LBS ASPHALT

Labour Intensive Road Surfacing




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LBS ASPHALT SURFACING

Section 1

1.1 Introduction

The aim of this manual is to provide road authorities, engineers, skills development consultants or contractors involved in the labour-based construction of LBS Asphalt surfacing *(picture 1)* with a detailed description of the materials, plant and equipment required together with the processes involved in the correct manufacture and application of the product.

Picture 1 - Lbs Asphalt surfacing

After studying this unit, you should be able to;

- Understand what LBS Asphalt is and understand in which situation it can be best applied.
- Know the materials required to manufacture the LBS Asphalt mix.
- Understand how to manufacture and apply this road surfacing technology.
- Know and plan the use of equipment, plant, and labour required to complete the application of LBS Asphalt.

1.2 Description

Asphalt mixes may be designed and produced from many different aggregate types, a wide range of aggregate size combinations and various bitumen binder types. Each mix has its own particular properties which make it suitable for specific conditions of use. *(Picture 2)*

Picture 2 - Asphalt Core

LBS Asphalt is a fine/medium continuously graded asphalt blend that offers high resistance to deformation and a high density from the interlocking aggregate matrix. LBS Asphalt complies with TRH8 strength and volumetric requirements for asphalt wearing course and provides a .durable all weather maintenance free surfacing. LBS Asphalt is ideally suited to labour intensive construction projects with no specialised equipment being required.

The manufacture of the LBS Asphalt mix consists of one or two sizes of aggregate stone, 9.5, 6.7mm, crusher sand, LBS Asphalt fillers and bitumen emulsion.

LBS Asphalt provides minimal disruption to traffic, roads can be opened to light traffic within a few hours after compaction, higher trafficked areas can be opened within 12 hours. No heating is required during the preparation or application of the LBS mix and the product is self-tacking in certain scenarios (i.e. no tack coat required).

LBS Asphalt has also been designed to be environmentally friendly.

1.3 Manufacture

LBS Asphalt Mix manufacturing options - in situ mix & place vs off-site batch mixing

The LBS Asphalt can be blended either as an in-situ mix & place on the road that is to be surfaced or alternatively as a batch production in a dedicated location within the contractors camp close to the construction site.

1.3.1 In-situ mix & place

The in-situ mix and place option is suitable for rural sites outside of urban or residential areas and can eliminate the need to transport the final asphalt blend to the road. *(Picture 3)*The use of an in-situ mix and place will require the careful co-ordination of aggregate delivery and water along the road length to be surfaced to ensure availability of materials in the correct proportions required. Care must be taken to ensure that distance between stockpiles is kept to a minimum to avoid delays. Materials can be deposited on the road base to avoid unnecessary wastage.

Picture 3 - In-situ mix and place

1.3.2 Off-site batch mixing

If possible the option of off-site batch mixing should be considered especially in urban or residential areas. *(Picture 4)* Off-site batch mixing will allow for easier control of stock and quality as well as eliminate material wastages. Materials can be delivered to a single point without the need for lengthy transport via a wheel barrow. Water for manufacture is also then located centrally. The off-site batch mixing will require the transport of the final asphalt mix to the road area to be surfaced.

Picture 4 - Off-site batch mixing

1.4 Materials

The materials required for the construction of the LBS Asphalt seal are: *(picture 5)*

1.4.1 Bitumen

Bituminous binder in the form of Anionic Stable grade emulsion (60%) conforming to (SABS 309) in 200 Litre drums.

PHYSICAL AND CHEMICAL PROPERTIES	Min	Max
Appearance - brown		
Viscosity at 50°C, Saybolt Furol seconds, max.	-	-
Binder content, % (m/m)	60	62
Residue on sieving, g/100 ml	-	0,25
Sedimentation after 60 complete rotations	-	Nil
Coagulation value, % (m/m)		
Dolerite chippings	-	-
Portland cement	-	2

1.4.2 Aggregate

Crusher sand and stone aggregate in the form of 6,7mm and 9,5mm Road Stone of the specified grading obtained from a commercial source or quarry.

Picture 5 - Materials

Aggregate Grading

Sieve Size (mm)	Nominal size of stone (Percentage passing sieve)		
	9.5 mm	6.7 mm	Crusher Sand
13.2	100	-	-
9.5	85 —100	100	-
6.7	0 — 30	85 —100	-
4.75	0 — 5	0 — 30	90 —100
2.36	-	0 — 5	-
0.15	-	-	0 — 20
0.075	-	-	0 — 10
Physical properties			
ACV		21% Max	
Polished stone value		(min) 50	
Flakiness index		(max) 30	

1.4.3 LBS Filler

LBS filler as supplied by the supplier in 30kg bags. *(picture 6)*

Picture 6 - LBS Filler

1.4.4 Water

Water shall be of potable quality or approved for use by the engineer.

1.5 Tools and Equipment

The individual quantities of each item will need to be determined by the size of the construction team and daily production rate required by the project. An example of equipment requirements is detailed below.

1.5.1 LBS Asphalt Production

Measuring containers (25ℓ buckets)	Hard brooms
Wheel barrows	Metal rakes
Spades	Bag of rags
Watering cans (with rose)	Paint scraper

1.5.2 LBS Asphalt application

Measuring wheel e.g. Rotowheel	Pedestrian roller e.g. Bomag 60/75
50m tape measure	1000ℓ water tank (or open top drums)
Pliers	Drum stand – *provided by LBS Supplier*
Hammers	Drum tap – *provided by LBS Supplier*
Kg bag 4" nails (concrete)	Drum key – *provided by LBS Supplier*
Fish Line	Hand stamper
Spirit level	Bucket
25/30mm angle iron (5mm thick)	Builders brush
4m levelling bar	Trowel

1.5.3 Labour requirements

A team of 14 people is capable of manufacturing approximately 15 metric tons of asphalt pre-mix per day however the labour requirements will be determined by the production rate required and can be increased or decreased according to project needs.

See 3.1 below

1.6 Fine continuously graded asphalt

Product uses - Sidewalks and cycle tracks and thin overlays to lightly trafficked areas, and is constructed to a nominal 20mm final asphalt thickness. *(picture 7)*

Picture 7 - Fine continuously graded asphalt suitable for sidewalks

1.6.1 Materials

The manufacture of a LBS Fine continuously graded blend will require;

Material	% of total	Mass (kg)
LBS Filler	20	30
Crusher sand	50	75
6.7mm Roadstone	21	31.5
Bitumen emulsion	9	13.5
Total:	**100**	**150**

Note: *The final mix proportions may vary depending on the actual properties of the individual aggregate components from the typical mix proportions mentioned in the above table.*

(for material speciation's refer to '1.4' above)

1.6.2 Tools & Equipment

For tools and equipment refer to refer to '1.5' above. Angle iron required for the thickness guides for a 20mm fine continuously graded LBS final asphalt layer will be 25mm.

1.6.3 Labour requirements

To surface approximately 350m^2 per day a team of ten (10) people is recommended however the labour requirements will be determined by the production rate required and can be increased or decreased according to the production rate required. *See 3.1 below*

1.7 Medium continuously graded asphalt

Product uses – surfacing of new roads, overlays, parking areas, pothole patching and repair work. LBS Medium continuously graded asphalt is constructed to a nominal 25mm final asphalt thickness for general surfacing and overlays and 30mm for pothole patching and repair work. *(picture 8)*

Picture 8 - Medium continuously graded asphalt suitable for road surfacing

1.7.1 Materials

The manufacture of a LBS medium continuously graded blend will require;

Material	% of total	Mass (kg)
LBS Filler	20	30
Crusher sand	50	75
6.7mm Roadstone	8	12
9.5mm Roadstone	12	18
Bitumen emulsion	9	15
Total:	**100**	**150**

Note: *The final mix proportions may vary depending on the actual properties of the individual aggregate components from the typical mix proportions mentioned in the above table.*

(for material speciation's refer to '1.4' above)

1.7.2 Tools &Equipment

For tools and equipment refer to refer to '1.5' above. Angle iron required for the thickness guides for a 25mm fine continuously graded LBS asphalt final layer will be 30mm.

1.7.3 Labour requirements

To surface approximately 300m^2 per day a team of ten (10) people is recommended however the labour requirements will be determined by the production rate required and can be increased or decreased according to the production rate required. *See 3.1 below*

1.8 Slurry

Product uses – LBS slurry is applied to existing surfaces that are still in fair to good condition and do not exhibit signs of fatigue cracking, as a means of a cost effective preventative maintenance. The application of LBS slurry will correct ravelling of aged bituminous seals, prevent further oxidation and improve skid resistance. *(picture 9)*

Picture 9 - LBS Slurry

1.8.1 Materials

The manufacture of a the LBS Slurry blend will require;

Material	% of total	Mass (kg)
LBS Filler	20	30
Crusher sand	69	103.5
Bitumen emulsion	9	15
Cement	1	1.5
Total:	**100**	**150**

Note: *The final mix proportions may vary depending on the actual properties of the individual aggregate components from the typical mix proportions mentioned in the above table.*

(for material speciation's refer to '1.4' above)

1.8.2 Tools &Equipment

For tools and equipment refer to refer to '1.5' above

- Angle iron for thickness guides is substituted with 6 – 10mm rope dependant on the final slurry layer required.
- Rubber squeegees will also be required for the spreading of the slurry.
- No pedestrian roller is required for the application of the slurry.

1.8.3 Labour requirements

To surface approximately 480m^2 per day a team of four (4) people is recommended however the labour requirements will be determined by the production rate required and can be increased or decreased according to the production rate required. *See 3.1 below (picture 10)*

Picture 10 - A typical team size required to manufacture and surface roads with LBS Asphalt

Section 2 – LBS Asphalt method statement

2.1 Road surfacing, overlay or slurry *(picture 11)*

2.1.1 LBS product preparation (fine and medium continuously graded asphalt)

- Adjust the size of the 25 litre buckets to hold the correct volumes of crusher sand, roadstone & bitumen emulsion for the LBS mix for the product to be manufactured.
- Place the required quantity of crusher sand and roadstone next to each bag of LBS filler in the designated manufacture area.
- For in-situ mix and place set the bags of LBS filler at the required intervals along the length of the surface to be sealed. The intervals will be indicated by the site foreman according to the width of the area to be surfaced and final asphalt thickness. Intervals are generally between 1 – 1.2 metres. . It is generally recommended to alternate the mixes each side of the half width centreline to allow sufficient space for mixing.
- Mix the crusher sand, roadstone and LBS filler thoroughly adjusting the moisture if required. Once a consistent colour is achieved the mixing is complete. Take note the correct moisture is indicated by the stone component of the mix being damp or coated with water to break surface tension in preparation for coating by the bitumen emulsion. Once this is achieved the pile can be opened for adding the bitumen emulsion.
- Add the required quantity of bitumen emulsion to each opened stockpile and mix thoroughly adjusting the moisture content with clean water to achieve the correct consistency. *(picture 13)* Mixes that are too wet can be blended with dryer stock piles to correct moisture levels and again achieve the correct consistency. The correct consistency is indicated by a loose granular mix where all the stone aggregate is well coated by bitumen and fines.
- If the prepared mix is not to be placed immediately, cover with the empty bag and/or water lightly.
- If an off-site batch mixing process is being followed the same mixing procedures as above are used with the prepared premix being either bagged for storage or delivered directly to the road area to be surfaced in bulk keeping the premix covered to prevent loss of moisture.

Picture 11 - Road surfacing

2.1.2 LBS product preparation (Slurry)

In Situ mix and place *(picture 12)*

- Adjust the size of the 25 litre buckets to hold the correct volumes of crusher sand, bitumen emulsion and cement for the LBS slurry mix. The quantity of cement per mix = 1% of the weight of final mix (approx. 1.5kg)
- Place the bags of LBS filler at the required intervals along the length of the section to be slurried. The intervals will be indicated by the site foreman according to the area to be surfaced. One mix @6mm thickness should cover approximately 12m2

Picture 12 - In-situ preparation

- Once measured out correctly place the required quantity of crusher sand next to each bag of LBS filler.
- Mix the crusher sand, LBS filler and cement thoroughly then adjust the moisture if required. Once a consistent colour is achieved the mixing is complete. Take note -The correct moisture is indicated by the sand component of the mix being damp or coated with water to break surface tension in preparation for coating by the bitumen emulsion. Once this is achieved the pile can be opened for adding the bitumen emulsion.
- Add the required quantity of bitumen emulsion to the opened stockpile and mix thoroughly adjusting the moisture content with sufficient clean water to achieve the correct consistency. The correct consistency is indicated by a very loose granular mix where all the crusher sand is well coated by bitumen and the mix can be easily spread using a squeegee . *(picture 13)*

Picture 13 - Blending the bitumen with aggregate and LBS Filler

Off-site mix batching

- Follow the same procedures as above with 2 exceptions –
- The consistency of the mix (Reduce the quantity of water substantially as this will only be required to be added once the pre-mix is correctly positioned on site.
- Do not add the 1% cement. The cement must only be added once the premix has been positioned on site. Mix the cement with water and add it to the mix at the same time as the additional water is added in order to ensure that the cement is evenly distributed throughout the mix.

2.2 General Surfacing Specification – LBS Asphalt

The specification will call for the construction of a labour intensive on site manufactured or in-situ mix and place cold asphalt of specified thickness (e.g. 25mm), constructed in accordance with the relevant specifications referred to in the scope of work in the contract documents.

2.2.1 Materials

Refer to 1.6, 1.7 and 1.8 above for the specific product being manufactured

2.2.3 Construction plant and equipment

Refer to 1.5 above

2.2.4 Construction

The general preparation and construction of the LBS Asphalt surfacing will require the careful operation and co-ordination of the labour force.

2.2.5 Requirements of the road surface or base layer

The application of LBS asphalt for general road surfacing or overlay or slurry will require the base layer to be constructed to the required project specification and or suitable for the placement of a permanent seal. An existing road surface to be overlaid should be free of any surface defects with the correction of any base failures where required.

2.2.6 General Operations of the labour force

The following example is of the labour requirements and equipment required for a daily production rate of 250 – 350m^2 per day.

Example: 350m^2 LBS Asphalt laid per day	
EQUIPMENT REQUIREMENTS *(excluding spares in case of breakages and all relevant safety signs and devices)*	
6 × wheel barrows 12 × spades 8 × hard brooms 3 × metal road rakes 1 × 4 m leve (straight edge) 8 × thickness guides (30 mm angle iron × 6 m long) 1 × pedestrian roller	1 × drum stand *(provided by LBS Supplier)* 1 × drum tap *(provided by LBS Supplier)* 6 × 25 Litre buckets *(provided by LBS Supplier)* 8 × watering cans 2 × hammer (plus 6" nails and fish line) 1 × 500 -1000ℓ water tank
LABOUR REQUIREMENTS	
Supervision Asphalt manufacture Asphalt application	Site foreman / Supervisor x 1 x 14 Labourers X10 Labourers
(The supervisor will oversee the manufacture and application of the LBS Product)	

Duties and responsibilities

2.2.6 (a) Site Foreman's Duties

- The site construction foremen will be responsible for the coordination of the various tasks and teams. *(picture 14)*
- Ensuring that all construction plant and equipment is available and in working order at the beginning of each work day and is cleaned and securely stored at the conclusion of the day's work.
- Establishing that the materials including water required to complete the days surfacing task are available on site in sufficient quantity at the asphalt mixing area or positioned correctly alongside the area to be surfaced for in-situ mix and place applications.
- Identify the day's area to surfaced, instruct the team assigned to set the guide rails, and mark the position for placement of the 30kgLBS filler bags for in-situ mixing or placement of the asphalt pre mixed.
- Keeping record of the quantity of LBS filler bags and emulsion drums consumed the total quantity of asphalt or slurry mixes completed and the area surfaced on a daily basis.
- Liaise with the community liaison officer regarding all labour issues.
- Keeping the site clean and in good order.

Picture 14 - Site foreman duties

2.2.6 (b) Road preparation teams duties

- The team assigned to set out the area to be surfaced is responsible for identifying and demarcating the as asphalt seal limits and placing the required guide rails.

2.2.6 (c) Wheelbarrow operator's duties *(picture 15)*

- They are required to deliver the 30kg bags of LBS filler to the designated area or marked positions on the road.
- They must use the supplied buckets to measure the required aggregates and deliver them to the designated area or marked positions on the road in the correct proportions.

Picture 15 - Wheel barrow operator duties

2.2.6 (d) Mixing teams duties *(picture 16)*

- The labourers assigned to mixing must ensure that the mixing surface is swept clean and is free of any loose material.
- They must ensure that the bitumen emulsion is correctly dispensed using the allocated container.
- They must mix the aggregate and bitumen emulsion according to the prescribed procedure.
- They are responsible for ensuring water is available for the asphalt mixing process.

Picture 16 - Mixing team duties

2.2.6 (e) Spreading and levelling team duties *(picture 17)*

- The spreading team and levelling team are responsible for placing the final asphalt mix within the set out guide rails to the minimum un-compacted thickness prescribed.
- The spreading team must also collect any un-used or waste asphalt from outside the thickness rails as a result of the spreading and levelling and incorporate this to minimise wastage.

Picture 17 - Spreading and levelling

2.2.6 (f) Pedestrian roller operator's duties *(picture 18)*

- The pedestrian roller must be checked for fuel and oil before works starts.
- The operator must instruct his assistant on the application of water to the roller wheels and surface of the spread asphalt mix as required to assist the compaction process.
- The pedestrian roller drums must be cleaned with water after each use to prevent the emulsion drying and bitumen building up on the roller drums.

Picture 18 - Roller operator duties

Surfacing procedures

2.2.6 (g) Preparation of the surface of the road base *(picture 19)*

- The base of the road to which the LBS Asphalt is to be applied should be firm and well compacted.
- Sweep the road clean and remove all loose material present. Any base defects should be noted and corrected before proceeding.
- Measure out the area to be surfaced and mark the edge and centre of the road with nails and fish line.
- Any areas where the prime or tack coat is missing can be lightly sprayed with a diluted 1:6 bitumen emulsion mixture (1 litre emulsion to six litres of water).

Picture 19 - Surface preparation team duties

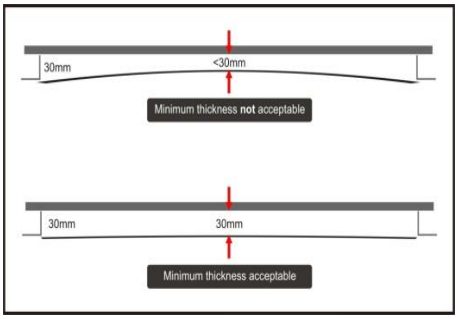
2.2.6 (h) Setting out the area to be surfaced*(picture 20)*

- Determine and mark the road centreline with nails at 6 metre intervals and place the fishline.
- Place the thickness guides along one edge and centre line using the fish line set out for guidance and secure with nails. Use the straight edge to check for a minimum clearance of 30mm and remove any isolated high spots. Isolated low spots can be corrected with extra asphalt to maximum 20mm. If a minimum of 30mm is not achieved over the road length due to camber then correct this with the inclusion of a centre guide placed at quarter width.

Picture 20 - Setting out the area to be surfaced

2.2.6 (i) LBS Asphalt product application

- Lightly water the base sweeping off any free standing water. *(picture 15)*
- Spread the prepared LBS mix and level to the required thickness using the back of the metal rakes so as not to separate the aggregates.
- Check to ensure that the minimum thickness of the loose levelled material is achieved and if not then place a centre guide to maintain minimum levels. *(picture 21)*
- Lightly apply water to the surface of the levelled LBS mix if necessary.
- Compact the area by roller with 2 – 4 passes with vibration. Water the drums of the roller lightly to assist with sticking of material if required.
- Roll the area again with two to three passes without vibration again lightly watering the roller drums if required.
- Once the surface becomes saturated with brown liquid sufficient water and compaction has been applied.
- Any faults or defects that occur can be corrected during the compaction process by adding additional asphalt mix and applying water lightly and rolling.
- Remove the angle iron shutter from the road edge and use the hand tamper, builders bucket with water and block brush to round off the asphalt edging. *(picture 22)*



Picture 21 – Minimum thickness

Picture 22 - Finishing the edges

2.2.6 (j) Finishing off of the completed asphalt seal

- To finish the completed LBS asphalt seal lightly apply water and roll the section the following day without vibration until a smooth consistent surface is achieved. *(picture 23)*
- The surfaced area can be opened to slow moving traffic if required.

Picture 23 - Finishing the completed asphalt seal

2.2.6 (k) Construction of the second half width of the road

- Place the angle iron shutter on the seal edge determined and marked as described "2.2.6 (h) above".
- Proceed with the application of the LBS asphalt as described in "2.2.6 (i)" above. *(picture 24)*
- If the centre angle iron shutter has been removed ensure that the asphalt edge is still at 90° and if not cut to 90° with a spade. Place a 10mm square rod on top of the compacted asphalt layer to compensate and allow for proper loose levelling to take place.
- If the angle iron shutter is still in place than proceed as normal and remove once levelling is complete. Fill the gap left by the removal of the angle iron shutter with asphalt mix prior to compaction.

Picture 24 - Construction of the second half

2.2.6 (l) Joining

- To join sections of LBS asphalt ensure that the edge is cut to 90 and is a minimum of 25mm thick. Take note that the roller will spread the end of the compacted area to less than 25mm.
- Ensure that the loose asphalt mix is placed to the join and use a broom to adjust the line to ensure a seamless transition. *(picture 25)*

Picture 25 - Joining

2.2.6 (m) Correcting defects to the final surfacing

- Any defects to the surface of the completed LBS asphalt seal should be corrected by following the "Pothole Repair Procedure" as set out in the "2.3 below". *(picture 26)*
- For areas where the surface of the completed asphalt appears loose and friable a LBS slurry mix can be applied to enrich and bind the surface.

Picture 26 - Correcting

2.3 General Surfacing Specification – LBS Slurry

The specification will call for the application of a labour intensive on site manufactured slurry of specified thickness (e.g. 6mm), constructed in accordance with the relevant specifications referred to in the scope of work in the contract documents. *(picture 27)*

2.3.1 Materials

Refer to 1.8.1 above.

2.3.2 Construction plant and equipment

Refer to 1.8.2 above.

Note: No pedestrian roller is required for the application of the LBS Slurry.

2.3.3 Construction

The general preparation and construction of the LBS slurry will require the careful operation and co-ordination of the labour force.

2.3.4 Requirements of the road surface or base layer

The application of LBS Slurry will require the existing road surface to be suitable for the placement of a slurry mix. The road surface should be free of any major surface defects with the correction of any base irregularities where necessary.

2.3.5 General Operations of the labour force

2.3.5 (a) Site Foreman's Duties

- Refer to 2.1.6a above.

2.3.5 (b) Setting out teams duties

- The team assigned to set out the area to be surfaced is responsible for identifying and demarcating the slurry seal limits and placing the required guide ropes.

2.3.5 (c) Wheelbarrow operator's duties

- They are required to deliver the 30kg bags of LBS filler to the designated area or marked positions on the road. *(picture 28)*
- They must use the supplied buckets to measure the required aggregates and deliver them to the designated area or marked positions on the road in the correct proportions.
- If an off-site batching facility is being used the pre-mixed slurry must be delivered to the marked positions on the road in the correct quantity.

2.3.5 (d) Mixing teams duties

- The labourers assigned to mixing must ensure that the mixing surface is swept clean and is free of any loose material.
- They must ensure that the bitumen emulsion is correctly dispensed using the allocated container.
- They must mix the LBS filler, aggregate, cement and bitumen emulsion according to the prescribed procedure. *(picture 29)*
- They are responsible for ensuring water is available for the final slurry mixing process.
- If an off-site batching facility is being used to pre-mix the slurry, the 1% cement component must only be blended with the mix when the required additional water is added to the mix.
- The consistency of the final slurry mix must be saturated enough for the mix to be easily spread with the squeegees.

2.3.5 (e) Spreading and levelling team duties

- The spreading team and levelling team are responsible for placing the final slurry mix within the set out guide ropes to the required thickness prescribed.
- The spreading team must also collect any un-used or waste slurry from outside the thickness ropes as a result of the spreading and levelling and incorporate this to minimise wastage.

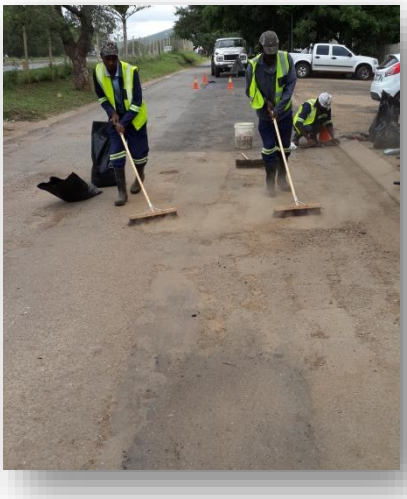
Picture 27 - Applying a slurry

Picture 28 - Wheel barrow operator duties

Picture 29 - Mixing a slurry

2.3.5 (f) Preparation of the surface of the road base

- Sweep the road clean and remove all loose material present. Any base defects should be noted and corrected before proceeding. *(picture 30)*
- Measure out the area to be surfaced and mark the edges area to be slurryed.
- Any areas where the prime or tack coat is missing can be lightly sprayed with a diluted 1:6 bitumen emulsion mixture (1 litre emulsion to six litres of water).



Picture 30 - Preparation of the road surface

2.3.5 (g) Setting out the area to be surfaced

- Place the thickness ropes along one edge and centre line as marked and secure with nails.

2.3.5 (h) LBS Slurry product application

- Lightly water the base sweeping off any free standing water.
- Spread the prepared LBS slurry mix and level to the required thickness using rubber Squeegees. *(picture 31)*
- Check to ensure that the minimum thickness is achieved and if not then place a centre guide to maintain minimum levels.
- Remove the Guide ropes from the surfaced edge.

2.3.5 (i) Finishing off of the completed slurry

- To finish the completed LBS slurry texture with a hard broom or wet hessian rag.
- The surfaced area can be opened to slow moving traffic if required.

Picture 31 - Spreading a slurry mix

2.4 Pothole patching and repair

The specification will call for the repair of defects or distressed areas to existing permanently surfaced roads with the use of an on-site manufactured labour based cold asphalt. *(picture 32)*

Picture 32 - Pothole repair

2.4.1 Materials and LBS Product preparation

The material requirements and preparation of the LBS Asphalt for pothole repair and road patching will follow 1.7 above for a "Medium continuously graded asphalt".

2.4.2 Construction plant and equipment

A mechanised concrete saw can be used in addition the required equipment's 1.5 above.

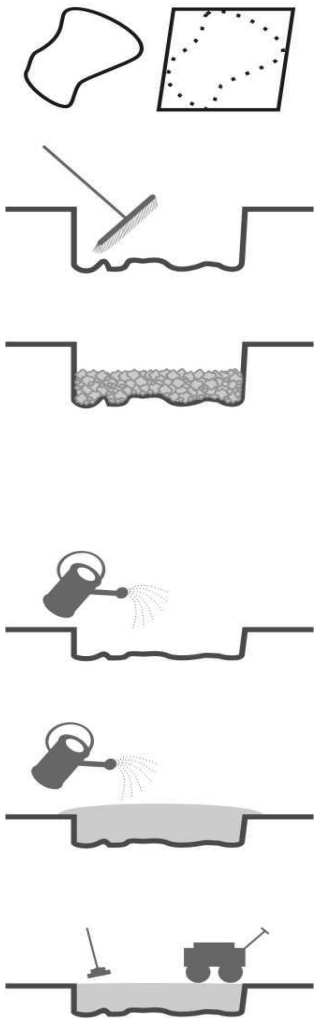
2.4.3 Construction *(picture 33)*

Preparation

- Identify and clearly mark the edges of the defect.
- The area or pothole should be squared off using a pick and spade or mechanical cutter.
- Ensure the base surface area of the pothole is firm, well compacted and free of loose material.
- For potholes deeper than 30 mm, fill with crusher run or equivalent suitable material to within 30 mm of the road surface and compact using a hand tamper or suitable mechanical compactor.
- If desired, the crusher run or fill material can be stabilised with cement.

2.4.3 LBS Product application

- Slightly dampen the surface and edges of the pothole with water or alternatively a prime or tack coat can be applied if specified or required.
- Place the prepared LBS Asphalt mix into the pothole allowing a 20 mm overlap to the edges of the pothole and a thickness of not less than 5 mm above the surface of the surrounding road.
- Level the LBS Asphalt evenly to ensure a smooth finish with good riding characteristics.
- Lightly apply water to the surface of the levelled LBS Asphalt mix.
- Compact the area using a hand tamper or with a suitable pedestrian roller (water the tamper/roller drums to help prevent material sticking to the drums).
- Once the surface is saturated with brown liquid, sufficient water and compaction has been applied.



Picture 33 - Pothole repair

Approximate LBS ASPHALT MIX Coverage Guide

Asphalt thickness (mm)	Un-compacted Asphalt thickness	LBS mix (kg/m^2)	m^2 per ton Asphalt
30	35	60	16
25	30	50	20
20	25	40	25

3 TECHNICAL INFORMATION

3.1 Production management

It is strongly recommended that projects incorporating the LBS asphalt technology be task based. The tables below will provide a task rate guideline for the manufacture of the asphalt and the various product applications.

PROCEDURE	RECOMMENDED TEAM SIZE	PRODUCTION PER PERSON PER DAY	TONNAGE	PRODUCTION PER TEAM PER DAY	TOTAL TONNAGE PER TEAM PER DAY
Manufacture	14	7 Mixes	1.05MT	98 Mixes	14.7 MT

PROCEDURE	RECOMMENDED TEAM SIZE	SQUARE METREAGE PER PERSON PER DAY	SQUARE METREAGE PER TEAM PER DAY	ASPHALT USEAGE PER SQUARE METRE	TOTAL TONNAGE ASPHALT USED PER DAY
Road surfacing (25mm)	10	30	300	50kg	15MT
Pothole repairs (30mm)	6	5	30	60kg	1.8MT
Slurry work (6mm)	4	120	480	12kg	5.76MT
Sidewalks (20mm)	10	35	350	40kg	14MT

3.2 Mix design procedure and testing requirements

3.2.1 Mix composition and grading

The typical LBS mix composition is as follows:

Typical LBS mix proportions

Material	% of total	Mass (kg)
LBS Filler	20	200
Crusher sand	50	500
Coarse aggregate	21	210
Bitumen emulsion	9	90
Total:	**100**	**1 000**

Note: The final specifications of the LBS Asphalt mix will have to comply with the requirements of TRH8 for a fine/medium continuously graded asphalt as follows. The final mix proportions will therefore depend on the actual grading's of the individual aggregate components and may therefore vary from the typical mix proportions mentioned in the above table.

Final LBS Asphalt grading envelope and nominal mix proportions

	Sieve Size (mm)	Continuously graded	
		medium	fine
CUMULATIVE PERCENTAGE BY MASS PASSING SIEVE	13200	100	-
	9500	82-100	100
	4750	54-75	64-88
	2360	38-57	46-70
	1180	27-42	35-54
	0.600	18-32	24-40
	0.300	13-23	16-28
	0.150	9-16	10-20
	0.075	4-10	4-12

NOMINAL MIX PROPORTIONS (BY MASS)		
Bituminous Binder	6.0%	

Test requirements for continuously-graded mixes*

Traffic Class*	E4		E3		E2		Test Methods
Property	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	
Marshall – Stability kN	8	18	7	15	4	10	TMH1;C2
Marshall – Flow mm	2	4	2	4	2	5	TMH1;C2
Stability / Flow	2.5	-	2	-	2	-	TMH1;C2
Creep Modulus @ 40°C Mpa	80	-	60	-	35	-	TMH1;C6T
Indirect Tensile Strength @ 25°C	800	-	800	-	800	-	ASTM
Air Voids %	3	6	3	6	2	5	TMH1;C3
Immersion Index	75	-	75	-	-	-	TMH1;C5

*Refer to table below

Traffic Class	Cumulative equivalent traffic (E80s/Lane)
E4	$12 – 50 \times 10^6$
E3	$3 – 12 \times 10^6$
E2	$0.8 – 3 \times 10^6$
E1	$0.2 – 0.8 \times 10^6$

4 RISK FACTORS

Operational Risk Factors

Various operational risk factors exist and are discussed below.

Construction and quality control

The production of the asphalt mix requires close control over quantities, mix proportions (i.e. aggregate, emulsion, LBS binder) and construction tolerances to achieve a mix with good performance. It is therefore required that provision be made on contracts for adequate on-site training of the labour force as well as strict site supervision by suitable personnel.

The following aspects require special attention during the construction phase:

It is strongly recommended that both a prime coat and tack coat be applied to the granular base layer prior to the application of the LBS Asphalt.

Material quality

The material components - i.e. aggregates, bitumen emulsion and LBS filler - required for the production of the LBS Asphalt must conform to the materials requirements as specified.

It is therefore important to make provision for adequate testing of materials during the construction phase of any potential labour intensive road works projects.

Control of mix proportions

The nominal mix proportions, as indicated above and confirmed during the design stage, must be implemented and will require close control and record keeping by site supervisory staff.

Containers used for proportioning of the mix components will have to be cut and/or marked to hold the correct volumes as indicated by the supplier, thus eliminating complicated measuring and ensuring the correct proportions are consistently mixed.

Level and thickness control can be achieved by placing thickness guides at pre-determined intervals along the road to be surfaced, thus ensuring that the required minimum asphalt thickness is placed (Post construction coring of the finished surfacing layer will determine whether the layer complies with the specified thickness requirements).

Compaction

The compacted asphalt layer must achieve one of the following density requirements:
Density as measured on recovered core equal to or greater than 97%, minus the percentage air voids in the approved production mix (nominal 5%); i.e. a minimum nominal density of 92%.

Density as measured on recovered core equal to or greater than 95% of the 75 blow Marshall Density of the approved production mix.

Curing and traffic accommodation

In order to achieve the optimum benefit from the finished surfacing it is recommended the LBS Asphalt be left to cure for a minimum of 12 to give the emulsion sufficient time to "break" and for the asphalt to gain strength. This will require the constructed section be closed to traffic during this time and traffic accommodation measure will have to be put in place; i.e. sufficient signage, delineators, barriers, flagmen etc.

Labour

Labour costs as a percentage of the total project cost is higher for labour intensive construction, it is imperative that the labour be employed productively. The following criteria should be met to achieve maximum productivity:

- Adequate financial reward must be set, preferably through an incentive scheme;
- The task to be performed must be of such a nature and carried out under such conditions that the workers can take pride in their work;
- The workers must be given training in the correct methods of doing their tasks;
- The workers needs in terms of nutritious food, adequate shelter and protective clothing must be met;
- Management must be good and the workers must feel it to be so.

Maintenance and Repair

Roads surfaced with LBS Asphalt typically display very little pavement distress within a 4–7 year period from construction.

Any localised pavement distress such as potholing and cracking can be repaired by applying pre-bagged cold-mix asphalt to the distressed area; after appropriate substrate preparation.

Depending on support and environmental conditions (i.e. climate, traffic, drainage, grey water etc.) it is generally recommended that low volume roads be resurfaced (using a similar surfacing) every 8 to 18 years (TRH4).

Health and Safety Risk Factors

All construction work must comply with the Occupational Health and Safety Act (Act No. 85 of 1993) and in particular with its Construction Regulations of 2003.

Contractors are therefore required to submit a detailed Health & Safety Plan prior to construction work commencing and requirements in this regard are generally detailed and complicated.

In order to mitigate the risks to the client regarding Health and Safety requirements, it is recommended that a generic Health and Safety plan for minor road construction and maintenance be compiled to assist emerging contractors in this regard.

Environmental Risk Factors

The environmental impacts caused by the use of LBS Asphalt are considered to be minimal. The standard Environmental Management Specification more than adequately covers what environmental controls need to be implemented by the contractor to safeguard the environment. This deals specifically with handling and storage of bituminous binders to negate their effects on the environment. Hazardous waste such as bitumen emulsion must be disposed of in a Department of Water Affairs and Forestry approved landfill site. Special care must be taken to avoid spillage of emulsion to avoid water-soluble phenols from entering the ground or contaminating water.

Under no circumstances must the spoiling of emulsion on site by burying be allowed. Unused or rejected emulsion must be returned to the supplier's production plant. No spillage of emulsion must be allowed on site and affected areas must be promptly reinstated.

LBS – LABOUR INTENSIVE ASPHALT COLTO SPECIFICATION

1 Scope

This specification covers the in-situ mixing and application of the fine continuously graded cold mix marketed as LBS Asphalt, designed as a Labour Intensive Asphalt laid to provide a nominal 25mm final asphalt seal.

2 Materials

(a) Bituminous binder

The specified bituminous binder used in the production of the LBS Asphalt is anionic stable grade bitumen emulsion containing a 60% net bitumen content and shall comply to SABS 309 specification.

(b) Aggregates

The aggregate for the LBS Asphalt shall be from an approved source and comply with COLTO requirement for a Grade 3 stone as specified in sub-clause 4302 (b)

(c) LBS Asphalt mix

The LBS Asphalt shall comprise of the following nominal proportions

Binder	60% anionic emulsion	9%
Filler	LBS Filler	20%
Sand	Crusher Dust	50%
Aggregate	6.7mm road stone	8%
	9.5mm road stone	13%

The combined grading of the aggregate mixture shall comply COLTO requirements for a fine continuously graded asphalt as defined in table 4202/7

3 Plant and Equipment

The following minimum equipment is required for the in-situ mixing and placement of the LBS Asphalt;

Equipment

1 × pedestrian vibratory asphalt roller e.g. Bomag 60/75
1 × 1000ℓ water tank (or open top drums)

Asphalt Placement

1 × measuring wheel e.g. Rotowheel
1 × 50m tape measure
1 × pliers
2 × hammers
1 × Kg bag 4" nails (concrete)
1 × fish Line
30 × 6m x 30mm angle iron (5mm thick)
1 × 4m levelling bar

Asphalt Production

6 × measuring containers (25ℓ buckets) *(Provided by supplier*
10 × wheel barrows
4 × watering cans (with rose)
3 × metal rakes
10 × spades
3 × brooms

Finishing

1 × hand stamper
1 × bucket
1 × builders brush
1 × trowel

Maintenance

1 × bag of rags
1 × paint scraper

4 Construction

(a) Weather limitations

The LBS Asphalt shall not be applied during periods of rainfall or when rainfall is expected and when air temperatures are below or expected to fall below 4°C.

(b) Preparation of the area to be sealed

Areas shall be cleaned of all dust, dirt, dung, oil or any other foreign matters that may be deleterious to the asphalt seal. The area to be sealed shall be clearly demarcated.

(c) Application of a prime or tack coat

The engineer shall be responsible for determining if the area to be sealed requires a prime or tack coat.

(d) Preparation and application of the LBS Asphalt

The in-situ mixing and placement of the LBS Asphalt shall be done in accordance to the suppliers specifications.

5 Opening to traffic

Completed sections of LBS asphalt shall be protected from traffic for a minimum of 12 hours.

The contractor shall not allow any construction equipment which is likely to cause damage over the completed seal.

6 Defects

Excepting fair wear and tear any defects to the asphalt surfacing arising from faulty or poor workmanship or non-compliance with the specification, shall be made good by the contractor at his own expense within the defects liability period stated in the contract.

7 Measurement and payment

As for continuously graded asphalt ……square metre (m^2)

The unit of measurement shall be the square metre of asphalt surfacing constructed to the thickness specified.

The tendered rate shall include full compensation for the procurement, in-situ mixing, placement and compaction of the materials as specified.