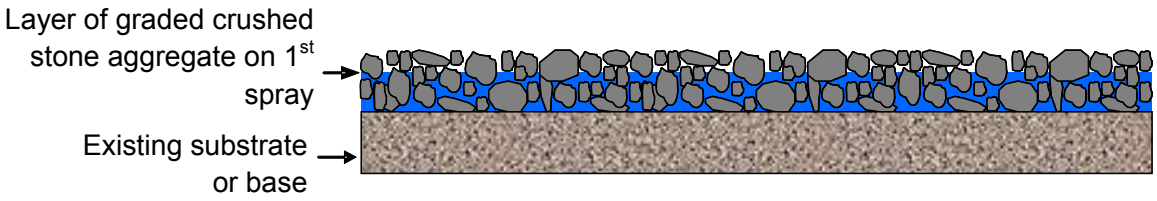
Method statement for labour based construction of:

Graded Crushed Stone Seal



Definition

A graded crushed stone seal is a sprayed application of modified bituminous binder followed by a layer of graded crushed stone aggregate. The layer of graded crushed stones is sometimes covered by a second spray application or fog spray to ensure that all particles are "locked in" and form an integral part of the seal. Apart from assisting to lock the graded crushed stone aggregates in from the top, the fog spray blackens the road Thereby making line marking more visible and efficient.

Application

Graded crushed stone seals are best suited to residential developments and rural roads with minimal heavy vehicles.

The main reasons for applying a graded crushed stone aggregate seal is 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.

A graded crushed stone seal is a fairly forgiving wearing course as any errors in design or construction can be rectified with the fog spray. The fairly large surface area of the graded crushed stones will facilitate the absorption of excess binder should this occur. Controls on site must, however, be closely monitored to ensure an acceptable, serviceable and durable riding surface.

Material requirements

Graded crushed stone surfacing aggregates: The aggregate should be free of dust, clay particles and organic materials and should conform to the project specifications. A typical grading is given in the table below.

Sieve size (mm)	Cumulative % passing
19,0	100
13,2	60 – 100
9,5	30 – 90
6,7	15 – 55
4,75	5 – 30
2,36	0 – 10

Modified Bitumen: A semi-priming elastomeric polymer modified binder (e.g. “Gravseal” or similar) is recommended. The application temperature is between 130 and 135 ^{o}C to ensure the correct viscosity. A diluted fog spray is recommended on the graded crushed stone aggregate seals. The total application of the modified binder should comply with the project specification

and is normally in the region of between 1.6 and 1.8 ℓ/m^2. The fog spray must not exceed 0.5 ℓ/m^2 of a 70:30 water:emulsion (60%) dilution.

The semi-priming binder dispenses with the need for a prime coat application. .

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 graded crushed stone 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 - 3
Walk-behind chip spreaders	3
Wheelbarrows	20 (2 for back chipping)
Shovels	9
Brooms	6

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

Labour requirements

Due to the nature of the modified binder used, application of the binder is invariably by means of a mechanised binder distributor. The typical composition of a graded crushed stone seal team necessary to lay 4 000 – 6 000 m² per day therefore includes the labour for the chipping operation only. The team size is relevant for the use of 3 chip spreaders, but it is quite possible to use only one chip spreader on a small site. Such an operation may not be cost efficient due to the high hire-rate of the binder distributor. Where this is unavoidable, the numbers of workers and equipment can be reduced proportionately for the chip spreading operation.

Activity	Number of workers
Chip spreaders	12 (4 per chip spreader)
Rollers	3
Stone aggregates loading	9
Wheelbarrows	20
Back chipping team	4

Construction

Site Preparation

Where the base has not been primed, as is usually the case as result of the self priming nature of the binder, it should be prepared as described in the method statement for applying a prime coat. Also the application rate of the binder 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”.

To ensure that the operation is not slowed down while chip spreaders are re-supplied with graded crushed stone aggregate, small stockpiles can be deposited along the road side at intervals of about 50m to reduce the distance of transporting the graded crushed stone aggregate to the chip spreaders. The size of the stockpiles can be determined based on the spread rate required for the particular application

Spray operation

The mechanised binder distributor must be positioned in such a manner that the edges of the spray application always coincide with the centreline or shoulders of the road or street and does not occur in the wheel tracks. The self-priming modified binder needs to be left for a period of 20 minutes before application of the stone to ensure it penetrates the base sufficiently to act as a bond between the granular layer and the graded crushed stone aggregate seal. The wind speed and temperature needs to be monitored to ensure the graded crushed stone aggregate is applied to the binder while it is still tacky.

Graded stone application

The graded crushed stone application must only commence after the required waiting period as described above. 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 binder. No severe turns should be made on the surface itself until the graded crushed stone aggregate is well bedded down. Any turning needs to be gradual on the oldest section of the graded crushed stone aggregates to prevent the graded crushed 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.

Fog spray

A fog spray of diluted emulsion as described above, can be applied once all the graded crushed stone aggregate has been bedded down well and all excess stone aggregate has been swept to the side of the road either by vehicular traffic or brooming – usually 2 – 3 weeks after completion of the layer works. The application rate should not exceed 0.15 ℓ/m^2 of net bitumen.

Traffic control

Graded stone 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

Four important aspects need to be controlled

- Spray application rate of the binder must not exceed 1.8 ℓ/m^2. Incorrect binder spray application rate will result in either the stone chippings not adhering to the base or bleeding of the surface
- Chippings should not contain more than 10% fines. Excessive dust in the graded crushed stone aggregate will result in a poor bond of the crushed stone aggregate to the binder, resulting in chip loss.
- Graded crushed stone aggregate must be applied at the correct spread rate. Too thin an application will demand a high work rate for the back chipping team, which may result in the binder being too dry by the time the back chipping occurs, leading to poor bonding and eventual ravelling. Over-application of graded crushed stone aggregate results in added work for the sweepers to remove the excess aggregate from the surface. This could also result in a shortage of graded crushed stone aggregate before the day's

production is achieved. However, it is better to over-apply the stones than to apply too little.

- Rolling is critical to a quality end product. Rolling needs to commence as soon as possible after chipping.