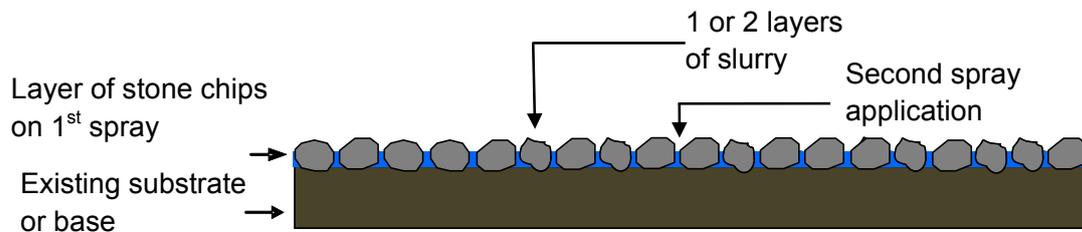


Method statement for labour based construction of:

Cape seal



Definition

A Cape Seal is in effect a single seal with the spaces between the chippings filled with slurry. Either 13,2 mm or 19,0mm stone sizes are used. Often, and especially if the stone chippings have not been pre-coated, diluted emulsion is applied as a second spray application. Where 13,2 mm stone aggregate is used, one layer of slurry is applied, while with 19,0mm aggregate two layers of slurry are generally applied. In the case of the 19 mm aggregate size the slurry of the first application should be of sufficiently runny consistency to ensure that all the spaces between the stone chippings are filled. The second application (or single application in the case of 13,2mm chips) would normally have firmer consistency and would be drawn off level with the tops of the aggregates to ensure contact between tyres and the stone, and not between tyre and slurry.

Application

Cape Seals are generally used in new road construction and parking lots. They are best suited to rural roads in view of the tendency for it to be a noisy surfacing as a result of the coarseness of the exposed aggregate,

A Cape Seal is a fairly forgiving wearing course as any errors in application rates during construction can be rectified in successive applications. Controls on site must still however be closely monitored to ensure an acceptable, serviceable and durable riding surface.

Material requirements

Stone aggregates: Suitable stone chippings for Cape Seals is a single sized aggregate that is clean and free of dust, clay particles and organic materials. The nominal aggregate sizes are limited to either 13.2 or 19.0 mm stone aggregate conforming to the project specifications.

Bitumen emulsion: Stable grade bitumen emulsion with 60% - 65% binder is recommended. The advantage of using a 60% emulsion is that it can be sprayed at ambient temperature, whereas the 65% requires heating to a minimum of 50°C to lower the viscosity.

Water: - Potable water

Plant and equipment requirements

Below is a list of typical plant and equipment required to construct 2 000 – 4 000 m² of Cape Seal surfacing per day. Aspects of this will need to be looked into for each contract to ensure that the individual phases of work are balanced with each other, e.g. the chipping operation following closely on the first binder application. The number of chip spreaders can also be influenced by the road width being sealed. In the case described below three chip spreaders covered a width of 3,6 m. Numbers given below are for a team of three chip spreaders running in parallel.

Item	Number of items
Pedestrian double drum vibratory roller with mass of 0.6 t or more	2 -3
Hand operated spray cart with 210 Litres emulsion drum holder	1
OR	
Spay tanker towed with tractor or bakkie	1
Walk-behind chip spreaders	3
Wheelbarrows	19 – 27 (2 for back chipping)
Shovels	12 - 19
Brooms	6 - 11
Concrete mixers (275 to 350 litre)	4 – 5
Rubber squeegees	10 – 15
Plastic buckets	6 – 10

Note: The equipment required for the preparation of the base is covered in the relevant method statements.

Labour requirements

Below is the typical composition of a team necessary to construct 2 000 – 4 000 m² of Cape Seal surfacing per day. This includes the labour for the chipping operation as well as the slurry operation and is based on a well balanced output of the two applications. On average, one concrete mixer will deliver about 5m³ of slurry on a day, and if this is scaled up to five mixers a total production of 20 - 25 m³ is achievable. Depending on the spread rate this converts to production of up to 4000m² for the day. The number of workers in the team listed below is appropriate for the operation of three chip spreaders and five concrete mixers, but it is quite

possible to use only one chip spreader and one concrete mixer if working on a small site, reducing the complement of workers and equipment accordingly.

Activity	Number of workers
Single Seal construction	
Brooming (pre-seal)	3 – 6 (depending on loose material)
Loading and Spraying of binder	3
Chip spreaders	12 (4 per chip spreader, incl. operator)
Rollers	2 – 3 (depending on requirements)
Stone aggregates loading	6 – 9
Wheelbarrows (seal construction)	9 – 12 (depending on stockpile distances)
Back chipping team	3 - 6
Slurry application	
Loading of crusher dust	6 - 10
Concrete mixer operator	3 - 5
Wheelbarrows (slurry operation)	10 -15
Loading emulsion and water	6 - 10
Squeegeeing	10 - 15
Sweeping (pre-slurry)	3 - 5
Traffic control	2 – 4

Note: The numbers listed above does not provide for preparation of the base, e.g. brooming that will be required before priming or applying the first spray where the prime layer is omitted. Refer to the method statement for priming.

Construction

Site preparation

It is assumed that the base has already been primed should this be a requirement (see applicable LIC priming method). Should the base not be primed it must be swept before the operation can commence. This process will be the same as for the priming operation. The binder content needs to be increased slightly to allow for a percentage to be absorbed into the base layer to create the bond required between the granular base and wearing course layers. This adjustment to the first spray application rate should be provided by the client or his agent.

Should the base not be primed it should be moistened very slightly after brooming to prevent “pin holing” of the binder.

To ensure that the operation is not slowed by lack of stone chips during the chipping process, small stockpiles can be deposited along the roadside at intervals of about 50m to reduce the transport distance when re-stocking the chip spreaders. The quantity can be determined based on the spread rate required for the particular application.

Spray operation

Spray applications should only be applied during the day and only in good weather conditions. Care should be taken when spraying on a windy day as the spray may be carried some distance and damage property or passing vehicles down-wind of the operation.

Kerbing and channels, if present, will need to be covered and protected with black plastic, metal or thin timber sheets or other suitable material.

The emulsion can be sprayed directly from the 200 L drums if the hand pulled cart is used. Should a towed tanker be used, the required number of drums will need to be pumped into the cart at the correct handling temperature, making allowance for the expansion of the binder in the cart while heating.

First spray application using a hand lance:

Whether using a spray tanker (drawn by either a tractor or bakkie) a hand pulled spray cart with motor driven pump or a hand pulled spray cart with a manually operated pump the preparation is essentially the same

The piping should be checked for leaks and the motor, where present, for correct operation, having no leaks, with pulley sufficiently tight and having sufficient oil and fuel.

Nozzles should be cleaned with diesel, if necessary, away from the road surface. Care should be taken not to cause spillages that will damage the environment. The trial spray can be done back into the drum to avoid pollution.

When using a hand pulled spray cart one or two additional team workers are required to pull the cart and assist with handling of the equipment on site. When using a spray cart with a manually operated pump a further additional person will be required to operate the pump action to spray the emulsion.

The area to be sprayed from a given quantity of binder should firstly be established and marked out to assist in achieving the correct application rate.. **Example:** 200 L (1 drum) of 60% emulsion applied at a spray rate of 1.1 L/m² **of net binder** will cover 109 m². Therefore, if the area being sprayed is 5 m wide, the drum will cover a total length of 22 m. The area should be marked out to assist in obtaining the correct spray rate.

Spraying should be carried out in wide sweeping movements of the hand lance with 1/3 overlaps between successive applications. The actual spray rate should be continuously checked by comparison of the area covered and the area marked. It is preferable to have the same experienced spray operator undertake this operation each time as the correct application is a critically important factor for satisfactory performance of chip seals.

The spray operation and the chipping operation should be closely monitored and coordinated to ensure that the chips are applied to the emulsion before it breaks. Hence, the spray operation should not advance too far ahead of the chipping operation.

After the completion of the spraying operation spray plant equipment should be cleaned with diesel and all waste products removed from the site. Remember that the environment must be protected at all times!

Stone application

The stone application must commence as soon as practically possible to ensure the stone aggregate falls onto the unbroken emulsion. The chip spreaders are pushed by three workers plus an operator who will ensure that the chipping operation takes place along the correct line. The aggregate is wheeled to the chip spreaders on the previously spread aggregate and discharged into the receiving hopper.

Rolling operation

Rolling on the newly applied chippings must commence as soon as possible to assist with the bedding down of the stone aggregate into the emulsion. No severe turns should be made on the surface itself until the stone aggregate is well bedded down and the emulsion broken. Any turning needs to be gradual on the oldest section of the stone aggregates to prevent the stone aggregates from being shifted out of position.

Back chipping

The back chipping operation of sweeping off excess aggregate and adding chippings to the spots where there are insufficient stones takes place between the roller passes. Care must be exercised in this operation so as not to collide with wheelbarrows. The rollers have right of way in this operation. After back chipping the aggregates should present an evenly spread single layer of chips, lying shoulder-to-shoulder.

Second spray application

The diluted emulsion fog spray (if applicable) can be applied once all the aggregate has been well bedded down and all excess aggregate has been swept to the side of the road surface. The same provisions as for the first application described above apply.

Slurry application

The mixing and application of the slurry is as laid out in the method statement for slurry.

The slurry can only be applied once the second spray application on the aggregate has fully dried, which may take a few days. The team that does the spreading by squeegee should be divided into four sections. The first section pushes the slurry in one direction, while the second section pushes the mix back down in the opposite direction. The third and fourth sections do the same but across the road. This is to ensure that the slurry is forced into all the spaces between the stone chippings and does not leave any voids. This will ensure that the aggregate is well bedded down with slurry fully surrounding each stone to ensure good retention and a waterproof layer.

Cape Seals using 13,2 mm aggregate only requires a single application of slurry while the larger 19,0 mm aggregate will require two applications as the first layer will still leave too many voids on the surface once it has set. The second application will assist in filling these voids, sealing off the layer fully and securing the aggregate on all sides with slurry.

Traffic control

Seals need approximately four to eight hours to set properly under favourable weather conditions. Traffic must not be allowed onto the seal until the slurry is fully set, particularly in areas where turning and stop start movements of vehicles occur.

Quality control

Five aspects, critical to achieving a sound end product, which need particular attention are:

- Spray application rate - incorrect binder spray application rate will result in either, the stone chippings not adhering to the base or bleeding of the surface
- Chippings to be dust free - dust on the chips will result in poor bonding of the aggregate to the binder, resulting in chip loss.
- Chipping at correct spread rate - too lean an application may result in the emulsion being set by the time the back chipping occurs, leading to poor bonding and eventual ravelling. Applying too much aggregate results in added work for the sweepers, who must remove the excess stone from the surface. This could also result in a shortage of aggregate before the day's production is achieved.;
- Slurry texture and mix must be consistent - The slurry application must be done as per the instructions and must never cover the stone aggregate fully to ensure that the contact of tyres will always be on the stone aggregate and not the slurry itself.
- Crusher dust deliveries must be checked for consistency as variations in grading and shape of this material will have a marked effect on the quality of the slurry and its ability to act as a waterproofing layer.