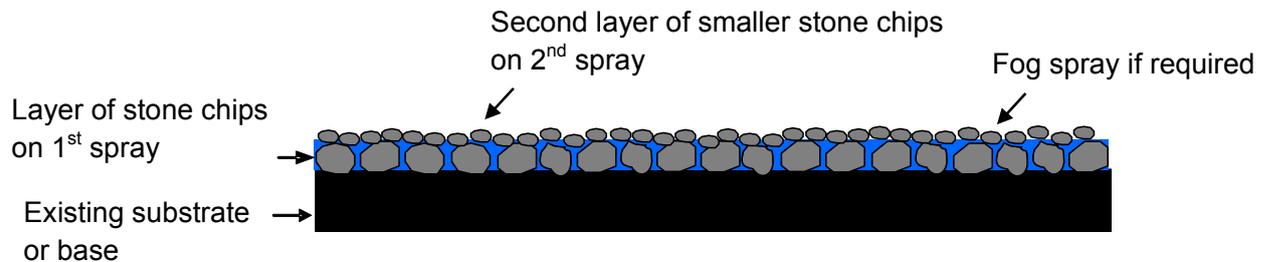


## Method statement for labour based construction of:

### Double seal



#### Definition

A double seal is a sprayed application of bituminous binder followed by a single layer of stone chippings, followed by a second spray application of bituminous binder and a single layer of **smaller** sized stone chippings or sand. The final layer of stone chippings is sometimes covered by a fog spray to prevent whip-off. Double seals can be made up from the following combinations of stone aggregate and sand:

9,5 mm chips and sand

13,2 mm chips and sand

13,2 mm chips and 6,7 mm

#### Application

A double seal is normally used as a first seal on a newly constructed road where a more durable surfacing than a single seal is required.

A double seal is applied to:

- waterproof the underlying pavement layers;
- provide a safe all-weather dust-free riding surface with adequate skid resistance;
- protect the underlying layers from the abrasive and destructive forces of the traffic and the environment.

From a construction perspective a double seal is a more forgiving surfacing than a single seal as one can make corrections to an incorrect preceding spray application rates during the application of subsequent applications e.g. 2<sup>nd</sup> spray coats or even the final fog spray to ensure the correct total application of binder. Controls on site must still be closely monitored to ensure an acceptable, serviceable and durable riding surface.

### **Material requirements**

**Stone aggregate:** Suitable stone aggregate for a double seal is a single sized stone chippings that are clean and free of dust and clay particles or organic materials. The aggregates are limited to sand or single sized 6,7, 9,5 mm and 13.2 stone chippings.

**Sand:**

Sand should be free of clay lumps and organic matter and should comply with the project specifications in terms of grading.

**Bitumen emulsion:** Cationic spray grade bitumen emulsions with 60 or 65 % binder is recommended. The advantage of using a 60% emulsion is that it can be sprayed at ambient temperature, whereas 65% emulsion should be heated to at least 50 to 60 °C to decrease the viscosity. A diluted fog spray is recommended on the final stone layer of all double seals. The total binder application that is specified includes the amount used for the fog spray, i.e. the total application of the 1st spray, 2nd spray and fog spray must comply with the specified quantity.

**Water:** - Potable water

## Plant and equipment requirements

Below is a list of typical plant and equipment required to construct 4 000 – 6 000 m<sup>2</sup> of double seal surfacing per day. For each contract it needs to be ensured that the various phases of the work are balanced with each other, e.g. brooming stays ahead of the spray application which should not advance too far from the chipping operation.. The number of chip spreaders should also be appropriate to the road width being sealed. In the example below three chip spreaders are required to cover a width of 3.6m and the number of workers listed below are appropriate for this number of chip spreaders operating in parallel.

Item	Number of items
Pedestrian double drum vibratory roller with mass of 0.6 t or more	2 to 3
Hand operated spray cart with 210 Litres emulsion drum holder OR Spray tanker towed with tractor or bakkie	1 - 2
Walk-behind chip spreaders	3
Wheelbarrows	9 – 12 (2 for back chipping)
Shovels	8 – 10
Brooms	3 - 6

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 double seal team necessary to lay 4 000 – 6 000 m<sup>2</sup> per day). The team size is also relevant to the use of three chip spreaders. Where less chip spreaders are used (on a small project) the labour and equipment requirements should be adjusted proportionately.

Activity	Number of workers
Brooming	3 – 6 (depending on loose material)
Loading and spraying binder	3 - 6
Chip spreaders	12 (4 per chip spreader, incl. operator)
Rollers	2 – 3 (depending on requirements)
Stone aggregates loading	6 – 9
Wheelbarrows	9 – 12 (depending stockpile distances)
Back chipping team	3 - 6
Traffic control	2 – 4

## Construction

### Site Preparation

It is assumed that the base has already been primed should this be specified (see applicable LIC priming method statement). 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. Note:

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

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 can also be moistened very slightly after brooming to prevent “pin holing” of the binder from occurring.

To ensure that the operation is not slowed down while chip spreaders are re-supplied with aggregate, small stockpiles can be deposited along the road side at intervals of about 50m to reduce the distance to be travelled as the stone aggregate is wheeled to the chip spreaders. The size of the stockpiles 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 operation 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/m<sup>2</sup> **of net binder** will cover 109 m<sup>2</sup>. 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!

### **First 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 stone 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 operation**

This operation is almost identical to the first spray. Corrections need to be made to the spray rate should insufficient or surplus binder have been applied during the first spray operation.

## **Second stone or sand application**

The second layer of chippings are applied evenly into the spaces of the first layer. The actual spread rate is different, given the different stone aggregate size and hence the different ALD.

Where the second application of aggregate consists of sand, it should be spread onto 2<sup>nd</sup> spray before the emulsion has broken. It can be spread either by hand using shovels or with pedestrian chip spreaders. When using a shovel to spread the sand, it should be done in such a manner that the sand falls vertically into the surface in as widespread an arc as is possible. This is achieved by tossing the sand from the shovel in an upward, circular motion. The sand must not be placed in piles on the actual layer and spread out from there. The spread rate needs to be such that the binder can bond with sand to assist in binding it to the layer. Such spread rates will differ depending on the stone chipping size used in the lower layer as well as the sand's characteristics. No excess binder should be visible through the sand layer. Where excess binder is still visible, additional sand should be applied to those areas. Both under-application and over-application of sand will need to be guarded against. Slight over application is preferable to under-application. Light drag-brooming of the layer will spread the sand evenly over the surface. Any excess sand will need to be broomed off once the binder has broken and the required quantity of sand is bonded to the layer.

## **Rolling operation**

The second layer of chippings are given a light rolling (normally two passes) to imbed the chippings into the binder and to knit the double seal..

## **Back chipping**

The same operation as for the first stone aggregate layer is also applicable here.

## **Fog spray**

A light spray of cationic spray grade 60 emulsion diluted 50:50 with water is applied on the seal if so required.

This fog spray can be applied after 2 – 3 weeks once all the stone chippings has bedded down well and all excess aggregate has been swept to the side of the road surface either by vehicular traffic or by brooming. This needs to be monitored and will be determined by the volume of traffic using the surface.

### **Traffic control**

Seals need approximately four to eight hours to set properly under favourable weather conditions. Traffic should not be allowed onto the seal until such time as it is fully set, particularly on areas where turning and/or stop start actions occur

### **Quality control**

Three 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.;