

COLD MIXED EMULSION ASPHALT (CMEA)

INTRODUCTION

Cold Mixed Emulsion Asphalt (CMEA) provides an alternative to Hot Mixed Asphalts (HMA) and slurry for surface shape correction and is particularly suited to remote locations.

COMPARING CMEA AND HMA PROPERTIES

CMEA

- Is produced using unheated crushed aggregates and bitumen emulsion at 70°C or less
- Usually remains workable for a much longer period, depending on the setting time of the bitumen emulsion, however for practical purposes it is compacted as per other open graded products
- Sets quicker as ambient temperature increases but takes longer than HMA to set
- Material used for paving can be stockpiled 2 to 3 days prior to use.

HMA

- Mixed at about 170°C
- Relatively short working time whilst it cools to about 110°C
- Sets quicker as ambient temperature decreases

COMPONENTS

Aggregates

The aggregates for CMEA are similar to those used for HMA except that sand aggregates may not be required depending on whether there are any deficiencies in the grading of crushed aggregates. The mix has a more open graded aggregate structure to allow the emulsion binder to cure more rapidly in the presence of air thus lessening the time before the mix becomes stable under trafficking. It is also more workable and produces a higher level of surface texture than HMA.

Typical gradings for Size 7 and Size 10 CMEA are shown in Table A.

The quality of source rock is specified in VicRoads Standard Specification 801 and is the same as for HMA.

Table A – Aggregate Grading

Sieve Size (mm)	Size 7	Size 10
	% Passing by Mass	% Passing by Mass
13.2	100	100
9.5	100	90-100
6.7	85-100	30-75
4.75	30-70	20-55
2.36	10-40	5-30
1.18	0-20	0-10
0.600	0-10	-
0.300	-	-
0.15	-	-
0.075	0-4	0-4

Binder

The bitumen emulsion used is generally a “high float” anionic bitumen emulsion with a bitumen content of 65 - 70%. “High float” emulsion is usually manufactured from C170 binder with additives that make the residual binder more tolerant over a range of in-service temperatures and provides a thick coating of binder to the aggregates without excessive binder drain off.

Mix Design

There are no formal mix design procedures for CMEA. Mix designs are based on “recipes” that were developed by field trials and experience in the United States. The residual binder content generally varies from 4% to 5% by mass for size 7 mixes and 3.5% to 4.5% for size 10 mixes.

MIXING AND PLACEMENT

CMEA is usually mixed in a pug mill batch type plant which may either be located at a permanent central location but more often a mobile plant is established at the paving site for reasons of economy and flexibility especially in remote areas. For a mobile operation, aggregates are stockpiled at the site and the emulsion is stored in portable storage tanks or road tankers.

CMEA requires a tack coat of cationic emulsion which may be applied slightly heavier than that for HMA because of the lack of heat softening of the underlying bituminous

surfacing. The tack coat application rate is similar to that used for Open Graded HMA. For large jobs, CMEA is usually placed with a conventional asphalt paver with similar compaction equipment to that used for HMA. For small isolated jobs, CMEA can be placed with a grader, drag spreader or leveling bar.

A special edge distributor/leveler, has been developed to repair edge breaks or provide a thick edge adjacent to the surface to reduce the incidence of further edge breaks.



Figure 1: Edge distributor/leveler

To prevent pick up of the heavily coated aggregate from the surface in hot weather immediately after placement, a light application of grit is applied to the surface. Use of sand or quarry fines also assists in sealing off the surface and reducing the permeability.

At this stage, assessment of compaction can only be made on a procedural basis similar to that used for Open Graded HMA. Taking of cores in CMEA, either to measure the density or to set nuclear gauge offsets immediately after placement, is not possible because the thin cores tend to disintegrate upon extraction.

SURFACE SHAPE CORRECTION OVERLAYS

Ride Quality

Research work undertaken by VicRoads in 2003 (R&D Project 857) showed that application of CMEA placed with conventional asphalt paving equipment gave an improvement to ride quality (reduction in initial roughness) of approximately 40% with a single 30 - 40mm thick layer. Similar results were achieved on trials undertaken in South Australia from 1995 to 1997 (Neaylan et al - 1997).

The improvement to ride quality should be similar to that achieved with HMA if normal HMA paving practices are used. The formula given in the Guide Notes to VicRoads Standard Specification Section 180 can be used to estimate the improvement to ride quality that should be achieved.

Rut Filling

CMEA can be used to fill wheel ruts (deformation) particularly for lower trafficked rural pavements. If a seal is to be placed within a few weeks, the minimum layer thickness can be as low as 1.5 times the nominal size of the mix. However if the seal is to be delayed for several months or years (not recommended), the minimum thickness of the layer should not be less than 2.5 times the nominal size of the mix.

Restoration of Surface Texture

There are many existing sprayed sealed surfaces where surface texture is non-uniform due to extensive patching and/or flushed areas making it almost impossible to avoid reflection of flushed areas through a reseal. As CMEA is an open graded mix, application of a CMEA regulation layer of 20–30 mm thick produces a uniform surface with a high level of surface texture on which to apply a sprayed seal treatment. The risk of unwanted flushing of the reseal is almost eliminated if good sealing practice is employed.

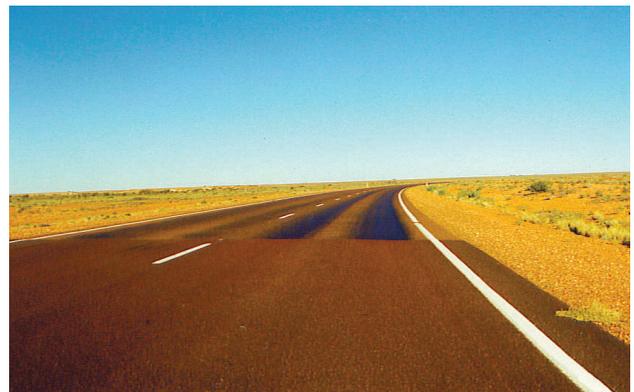


Figure 2: Restoration of flushed surface on Cunningham Highway, Queensland.

LIMITATIONS OF CMEA

Surfacing Scuffing and Ravelling

Unlike dense graded HMA which achieves its full strength on cooling, CMEA has a relatively slow setting time varying from a few hours to 1-2 days depending on weather conditions. CMEA that has not fully set is prone to scuffing or ravelling under vehicle turning movements and therefore should not be applied to intersections and roundabouts.

Permeability

As CMEA has an open graded aggregate structure it is quite permeable and will not prevent water entering cracks in the pavement below. Consistent with all other types of open graded mixes, CMEA is not as durable as dense graded mixes because constant exposure to air and water within the mix causes the binder near the surface to oxidise more rapidly and become brittle. It is therefore desirable to reseal the CMEA to maximise the overall service life of the

treatment. To achieve full compaction, it is desirable that CMEA receives at least 1 - 6 months of trafficking prior to sealing, depending on the time of year it is placed.

Resealing

If site conditions require waterproofing (eg cracked pavement) during the early trafficking stage, a temporary size 5 or 7 emulsion “void filling” seal can be applied at the base rate of application until the final seal is applied.

If a temporary light emulsion seal or sand or quarry fines are not applied, there is a risk that a size 10 or 14 seal could have some stripping as a result of absorption of the binder in to the surface of the CMEA. To minimise this possibility, the rate of binder application needs to be either increased to allow for absorption or alternatively, by applying a High Strength Seal (HSS) or Stress Alleviating Membrane (SAM) seal. Polymer modified binders used in these treatments are more viscous and less likely to penetrate the surface and are applied at a higher rate of application than conventional binder.

Pavement Investigation

As with any asphalt surfacing, CMEA is not as flexible as a sprayed seal and a pavement investigation should be undertaken to confirm the soundness of the pavement prior to its placement. The investigation may show that it is necessary to patch or strengthen weak areas of pavement prior to overlay. If the pavement is cracked or lacks sufficient stiffness for the traffic loading to prevent inducement of flexural cracking, a SAM or geotextile reinforced seal should be applied over the CMEA overlay to prevent cracks propagating to the surface prematurely.

REFERENCES

- VicRoads Standard Specifications for Road and Bridgeworks
- VicRoads R&D Report No 857 (Favaloro & Gresik): “Evaluation of Cold Asphalt for Roughness Regulation” (Dec 2003)
- Queensland Department of Main Roads (Wellauer): “Koltec” Overlay Performance Study (June 2004)
- VicRoads Guide Notes to Standard Specification Section 180: Ride Quality for Pavements
- Department of Transport South Australia (Neaylan, Horner & Armstrong): “Cold Open Grade Asphalt Use in South Australia” (AAPA Conference Proceedings: Perth 1997)

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