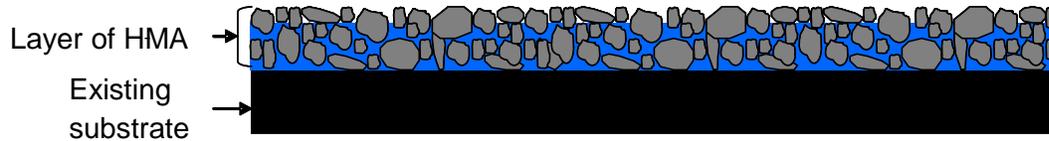


Method statement for labour based construction of:

HMA surfacing



Definition

The term hot mix asphalt is generally used to describe a variety of mixtures of aggregate, bitumen and mineral filler that are produced at an elevated temperature in an asphalt plant. The aggregate fractions are obtained from crushing or natural sources. The coarse aggregate is, in most cases, crushed rock. The fine aggregate may be crusher sand, clean natural sand, mine sand, selected river gravel or a mixture of these. The filler usually consists of cement, lime or rock flour. The bituminous binder is usually penetration grade bitumen

Application

HMA is suitable for applications where a reasonably smooth or even surface is required, typically on sidewalks, driveways, parking areas and tennis courts. Although not as conducive to labour intensive construction methods as other bituminous surfacings, a reasonable finished product can be achieved, provided that all the controls are in place and well managed. For most hand laid applications of asphalt where the layer thickness is 30mm or less, mixes with maximum nominal size of 9.5mm is recommended. For layer thicknesses of less than 25 mm the maximum nominal size should not exceed 6.7mm. Hand applied HMA would not be appropriate for roads accommodating high traffic volumes. In such situations laying by mechanised pavers and rollers is the preferred method.

Material requirements

HMA: The required mix is obtained from an established supplier. When placing an order for the HMA, the supplier should be advised that the material will be used for hand work. This will enable the supplier to make recommendations on the appropriate mix type and aggregate gradings to suit the particular job requirements. The order for the HMA should stipulate the minimum temperature of material delivered on site.

Diesel is used for cleaning the rakes and shovels of asphalt build-up. The wheelbarrow or any other container used for containing the diesel should not have any leaks as spillage onto the asphalt will adversely affect its quality.

Note:

Material requirements for priming and tack coats is covered in the relevant method statements.

Plant and equipment requirements

Below are the plant and equipment requirements to lay 15 – 20 tons of asphalt per day

Item	Number of items
Brooms	4
Shovels	6
Wheel barrows	3
Rakes	3
Rollers: Static steel wheel roller - 2 tons mass for break down rolling	1
Pedestrian vibrating roller or small sidewalk roller	1
Hand stampers	2

The required number of each item will need to be balanced for each operation depending on required production rate and area that is to be covered. An additional wheelbarrow may be necessary for the diesel used to keep the rakes and shovels clean of asphalt build-up.

Labour requirements

Below is the proposed composition of a team required to lay 15 - 20 tons of asphalt per day.

Activity	Number of workers
Broom team	2
Wheelbarrow team	3
Wheelbarrow loading team	3
Rakemen	2

Roller operator	1
Hand stamping team	2
Total	13

Construction

Prime or tack coats

It is assumed that the priming activity has already been completed (See appropriate LIC method for priming). Almost without exception, but especially when the prime has lost its tackiness a tack coat is required. (See appropriate LIC method statement for tack coats.)

Determining the quantities to be ordered

An initial rough estimate can be obtained for bulk ordering by multiplying the area to be covered by the specified thickness of the asphalt layer. This value which represents the compacted volume (in m³) should be converted to mass (tons) by multiplying by the volume with the Bulk Relative Density of the HMA as provided by the supplier.

Variations in the thickness of the asphalt layer normally occur due to undulations of the substrate. To account for this, dip readings should be carried out over the area to be paved, using the level controls that are described below. This procedure will enable a more accurate estimate of the quantity for ordering on the day. Allow for approximately 5mm extra height above the final kerb edge to prevent damage to the kerbing during compaction.

Setting up level controls

The area to be paved needs to be surveyed to ensure that the correct slopes and cross fall are obtained for drainage of surface water. This is especially critical on large areas such as parking areas. To ensure adequate slopes are obtained, C-channels or similar rigid forms need to be laid out to the correct levels and slopes. These will assist the rakemen to obtain the correct final levels. Normally the work would be carried out in long strips, starting from the lowest point and working towards the highest point.

NOTE: The HMA layer will NOT iron out all the irregularities of a poorly constructed base course layer. The better the finish of basecourse layer, the better the final finish of the HMA layer will be.

HMA delivery

The HMA delivered to site should be dumped in an accessible area close to where the work will be carried out and in as large a pile as possible to promote heat retention. Before receiving the load the temperature of the mix should be measured to ensure that it is at least 130 °C; if not, the load should be rejected. The dumped HMA needs to be covered with a tarpaulin to assist in retaining the heat, which is one of the most important factors for achieving a satisfactory compaction. *Every effort needs to be made to ensure the HMA remains above the minimum compaction temperature of 100 °C.* The additional 30°C allows for a certain amount of cooling while working with the material on site. The delivery of material on site during a day's production needs to be well coordinated so as to ensure that the loads arriving on site are reasonably staggered and that there is no surplus material at the end of the day's work.

Placing HMA

The surface on which the HMA is placed should be prepared in accordance with method statements for prime and/or tack coats. The HMA is loaded into the wheelbarrows from all around the stockpile to ensure that material is continuously removed from hot sections. This will also prevent one side from cooling down and creating a cold crust on the surface that will be unusable and going to waste.

The HMA should be tipped out - as indicated by the rakemen - in a splayed manner to ease the spreading of the mix to the correct level quickly and effectively. Minimal movement of the material should be required of the rakemen as this will limit the degree of segregation of the material and allow the mix to be compacted as soon as possible before excessive cooling. It is critically important that the level of the raked material should be proud of the finished level by an amount equal to 20% of the final layer thickness to allow for compaction.

Note that the term "raking" refers to the use of the flat back end of the rake (lute) to distribute and spread the material since using the pronged side would tend to segregate the asphalt.

Compaction

Compaction should follow as soon as possible after spreading to the correct level. Firstly a static roller pass is made to bed the material down, preferably using a steel wheeled roller with a minimum mass of 2 tons. The first pass should be made with the driven wheel leading in the direction of compaction to ensure that the asphalt is tucked under the wheel and not pushed forward in a wave. This pass will also allow the rakemen to ensure that the correct amount of material has been spread relative to the level controls and that there are no low or high spots. Following the first pass, compaction is continued in half width overlaps until the mat is at the required density. A final pass in static mode is made to ensure a smooth finish without any visible roller tracks.

Pedestrian rollers may also be used for smaller areas.

No turns should be made on the warm mat while still being compacted. Lateral changes in the position of passes should be carried out on compacted, cooled asphalt. Compaction passes should take place in straight lines working from lower areas to higher ones to allow for a compacted edge to support the next pass.

Only sufficient water to moisten the roller drums to prevent the mix from sticking should be used. Excessive water will accelerate the cooling of the mix which may give rise to inadequate compaction.

The roller direction should not be changed while still moving in the opposite directions as this may result in the gears kicking into place resulting in the mat being shoved unnecessarily leading to undulations. Such undulations can be very difficult to correct resulting in a poor finish as well as possible ponding of water. Where vibratory rollers are used, vibration should be switched off while changing direction to prevent excessive vibration on the area where the roller comes to a complete stop.

A 3m straight edge should be used to ensure that the final level of the finished mat is correct and that the water will drain from the surface as required.

If the correct levels are not achieved after final compaction, this cannot be corrected by adding additional HMA. Such a measure would create a biscuit layer which will lead to unsatisfactory quality of the surface. To correct such level discrepancies all the material in the depressed area would need to be removed and replaced. **Edge treatment**

A heavy stamper should be used at the edges to ensure that they are well compacted and sealed off from any possible water ingress. This is particularly important in corners or areas which rollers cannot access. Care should be taken not to damage any of the edging with the stamper.

Traffic control

It is advisable to leave the completed section closed to traffic overnight for it to cool down fully. This will prevent any ravelling in areas where sharp turning movements are carried out by vehicles, and steep inclines where high traction forces are likely.. During hot summer periods the asphalt could be tender for some time after construction and the overnight cooling period might not be enough. Especially in areas where heavy vehicles turn, such as loading areas at factories, it may be advisable to apply a thin layer of crusher dust on top of the surfacing after compaction to prevent ravelling. This should however not be done on roads or at intersections as skid resistance may be compromised.

Quality control

A number of aspects need to be borne in mind when dealing with HMA and laying it by hand:

- The material cools very rapidly once spread out, so no time must be lost in getting the HMA raked to the correct level and compacted;
- Excessive quantities of paraffin on the rakes and shovels will soften the HMA and cause it to ravel at an early age;
- Levels must be carefully controlled to ensure an even, drained surface with no ponding.
- The edges need to be well compacted to prevent the seepage of moisture into the edges of the pavement, which may also lead to premature failure;
- It is better to have a kerbed edge to give the HMA layer some lateral support. This tends to prolong the life of the pavement by preventing edgebreaks.

Reference material

Hand-Laid Hot Mix Asphalt 3rd Edition, April 2009, published by Much Asphalt