Bitumen emulsion

About bitumen emulsions

A bitumen emulsion is a product in which bitumen globules are dispersed in chemically treated water. This emulsification of bitumen in water is a means of having bitumen (which is normally solid or semi-solid at ambient temperatures) behave as a fluid during its handling and application with only limited heating. Bitumen emulsions have been used in road construction for almost a century.

Since the 1950s their use in road construction increased sharply as a result of extensive road building programmes and the demands of higher traffic loads and volumes. This accelerated use increased further in the early 1970s when the energy crisis prompted energy conservation measures, as the application of emulsions requires less heating and thus consumes less energy.

The popularity and use of bitumen emulsions in southern Africa has grown significantly over the past two decades, and recent figures show that this product makes up 40% of all locally produced bituminous road products.

Bitumen emulsion may be sprayed at an accurately controlled rate onto a road surface before the application of gravel to improve surface condition and skid resistance.

Properties and applications

Emulsions have some advantages over conventional bitumen, e.g.:

- damp aggregates may be used in chip sealing when applying bitumen emulsions as a binder;
- no pre-coating of the stone chips is required;
- emulsions can be sprayed at lower temperatures and under conditions of lower ambient temperatures resulting in significant energy savings and minimal greenhouse gas emissions;
- emulsions are suitable for handwork as generally no heating is required for these types of operations.

Bitumen particles in emulsions can either be negatively charged (anionic emulsion) or positively charged (cationic emulsion). This type of formulation enables the use of emulsion with all aggregate types encountered in southern Africa through the judicious use of the correct emulsion class in conjunction with available aggregates.

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Classification of bitumen emulsions

Road emulsions are further classified according to their stability when in contact with aggregates, and bitumen content. Four main grades - spray, premix, stable mix and quick setting - are produced. In addition to the above grades, modified emulsions are available for specialised applications such as crack sealing, chip seals on slightly cracked surfaces, rut filling and rapid-setting microsurfacing overlays.

With the current emphasis on conservation of diminishing resources such as good quality aggregate and energy required for heating bitumen, great success has been achieved in stabilising gravels and reclaimed road pavement layers with small quantities of bitumen emulsion for the construction of base layers. This often supports the use of local or *in situ* material, eliminating the need to transport suitable base course material over long distances.

Used to build durable base layers, this process, known as bitumen emulsion stabilised materials (BESM) offers the following advantages:

- increased strength of base layers with improved resistance to deformation (rutting), resulting in extended lifespan;
- construction time and cost is reduced because compaction requires less effort and the need for applying a prime coat is eliminated;
- prior to receiving its wearing course, the BESM layer can carry construction and other traffic for extended periods, reducing disruption to construction or public traffic flow;
- reduced loss of strength arising from moisture in the layer;
- reduced development of potholes in the base when the surfacing layer is damaged;
- savings in fuel required for heating as emulsions are used at ambient temperatures.

Known as the "cold in-place bitumen emulsion recycling train", the arrangement above consists of a water tanker and bitumen emulsion tanker followed by a milling/mixing/paving combination. As the train moves forward bitumen emulsion stabilised material, using reclaimed asphalt milled from the pavement being repaired, is manufactured and paved simultaneously.

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