C-03 Construction of slurry seal surface dressings on roads using manual methods

D P Mallawaratchie, G G A D A Seneviratne
(Research & Development Div.Road Development Authority, Ratmalana)

Slurry seals are surface dressings that are prepared by mixing well graded fine aggregates, emulsified bitumen, water and small percentages of Portland cement, and applied on pavements as free flowing slurries to thicknesses of 5-10mm. They are used to improve aged bituminous surfacing and/or surfacing with fine cracks as they could penetrate and seal voids and small cracks very effectively. They are also used for both preventive and corrective maintenance of old bitumen surfaces and to correct very small irregularities and depressions.

In other countries, machines are used for mixing and laying of slurry seals. As these machines are not available in Sri Lanka, trials were carried out using a concrete mixer for mixing on Templers Road, Mount Lavinia and manual methods for mixing, on Egoda Uyana New Deviation on Colombo - Galle Road, Stanley Tillakeratne Mawatha, Nugegoda and Pelmadulla - Madampe - Nonagama (P.M.N) Road. At all these trials, manual methods were used for laying. This paper deals with the development of techniques of construction of slurry seals using methods to suit local conditions

Trials were carried out on Templers Road using 3 grading bands, Type I, II & III conforming to American Society for Testing Materials (ASTM) specification D-3910. Slurry seals prepared with Type-II grading performed better than those with other gradings and was selected for the other construction sites where trials were carried out.

The following materials with percentages by weight of dry aggregates were used for the trials:

(a) Type-II grading was achieved by blending of 20% 4-10mm aggregate and 80% crusher dust.
(b) 1% Portland cement.
(c) 12.5 to 13.5% bitumen emulsion, cationic slow setting-1 (CSS-1). (d) Potable water as required for a slurry (generally the same quantity as for emulsion in wet areas and double that quantity for dry areas).

The following steps of construction were worked out, where necessary, as most suitable after carrying out various trials:

(a) Preliminary work including patching depressions and potholes using cold aggregate bituminous premix and 1:8 emulsion:sand premix.

(b) Cleaning the surface.

(c) Applying a tack coat if necessary.

(d) Mixing of coarse and fine aggregates to the blended proportions using showels.

(e) Adding 1% cement by weight of aggregate and mixing using showels.

(f) Adding half the quantity of calculated water and mixing.

(g) Adding CSS-1 emulsion in two equal halves and mixing.

(h) Adding the balance water and mixing to get a uniform slurry with the best consistency for easy spreading.

(i) Laying the mixture using mortar pans and showels.

(j) Spreading and levelling using rakes and wooden level boards etc.

(k) Compacting the slurry using wooden stamper.

(l) Rolling using improvised roller.

(m) Rolling with 2 to 4 passes of a 2 tonne roller.

(n) Curing the seal for 2 h without allowing traffic.

(o) Opening for traffic.

It was evident from the trials at Templers Road that the concrete mixer was not suitable for mixing. Manual mixing method introduced at the Egoda Uyana site was successful even for high traffic volumes for a period of more than 3 years. Therefore the same method was introduced last year at the Stanley Tillakaratne Mawatha and P.M.N. Road where these sections are performing very well to date.

It was observed that the tack coat was not necessary where the surface was rich in bitumen. Where necessary a tack coat should be applied with diluted emulsion (1:1 CSS-1 : water) at a rate of 0.5 $1/m^2$ where the surface aggregates are exposed or where cracks are present in the existing surfacing. 1% portland cement by weight of total aggregate should be added to increase the consistency of the mix. Emulsion content should be in the range of 12.5 - 13.5% by weight of total aggregate. Bleeding may occur when this range is exceeded.

It was found that a proper slurry cannot be obtained if the emulsion at the stage of mixing is not of proper quality. This should be done by manufacturing, transporting and storing emulsions according to the Standard Specifications. Batch per mix should not exceed 0.1 m^3 to avoid delays in mixing and laying. When mixing is done on the existing road surfaces, there were difficulties in cleaning such surfaces for the application of tack coat, prior to carrying out slurry seal work. Therefore buckle plates should be used for mixing of slurry seal materials.

The problem of carrying out surface dressings in order to improve aged bituminous surfacing, repairing bitumen surfaces with fine cracks and correcting very small irregularities and depressions has been successfully solved by constructing slurry seals by manual methods. The rate per m^2 of slurry seal is about Rs. 85.00. If slurry sealing machines are used, this rate may be further reduced. When compared to rates per m^2 of Rs. 95.00 for Single Bituminous Surface Treatment (SBST) and sand seal and Rs. 135.00 for Double Bituminous Surface Treatment (DBST) and sand seal, slurry seals as surface dressings, would ultimately become a cost effective solution for such work.