES

Branch	Telephone	Email
ALBERTON (GAUTENG)	+27 11 868 5451/2	info@spraypave.co.za
HILLCREST (KWAZULU-NATAL)	+27 31 777 1905	info@spraypave.co.za
PAROW INDUSTRIAL (WESTERN CAPE)	+27 21 931 0459	info@spraypave.co.za

9.4 PROCEDURE FOR ORDERING HOT MIX ASPHALT

(a) Pricing

The price of hot mix asphalt may vary from time to time due to a range of economic factors, including delivery distance. Contractors are therefore advised to ensure that they have a formal Much Asphalt quote before tendering for contracts.

Prices for the required product, delivered or collected, may be obtained from your nearest Much Asphalt branch.

(b) Ordering

Please contact your nearest Much Asphalt branch for assistance with the ordering process.

SprayPave supplies emulsions and primes in 200 litre drums as well as 20l and 5l polycans. These are also available at some Much Asphalt plants.

Quantity ordered	Minimum notice period
Volumes in excess of 150 tonnes	Order at least 2 working days before required.
Volumes less than 150 tonnes	Order 3 working days before required.

(c) Payment

Much Asphalt products may be purchased for cash or credit, provided that formal credit facilities have been negotiated.

NOTES

Much Asphalt

Head office and Western Cape Regional Office: +27 21 900 4400
Eastern Cape: +27 41 364 1116
KwaZulu-Natal: +27 31 450 0400
Gauteng Inner and Outer Regions: +27 11 423 1004

info@muchasphalt.com

SprayPave

Johannesburg: +27 11 868 5451/2
Durban: +27 31 777 1905
Cape Town: +27 21 931 0459

info@spraypave.co.za
www.spraypave.co.za

East Coast Asphalt

East London: +27 43 745 2016
Francois.meyerhoff@muchasphalt.com

Mthatha: +27 76 982 6366
Luvo.hlaba@muchasphalt.com

www.muchasphalt.com