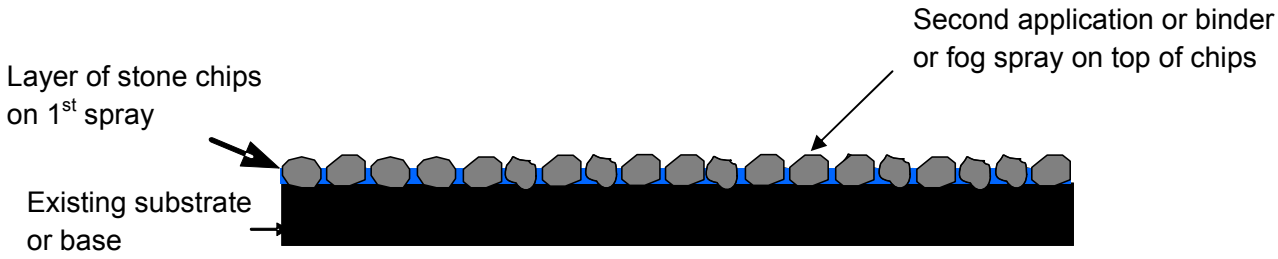
# Method statement for labour based construction of:

# Single Seal




## Definition

A single seal is a sprayed application of bituminous binder followed by a layer of stone chippings. The stone chippings are sometimes covered by a light second application of binder or fog spray to ensure that it is all "locked in" and forms an integral part of the seal. Very often (and especially with the larger aggregates), the total application of the binder is split between the first spray and a second spray. Apart from assisting to lock the stone aggregates in from the top, this "blackens" the road, particularly when the stone aggregates are not pre-coated, thereby making road markings more visible and efficient.

## Application

Single seals are used as a first surfacing on newly constructed roads or as a reseal on an existing surfacing. Single seals are best suited to residential developments and rural roads with occasional heavy vehicles.

The main functions of a single seal are 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.

As errors in the application rate of the bituminous binders cannot be readily rectified, as is the case with double seals, controls on site must be closely monitored to ensure an acceptably, serviceable and durable riding surface.

## Material requirements

**Stone aggregates**: - Suitable stone aggregate for a single seal is a single sized stone aggregate that is clean and free of dust particles, clay or organic materials. The stone aggregates are limited to sand or single sized 6.7, 9.5 mm or even 13.2 stone aggregate. Aggregates should comply with the requirements of the project specification.

**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 lower the viscosity. A diluted fog spray is recommended on the 9.5 and 13.2 mm stone aggregate layers. The total binder application that is specified includes the amount used for the fogspray, i.e. the total application of the first spray and fog spray must not exceed 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 m² 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<br>OR<br>Spay tanker towed with tractor or bakkie | 1 - 2<br><br>1 - 2 |
| Walk-behind chip spreaders | 3 |
| Wheelbarrows | 20 (2 for back chipping) |
| Shovels | 9 |
| Brooms | 8 - 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 single seal team necessary to lay 4 000 – 6 000 m² 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) |
| Rollers | 2 – 3 (depending on requirements) |
| Stone aggregates loading | 6 -9 |
| Wheelbarrows | 9 – 12 (depending on stockpile distances) |
| Backchipping team | 4 |
| 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 will need to 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.

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 stone chippings, small stockpiles can be deposited along the road side at intervals of about 50m to reduce the distance to be travelled as the stone chippings are 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.

**Tack coat or 1$^{st}$ 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/$m^2$ ***of net binder*** will cover 109 $m^2$. 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 stone aggregate and adding chippings to the spots where there are insufficient stones lean will take 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.

**Fog spray**

A diluted emulsion fog spray can be applied after 2 – 3 weeks once all the stone aggregates have bedded down well and all excess stone aggregates have been swept to the side of the road surface either by vehicular traffic or brooming.

**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 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.;