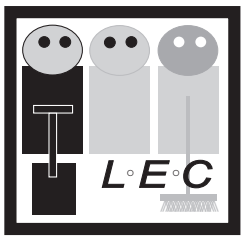
METHODS AND PROCEDURES
Labour Enhanced Construction for Bituminous Surfacings



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SOUTHERN AFRICAN BITUMEN ASSOCIATION

INTRODUCTION

This Methods and Procedures Manual is intended for use by contractors' staff in the planning of labour enhanced construction of surfacings and in the training of workers. It could also be included in the contract document as a method specification.

Please note that the manpower requirements and productivity rates are based on the best information available, and are supplied as an estimate only.

The Methods and Procedures Manual is a complement to Manual 11, the Sabita publication *"Labour enhanced construction of Bituminous Surfacings."*

ACKNOWLEDGEMENTS

The first edition of this manual was produced for Sabita by the Division of Roads and Transport Technology, CSIR. The team consisted of:

Dr SJ Emery, project leader	Consultant DRTT - CSIR
Mr N Alli	Ninham Shand
Mr B Veldman	Ben Veldman and Associates
Prof R McCutcheon	University of Witwatersrand
Mr S van Huyssteen	DRTT - CSIR
Mr AO Bergh	Mackintosh, Bergh and Sturgess

The second edition has been updated by Mr DFH Wright of Ninham Shand Inc, based on experience gained in the production of the Sabita funded training programme on biruminous surfacings for black-top roads.

CONTENTS

CONSTRUCTION ACTIVITIES

MAINTENANCE ACTIVITIES

C01 PREPARING OF BASECOURSE SURFACE

Description
The sweeping and demarcation of the basecourse surface.

LABOUR		PLANT/EQUIPMENT		MATERIAL	
Nº	Class	Nº	Type	Nº	Description
As req	General assistants (1 sweeper for every 125m^2 of road surface	2 As req 1	Hammer Broom Bass (1 broom for every 125m^2 of road surface Measuring tape	As req As req As req	Nails 6mm rope Reinforced paper

Method and procedure			C01 pg 1
STEP		KEY POINTS	
1	Determine the length of basecourse to be primed.	1 2	Each general assistant can effectively sweep 75m^2 in one hour, depending on conditions. Ensure the area matches the capacity of the spray tanker.
2	Sweep the basecourse surface at 90^0 angle to centre-line starting at the highest point.	1 2	Remove all loose and foreign material. The sweeping should be done firmly but slowly in order to minimise the floating of dust.
3	Demarcation of area to be primed (on roads where kerbs are not provided.) Where kerbs are provided, key points 1 to 3 are not applicable.	1 2 3 4	Place 100mm nails 90mm into basecourse on both sides of the road indicating the width of surfacing stone aggregates. These nails should be placed at most 50m apart on straight sections, and 10m apart on curves. By stringing between the nails with the 6mm rope, mark the edge of the area. Place a strip of reinforced paper $\pm$ 300 mm wide at the start and end of the section to be primed. The length of the reinforced paper depends on the length of the spray-bar.

Quality standard
All loose soil and foreign materials removed and the top surface of stones exposed.

C02 PROTECTING KERBS AND OTHER ROADSIDE FURNITURE

Description

The protecting of kerbs and other roadside furniture before applying bituminous products.

LABOUR		PLANT/EQUIPMENT		MATERIAL	
N°	Class	N°	Type	N°	Description
As req	General assistants	1	Shovel	As req	Plastic, sand, clay/mud, paper, splash-boards

Method and procedure			C02 pg 1
STEP		KEY POINTS	
1	Identify objects to be protected.	1	The effect of the wind must be considered.
2	Protect kerbs and other roadside furniture with appropriate material.	1	Where such protection as plastic or paper is used, ensure that it is firmly and fully protective.
3	When bituminous surfacing is complete remove protection.	1	Dispose of all protective materials using an environmentally sound method.

Quality standard

All kerbs and roadside furniture shall be free of bituminous material and unstained.

C03 WATERING OF BASECOURSE

Description
The watering of basecourse surface to facilitate the penetration of prime.

LABOUR		PLANT/EQUIPMENT		MATERIAL	
Nº	Class	Nº	Type	Nº	Description
1 1 3	Operator Controller (spray-bar) General assistant	As req	Water bowser		Water

Method and procedure			C03 pg 1
STEP		KEY POINTS	
1	Ensure that the basecourse surface is free of loose soil and foreign materials.	1	If not, repeat Activity C01.
2	Pump sufficient water into water bowser.	1	Filling of the water bowser must be done off the road surface.
3	Prepare water bowser.	1 2 3	Park the water bowser on a site off the road surface where the spray-bar can be tested. Ensure a uniform spray thickness along the full length of the spray bar. Move the water bowser 3m from the start of the section of road to be sprayed.
4	Apply water.	1 2 3 4	Determine the speed with which the water bowser must move over the demarcated area to ensure the correct application rate. Accelerate over the first 3m in order to reach the start point at the desired speed. As the spray-bar passes over the section to be sprayed, start spraying. As the spray-bar passes over the end of the spray section, stop spraying.
5	Priming	1	Priming should be done while the surface is still damp

Quality standard
Light even sprinkling without excessively wet patches.

C04 SPRAYING OF BITUMINOUS PRODUCTS

Description

The spraying of bituminous products onto a suitably prepared basecourse surface using a spray tanker, spray bar and hand lance.

LABOUR		PLANT/EQUIPMENT		MATERIAL	
N°	Class	N°	Type	N°	Description
1	Operator	1	Spray tanker	As req	Prime, emulsion, penetration grade bitumen or dust palliative.
1 or 2	Controller (spray-bar or hand lance)	As req	Brooms (Bass)		
		As req	Spanners to adjust spray-bar or hand lance nozzles.		
3	General assistant	As req	Cloth for cleaning.	As req	Diesel

Method and procedure			C04 pg 1
STEP		KEY POINTS	
1	Ensure that all kerbs, other roadside furniture and road surface have been prepared for spraying.	1	Spraying can only be carried out if preparation and protection work have been satisfactorily completed.
2	Where necessary repeat preparation (C01) and/or protection (C02) and ensure that any damage to road surface is repaired.		
3	Carry out prestart checks on the gas system.	1	Check gas bottle, regulator, hose and burner for leaks.
4	Heat the bituminous product in the batch holding tank to the required temperature.	1	Adhere to the supplier's instructions. As an example the minimum temperature for RTH 3/12P prime is 54^0C and the maximum temperature is 68^0C.
		2	Ensure the correct minimum road surface temperature is obtained before bituminous product is applied

Method and Procedure			C04 pg 2
5	Pump sufficient bituminous product into the spray tanker.	1	Ensure that the spray tanker is level.
		2	Control the level of the spray tanker using dipstick provided.
		3	Record the level onto a suitable control sheet.
		4	Ensure that the contents are circulated continuously until the spraying begins.

Method and procedure has been split into parts C04A, covering “Spraying using a spray tanker and spray-bar” and C04B, covering “Hand spraying using a spray tanker and hand lance”.

Method and procedure			C04A pg 2
STEP		KEY POINTS	
6A	Prepare spray tanker and spray-bars.	1	Park the spray tanker on a site off the road surface where the spray bar can be tested.
		2	Drop the spray-bar to the correct height (usually 225 mm) and adjust the spray nozzles until the desired spray-width is as required.
		3	Ensure a uniform spray thickness along the full length of the spray-bar except at the end where the thickness must be reduced to allow for overlapping when spraying the adjacent lane. (See Table C04 pg 7). An alternative is to use end nozzles.
		4.	Carry out prestart checks on the pump and motor for leaks and test the spray-bar.
		5	Ensuring the tanker is parked on level terrain, record the level of the bituminous product within the tanker onto a suitable control sheet. (See Table C04 pg 8).

Description
Method C04A - Spraying using a spray tanker and spray-bar

Method and procedure			C04A pg 3
STEP		KEY POINTS	
		6	Move the spray tanker to a position approximately 3m from the reinforced paper strip indicating the start of the spray section and so that the direction indicator on the spray tanker is over the paint marks (for roads without side kerbs) or over the inside edge of the side kerb.
		7	For roads without side kerbs ensure that the spray width is 300mm beyond the paint marks.
		8	Drop the measuring wheel onto the road surface.
		9	Record the temperature reading of the bituminous product in the tanker. If less than minimum, reheat using gas burners.
7A	Apply bituminous product.	1	Determine the speed at which the spray tanker must move over the demarcated area to ensure the correct application rate. The correct application rate should be confirmed with the engineer.
		2	Accelerate over the first 3m in order to reach the start point at the desired speed.
		3	As the spray-bar passes over the reinforced paper strip, start spraying.
		4	As the spray-bar passes over the reinforced paper strip indicating the end of the spray section, stop spraying.
8A	Check calibration (after first spray each and every day). Note: it is more desirable to use a spray tanker with a valid certificate of competence. This step may then be omitted.	1	Park spray tanker on level terrain.
		2	Measure level of bituminous product remaining in tanker.
		3	Record the distance recorded on the measuring wheel.
		4	Calculate actual spray rate. If it differs from the required spray rate by more or less than 0,15 ℓ/m^2, adjust the speed of the spray tanker accordingly.
		5	This is to be repeated after each spray until the desired spray rate is achieved.

Method and procedure			C04 pg 4
9A	Continue applying bituminous product.	1	The left and right lanes of the road are sprayed first. If the spray tanker can spray the full width of the road, then this is recommended.
		2	The spray width at the end of the spray bar is adjusted to allow reduced spray thickness.
		3	The procedure in step 4 is repeated until the middle lanes are completed.
		4	When spraying the middle lanes the direction indicator must be over the edge of the bituminous product sprayed on the adjacent lane and the spray-bar is set to allow a spray overlap of 150mm.
10A	Clean spray tanker and spray-bar	1	Clean spray equipment using diesel.

Description

Method C04B - Hand spraying using a spray tanker and hand lance

Method and procedure			C04B pg 5
STEP		KEY POINTS	
6B	Prepare spray tanker and hand lance.	1	Park spray tanker off the road surface where the hand lance can be tested.
		2	Carry out the prestart checks on the pump and motor for leaks and test the hand lance.
		3	Ensure the tanker is parked on level terrain, record the level of bituminous product within the tanker on a suitable control sheet (see Table C04 pg 8).
		4	Move the spray tanker onto the road surface so that the hand lance is correctly positioned at the start point.
		5	Make final checks of the kerbs, roadside furniture and road surface.
		6	Record the temperature reading of the bituminous product in the tanker. If less than the minimum, reheat using gas burners.
7B	Apply bituminous product.	1	Confirm the required application rate with the engineer. To assist the handlance controller, prepare a $1m^2$ square by handpainting on the correct amount of bituminous product to provide a visual guide.
		2	Spray the bituminous product with a constant spray action, avoiding bare patches and achieving an even application.
		3	General assistants support and move the spray hose as the hand lance controller advances.
		4	Protective clothing must be worn to prevent skin contact with the bituminous product.
		5	When spraying large areas a second hand lance controller is required as a relief.

Method and procedure			C04 pg 6
8B	Check calibration (after every 300 litres).	1	Park spray tanker on level terrain.
		2	Measure level of bituminous product remaining in the tanker.
		3	Record the distance on the measuring wheel.
		4	Calculate the actual spray rate. If it differs from the required spray rate by more or less than 0,15 ℓ/m^2, advise the hand lance controller. Care must be taken not to overcompensate when making adjustments to the spray rate.
		5	Repeat after every spray.
9B	Continue to apply bituminous product.	1	Spray the full width of the road.
10B	Clean spray tanker and hand lance.	1	Clean spray equipment using diesel.

Quality standard

Application rates:

Spraying by an experienced hand lance controller can achieve rates to within 0,10 ℓ/m^2 of the specified rate. However, occasional larger variations must be expected. Each situation must be carefully evaluated taking into account traffic usage, locality and type of seal used. For example in the use of certain seals such as a sand seal or dust palliative, the application rate is less critical even with some heavy traffic.

Plant:

All plant and equipment that is operated on the road during construction of the surface treatment shall be free of any binder, fuel or leaks. The minimum specifications for a spray tanker is that:

- It shall be capable of maintaining the binder temperature as specified
- It shall have a facility whereby the contents are circulated regularly.

There are several options for spray tankers:

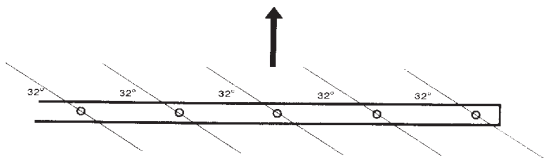
- Use existing large spray tankers (9 000-12 000 litres) from bitumen suppliers
- Use a tractor drawn small spray tanker (1 000-2 000 litres) with its own 5kW motor/pump and spray bar. This type of unit can be calibrated to a reasonable degree of accuracy.

• Use a hand drum trolley with a 2,5kW motor, hand lance and carrying a 212 litre drum. This option requires extra training for the operator to guage the distribution of bitumen.

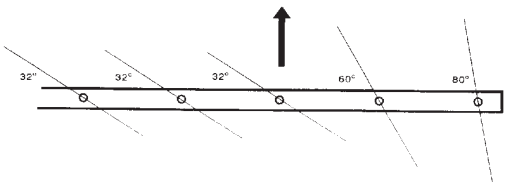
Weather limitations

No spraying of bituminous products shall be done during foggy or rainy weather, or when the temperature of the road surface is below the minimum specified.

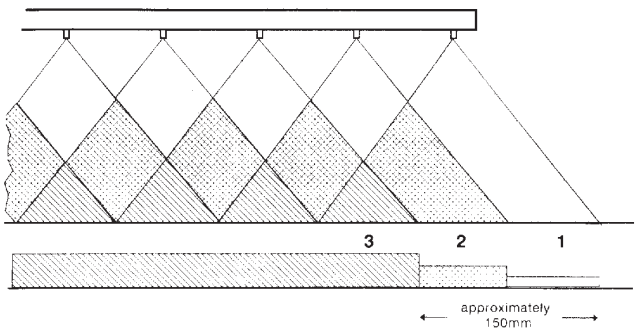
Spray bar: position of nozzles Table C04 pg 7



Spray width allowing for overlap



Spray width at side where there is no overlap



Spray widths allowing approximately 150mm overlap

CONTROL SHEET
PRIME AND SECOND LAYER BITUMINOUS MATERIAL

PROJECT:					CONTROLLER:						ROUTE/SECTION:		
					Allowable water content %			Allowable min surface temp ^{0}C			DATE:		
					Actual water content %			Actual surface temp ^{0}C					
TYPE OF PRIME					SPECIFIED SPRAY TEMPERATURE			Min	^{0}C	SPECIFIED SPRAY RATE		Min	ℓ/m^2
TYPE OF BITUMEN								Max	^{0}C			Max	ℓ/m^2
Lane			Chainage		Length	Spray width	Spray area	load	Act spray temp	Dipstick reading		Volume sprayed	Act spray rate
										Before	After		
R	M	L	From	To	m	m	m^2	N^o	^{0}C	ℓ	ℓ	ℓ	ℓ/m^2
						Total area sprayed			Total vol loaded		Total vol sprayed		

Storage and spraying temperatures of bituminous binders Table C04 pg 9

Bituminous binder	Storage temperature - ^{0}C		Spraying temperatures - ^{0}C		
	For periods in excess of 24 hours	For periods up to 24 hours	Minimum	Maximum	Recommend
Penetration grade bitumens					
150/200	115	165	150	175	165
80/100	125	175	160	190	175
Cutback bitumens					
MC030	Ambient air temp.	60	45	65	55
MC-70	45	85	60	80	70
MC-3000	100	155	130	155	145
Bituminous emulsions	Ambient air temp.	60	Ambient air temp.	60	60
Dust palliative	na	na	120	140	130

C05 SPREADING OF SURFACING AGGREGATES

Description

The cleaning, loading, dumping and spreading of surface aggregate

LABOUR		PLANT/EQUIPMENT		MATERIAL	
N°	Class	N°	Type	N°	Description
As req	Truck operators	As req (see table)	½ drums	As req (see table)	Surfacing aggregate
As req	General assistants for spreading using ½ drums	As req As req	Trucks (dump) Shovels	As req	6mm rope

Method and procedure			C05 pg 1
STEP		KEY POINTS	
1	Allocate areas to each general assistant.	1	The productivity rate for spreading and back chipping and the spotting distances for ½ drums are attached.
2	Drop off ½ drums loaded with surfacing aggregate at each of the above areas.	1	If the surfacing aggregates are dusty, they must be washed before delivery to the road. This is best done by washing the stockpile before loading onto trucks.
3	Spreading of surfacing aggregate.	1 2 3	Ensure the edge and centre lines are demarcated with 6mm rope. Spread the aggregate evenly between the rope and between each ½ drum. Too much aggregate should not be applied. Only a single layer of stone is required.
4	Back chipping and rounding off.	1 2 3 4	Once the whole demarcated area is covered. the general assistante inspect the area. In those areas where there are large openings between the aggregates, the general assistant places additional stone by hand. In those areas where there has been over-chipping, the excess stones must be removed by hand. The joints and sides are then lightly broomed to ensure that the stones are in line with the 6mm rope edges.

Method and procedure			C05 pg 2
STEP		KEY POIINTS	
5	Remove nails indicating the edge of the stone surfacing aggregate	1	To minimise damage to the road surface, rotate the nail whilst pulling. This is to be done after placing the first layer of surfacing aggregate

Note: Instead of using half drums, stone may be dumped either at set stockpile points spaced at frequent intervals and then transported to the spreading area in wheelbarrows, or loaded on a flat trailer that is towed behind the aggregate spreading team.

Quality standard

There should be a carpet of stone aggregate shoulder to shoulder overlapping and without open areas. The 6mm rope used to demarcate the edge in C01 will help to neatly mark the edges.

Materials

When using emulsions for seals, 9,5mm and 6,7mm aggregates are more appropriate than larger aggregates.

Spreading by hand:
Application, productivity rates and spotting distances

Table C05 pg2

Size of aggregate (mm)	Application rate m^3/m^2	Area covered by ½ drum[a]	Spotting distance of ½ drum[b] Lane width			Approximate labour required[cd]
			3,05m	3,35m	3,65m	
6,7	,005	$20m^2$	6,56m	6,15m	5,47m	30 labourers
9,5	,007	$14,28m^2$	4,68m	4,39m	3,90m	30 labourers
13,2	,009	$11m^2$	3,60m	3,38m	3,00m	40 labourers
19	,014	$7,14m^2$	2,34m	2,19m	1,96m	40 labourers

Note: a: ½ drum = (44 gal. drum)[e] = ½ of 200 litre drum = $0,1m^3$
b: The above spotting distances are for half-widths of the roadway; i.e. one lane width
c: If 500 metres were sprayed in one operation, on one half of the roadway, this could be covered by 30-40 labourers spreading the aggregate in 20 - 40 mins.
d: The maximum amount each labourer must spread is $0,63m^3$ for the 19mm aggregate and $0,42m^3$ for the 9,5mm aggregate
e: The 44 gal drum is cut in half. bottom removed and two handles welded to the sides of the drum.

C06 MIXING SLURRY

Description

The mixing of the water, fine aggregate, cement and bitumen emulsion into a creamy, workable consistency

LABOUR		PLANT/EQUIPMENT		MATERIAL	
N°	Class	N°	Type	N°	Description
1 3	Supervisor General assistants	1 As req As req	Concrete mixer Measuring devices Wheel barrows	See mixing slurry table (C06 pg2)	Water Stablemix bitumen emulsion Cement Graded crusher dust

Method and procedure			C06 pg 1
STEP		KEY POINTS	
1	Ensure that there is sufficient material to mix the right amount of slurry.	1	Refer to attached table to determine the required quantity.
		2	Wheelbarrows are required to transport the slurry to the road.
2	Mix the various components.	1	Based on the volume of the concrete mixer. determine the required quantities of the various components.
		2	Start the mixer.
		3	Pour 75% of the required volume of water into the mixer.
		4	Add the required amount of crusher dust and cement slowly.
		5	Allow sokme time for this mixture to mix into a uniform consistency. Add the remaining 25% of water.
		6	Add the required amount of stablemix bitumen emulsion and agitate until a creamy workable consistency is achieved.

Quality standard

The metering and mixing of the constituents shall be such as to produce a creamy workable consistency. The mixture shall not be allowed to become dry enough to ball, nor shall there be any signs that the emulsion has broken during mixing.

Nominal rate of application m^3/m^2	Materials required		Cement $m^3/100m^2$	Graded stone or crusher dust $m^3/100m^2$
	Water $\ell/100m^2$	Emulsion[a] $\ell/100m^2$		
0,006	96	138	0,006	0,6
0,008	128	184	0,008	0,8
0,020	320	460	0,020	2,0

Note: a: 60% anionic emulsion or slow setting grade.

C07 APPLICATION OF SLURRY

Description

The preparation of road surface and the discharging, spreading and working of slurry into the space between the surfacing aggregate.

LABOUR		PLANT/EQUIPMENT		MATERIAL	
N°	Class	N°	Type	N°	Description
1	Operator	As req	Brooms (bass)	As req	Water
1	Controller	As req	450mm wide rubber squeegees	As req	6mm rope
As req	General Assistants			As req	Diesel
		As req	Gum boots		
		As req	Hessian sheet		

Method and procedure			C07 pg 1
STEP		KEY POINTS	
1	Prepare road surface.	1	Determine the size of the area that can be covered within a day.
		2	Sweep all foreign material from the road surface where necessary.
		3	Lightly sprinkle the allotted area with water. There should be no free standing water on the surface.
		4	Divide the area into lanes that can be covered by the discharging and the minimum requirement for spreading. Use 6mm rope to demarcate the lanes.
2	Discharge and spread first slurry layer.	1	With the wheelbarrows discharge the slurry over the centre demarcated lane, ensuring that no material remains in the wheelbarrow. Ensure that there is no breaking of the emulsion or formation of lumps during application. If this occurs the mix must be discarded. After discharging each wheelbarrow load on the road surface, remix with a squeegee to obtain a non-segregated uniform consistency.
		2	Spread the slurry over the full width of the lane using rubber squeegees 450mm wide. Use serrated squeegees if this is the first of two layers; this is not applicable for a Cape Seal.

Method and procedure			C07 pg 2
STEP		KEY POINTS	
		3	Continue spreading until the tops of the surfacing aggregate are just visible.
		4	When the first lane is complete, start the second lane following the same procedure, ensuring no overlapping at any longitudinal joint and no uncovered areas. The overlap on transverse joints should be between 25mm and 150mm.
		5	All stone dislodged during the slurry process must be removed immediately.
3	Apply second slurry layer if required by engineer	1	Two layers will be required if the slurry is applied as an initial surfacing. The second layer must only be applied after the first layer has dried and been open to traffic for a period to be specified by the engineer. Before applying the second layer, the surface must be clean of dust, dirt and foreign materials.
4	Finish the upper surface	1	Use the hessian sheet to drag the surface and give the final "drag finish".
5	Clean all tools and equipment	1	Use diesel to thoroughly clean all tools and equipment after each day's work.

Quality standard

The road surface is finished to specified widths and lines. All spillage of slurry and all excess slurry to be removed from road surface.

Plant

If a two layer slurry is used, a serrated squeegee is recommended to spread the first layer. It gives a rough surface that the second layer can bond to, and a smooth squeegee is used for the second layer. This is not applicable to a Cape Seal.

Nominal rates of application of slurry seal Table C07 pg 2

Surfacing type	Nominal size of aggregate used for surface treatment	Nominal rate of application (m^3/m^2)
Cape Seal	13,2mm 19,0mm	0,006 0,008
Slurry	Thin (6mm) Thick (15mm)	0,008 0,020

C08 APPLICATION OF DUST PALLIATIVE

Description

The spreading and rolling of sand onto a bituminous dust palliative

LABOUR		PLANT/EQUIPMENT		MATERIAL	
No	Class	No	Type	No	Description
1/ 50m^2	General assistants	1/50m^2 1/50m^2 1 As req Option -al	Shovels Brooms (bass) Measuring devise Traffic control signs Light broom drag	0,004 0,005 m^3/m^2	Crusher dust or sand

Method and procedure			C08 pg 1
STEP		KEY POINTS	
1	Prepare sand.	1	As wet sand is difficult to apply, it must be screened and washed well ahead of spreading.
		2	The sand will have a nominal size not exceeding 9,5mm. Crusher dust is ideal, and the grading is not critical.
		3	The amount of sand required is 0,004m^3 for every 1m^2 of road surface plus ± 10% for wastage.
2	Dump required quantity of sand on side of road. (An alternative method is to use ½ drums as discussed in C05).	1	Each general assistant would be able to spread 50m^2 in an hour.
		2	Demarcate the surface of the road into approximately 10m^2 areas, using 6mm rope.
		3	Dump approximately 0,05m^3 of sand alongside the road at each of these areas.
3	Spread the sand.	1	Each general assistant spreads the sand across the road surface using shovels, starting close to the stockpile and working away from the stockpile until the demarcated area is completely covered.
		2	To spread more evenly the area can be broomed lightly using a light drag broom.
		3	Any spots where the dust palliative appears through the sand must receive a further application of sand.
4	Roll the sand.	1	The surface is then rolled using the same procedure as set out in Activity C09. A loaded truck would be an effective roller here.

Method and Procedure			C08 pg 2
STEP		KEY POIINTS	
5	Open road to traffic	1	Place 20km/h traffic speed control signs at regular intervals along the length of the newly constructed area. Open the road to traffic immediately after the sand has been spread evenly over the whole area.
6	Maintain sand cover	1	Whilst open to traffic the sand must be continuously broomed back onto the road surface until the bituminous binder has cured sufficiently to retain the sand. This period can extend up to a month and will require considerable labour efforts.

Quality standard

The sand shall be spread evenly over the whole area at a rate of approximately 0,004 m^3/m^2. Any spots where the dust palliative appears through the aggregate should receive a further application of aggregate and be rolled again.

Materials

The sand should either be crushed stone graded to dust with an upper limit of about 9mm, or sharp, cubical sand.

C09 ROLLING

Description

The bedding of surfacing aggregate onto the bitumen layer using rollers without vibration.

LABOUR		PLANT/EQUIPMENT		MATERIAL	
N°	Class	N°	Type	N°	Description
As req	Roller operator	As req	see below	As req	Diesel

Method and procedure			C09 pg 1
STEP		KEY POINTS	
1	Prepare roller.	1	Ensure that the water tanks on the roller are full and in working order.
		2	To prevent stones and/or bitumen sticking to the drum or tyres it is helpful to wipe them with diesel before rolling begins, and intermittently during rolling. This must be done off the road surface.
		3	There needs to be a sufficient number of rollers in order to minimise the delay between the spreading of the aggregate and their subsequent bedding.
2	Start rolling.	1	Start rolling as soon as sand or sand spreading is complete. Roll along the lower side first, moving lane by lane to the highest point in the road cross-section. The overlap between lanes should be as small as possible. The changing of lanes should take place before the beginning or after the end of the section requiring rolling. Each section should receive at least four passes with the roller, and as a guide one roller hour per 1000 litres of bitumen sprayed.

Quality standard
After the rolling there should be a carpet of bedded stone aggregate shoulder to shoulder, without excessive crushing of the stone aggregate

Plant
There are several options for plant, depending on availability; this is interrelated to the plant available to emerging small contractors.

- *Large roller*
  At least an 8t roller (either steel flat or rubber tyred). It is common to require one or two passes with a steel roller, then multiple passes with a rubber tyred roller.
- *Trucks*
  Three laden trucks will be suitable to roll a dust palliative or a single seal. For a double seal they will also be suitable with the addition of a heavy pedestrian roller.
- *Pedestrian roller*
  The heaviest pedestrian rollers, without vibration, are suitable for rolling slurries, dust palliatives, maintenance patches and, to a lesser extent, seals.

C10 PLACING OF GEOTEXTILE FOR A GEOTEXTILE REINFORCED SURFACING

Description

The placing of geotextile onto a suitable prepared road surface.

LABOUR		PLANT/EQUIPMENT		MATERIAL	
N°	Class	N°	Type	N°	Description
1 5	Supervisor General assistants	1	Cutter	As req	Geotextile

Method and procedure			C10 pg 1
STEP		KEY POIINTS	
1	Preparation of base..	1	Refer to activity C01 for sweeping of base, C03 for watering of basecourse, and C04 for applying the prime and bitumen tack coat.
		2	The spraying of the geotextile tack coat must be done in lane widths equal to the width of the geotextile.
2	Prepare geotextile.	1	Extend the edge of the tack coat to a point 3m before the start of the tack coat using rope and nails as described in Activity C01, Step 3, Key Points 1, 2 and 3.
		2	Place the roll of geotextile at this point (3m from start), with the edge of the roll in line with the string.
		3	Unroll the geotextile by pushing in the direction of the start point.
		4	Ensure that the edge of the roll stays in line with the rope. If not, correct the position of the roll.
3	Unroll geotextile.	1	Once the position of the roll is correct, continue pushing the roll of geotextile onto the tack coat. The general assistants pushing the roll should do so slowly and evenly so as to ensure minimum steering deviation. Where large wrinkles (longer than 300mm) occur these should be cut and the two parts overlapped. Overlaps should be 100mm — 200 mm and adhered using additional bitumen.
4	Starting with additional rolls of geotextile.	1	Transverse overlaps should be in the direction of the surfacing operations. Key points 3 and 4 of step 3 should be applied.

Method and procedure			C10 pg 2
STEP		KEY POINTS	
5	Laying around corners	1	The changes in the direction of the roll of geotextile should be sufficient to ensure that wrinkles are large enough. See Key points 3 and 4 of Step 3.
		2	Where the overlap after cutting the wrinkles is larger than 200mm, the bitumen overlap must be cut to size.
		3	Overlaps should be in the direction of traffic flow.
6	Spreading of armour layer	1	The armour layer is a very thin layer of 6,7mm stone placed on top of the geotextile to stop the roller picking up the geotextile.
		2	The stone is spread at a nominal rate of 0,003m3/m width using shovels to sprinkle stone in the initial path of the roller, and thereafter as required.
7	Roll the geotextile using a roller	1	Follow procedure described in Activity C09, with 3-4 passes of the roller This ensures a good bond between the road surface and the geotextile.

Quality standard

The geotextile must be smooth with wrinkles opr folds cut and laid flat. Overlaps shall be sufficient to ensure full closure of the joint, but should not exceed 150mm.

C11 PLACING OF HOT-MIX AND COLD-MIX ASPHALT

Description

The placing of hot-mix and cold-mix asphalt on a suitably prepared road surface.

LABOUR		PLANT/EQUIPMENT		MATERIAL	
N°	Class	N°	Type	N°	Description
1	Supervisor	1	Pedestrian roller	As req	Diesel
		As req	Shovels, rakes, picks		
		As req	Wooden battens at least 3m in length	As req	Diluted emulsion
2	General assistants				
			½ drums for diesel screed rail	As req	Asphalt

Method and procedure			C11 pg 1
STEP		KEY POIINTS	
1	Prepare road surface.	1	Determine the size of the area that can be covered within a day.
		2	Sweep all foreign material from the road surface.
2	Order asphalt.	1	Determine the quantity of asphalt to be placed
3	Prepare plant and equipment.	1	Ensure that all necessary plant, equipment and materials are available.
		2	Prepare plant and equipment by lightly coating with diesel.
4	Prepare cold asphalt joints	1	Mark edge of cold joints in a straight line
		2	Chip off excess asphalt along the liine to form key. The edge formed should not be steeper than 60^0 from the horizontal.
5	Apply tack coat (where required)	1	Determine from the engineer whether a tack coat is required.
		2	Apply diluted stablemix emulsion as per C04. An application rate of 0,25 ℓ/m^2 net bitumen should be aimed for.
6	Place thickness control battens	1	Determine from the engineer the compacted thickness of asphalt required. Select a batten thickness greater than the required thickness to allow for compaction (about 5mm extra). Place battens parallel in the direction of paving between 2m and 3m apart.

Method and procedure			C11 pg 1
STEP		KEY POINTS	
7	Place asphalt	1	In the case of hot asphalt dump from the truck only what can be worked by a team at above the minimum compaction temperature.
		2	Spread asphalt to rough level between the battens using shovels.
		3	Level the asphalt carefully to the top of the battens using rakes. The level and texture of the asphalt is critical to the appearance and ride of the compacted asphalt. A screed rail may be used with or instead of raking.
		4	Move the battens and continue to place asphalt, repeating step 6.
8	Rolling asphalt	1	Remove battens before rolling Roll asphalt at correct temperature. Usually in handwork and with a pedestrian roller this would be as close behind the placing team as possible. Roll one initial pass in static mode, check surface texture and shape, and make any necessary corrections by backcasting and raking. Compact using vibratory mode until no further compaction can be seen between roller tracks. Vibrating should be stopped when changing direction of rolling. Ensure that there is correct water feed to the roller drum so that asphalt does not pick up. Avoid contact between roller and kerbs. Use diesel to thoroughly clean all tools and equipment after each day's work.

Quality standard

The asphalt surface is finished to specified widths, lines and thickness. There should be no slacks where water can stand and no segregated areas. All excess asphalt should be removed from site.

Plant

In situations where the relative compaction of the asphalt is critical the use of a standard asphalt paving roller is recommended.

CONTENTS

MAINTENANCE ACTIVITIES

M01 BASE & SURFACE REPAIR

Description
The repair of deformation of the road surface due to failure of the base layers, probably with "crocodile" cracking and fines leaking from cracks.

LABOUR		PLANT/EQUIPMENT		MATERIAL	
N°	Class	N°	Type	Qty	Description
1	Driver (truck)		*Plant*	0,40 m^3	Approved material
		1	Truck with amber flashing light	(loose)	(see below)
7	General assistants	1	Hand rammer	1 litre	60% Cationic spray grade emulsion
2	General assistants (traffic controllers)		*Equipment*	0,08m^3	Asphalt
		2	Wheelbarrows	(loose)	
		7	Picks		
		7	Shovels	5 litres	Water
		1	Bass broom		
		2	Tar buckets		
		1	Watering can with rosehead		*If necessary for subgrade treatment*
		1	Metal rake with metal straight edge		
		1	2m straight edge		
		1	Measuring tape of 1m	as req	50mm subsoil drainpipe
			Wooden guage		
		1	Depth guage		
		5	Sticks chalk		13mm stone aggregate
		1	Block brush		
		2	Red flags		
		2	Safety vests		
			Signs		
		2	Road workmen		
		1	Road narrows LHS		
		1	Road narrows RHS		
		2	Stop/Go control ahead		
		2	Stop/Go control boards		
		10	Traffic cones		
			If necessary - plant		
			Pavement breaker		

Method and procedure			M01 pg 2
STEP		KEY POINTS	
1	Set out traffic control signs and cones.	1	Set out according to nationally accepted road signs manual.
2	Mark the patch area with chalk.	1 2	Mark a rectangular shape around all crocodile cracks. Round corners to accommodate hand hammer.
3	Excavate area.	1 2	Use picks or pavement breaker to a minimum depth of 150mm below road surface. Trim blacktop edges 45^0.
4	Remove material.	1 2 3	Remove material from hole and stockpile if suitable for use in the lower layers. If material is not suitable for re-use it must be disposed of as indicated. Material should be stockpiled in a manner and location that is safe for the public (i.e. not on road shoulders).
5	Inspect hole for dampness or water seepage and the quality of subbase material.	1 2 3	If base of excavated hole is damp or subbase of poor quality, refer to M01.1. If there is free water or signs of water seepage in the hole: Drain hole with 50mm subsoil pipe surrounded with a layer of 13mm stone aggregate and refer to M01.1. If subbase is dry and of acceptable quality proceed to point 6.
6	Compact bottom of hole	1	Use hand rammer to compact.
7	Prepare approved basecourse material.	1 2 3	Approved basecourse material can be natural gravel or crusher run. For required cement, bitumen and approved basecourse material quantities, refer to the material notes. Add water if necessary, to bring the mixture to optimum moisture content.
8	Place stabilised material into hole and compact.	1	Backfill in 3 equal layers Compact each layer according to Step 5, key point 2 Backfill and compact to 25mm below the road surface.
9	Sweep compacted area	1	Use a bass broom to sweep the area clean of any loose gravel.
10	Prime the patch	1 2 3 4	If very dry, slightly dampen area to be primed. Use block brush to apply 60% Cationic Spray Grade Emulsion. Prime: i. the backfilled area ii. the vertical edges of existing surface Wait for prime to break (turn from brown to black)

Method and procedure			M01 pg 3
STEP		KEY POINTS	
11	If necessary, prepare cold asphalt.	1 2	Prepare cold asphalt according to Activity M08, Cold Asphalt Preparation OR Mix pre-packed cold asphalt according to Activity M09. If the material is not suitable for re-use, it must be disposed of as indicated. Material should be stockpiled in a manner and location that is safe for the public (i.e. not on road shoulders.
12	Place asphalt and compact.	1 2 3 4	Use rake to screed asphalt to a height of approx. 10mm above existing surface. Use straight edge to check that loose asphalt corresponds with road crossfall. If necessary wipe diesel onto plate of compactor to stop asphalt sticking (for hot asphalt sprinkle water on top of asphalt to stop sticking). After compacted, add more asphalt to any low spots and recompact.
13	Optional: surface with a manufactured patch of bitumen/stone instead of asphalt.	1	As for step 8 fill the hole to level with the surrounding surface. Enrich the surface with emulsion and allow to dry. Apply a patch to the repaired area, overlapping by 150mm the repair and existing surface.
14	Tidy up work area and load up equipment.	1	If necessary, remove any excavated material to a suitable dump site.
15	Remove traffic control signs.	1	Remove signs starting in the middle and moving to the outer-most signs.

Trigger condition

i Deformation of the road surface due to failure of the base layers, probably with "crocodile" cracking and fines weeping from the cracks.

Quality standard

i Surface of patch to be smooth and level with the surrounding road surface.
ii Patch to be rectangular in shape

Plant

i Hand rammers are suitable for the smaller areas of repair only.

Materials

i The material that can be used is an approved basecourse material, e.g.
Decomposed granite with PIs less than 6.
Non-plastic quartzitic material.
Non-plastic dolomitic/chert gravels.
Decomposed dolerites.

ii These materials treated with 2% cement and diluted stable grade emulsion are very effective (1,5% resirual bitumen).

iii If suitable natural gravels are not available, crusher run material must be used.

iv The amount of stable grade anionic emulsion to be used is approximately 30 - 35 litres/m^3 (1% - 1,5% nett bitumen).

v The amount of cement to be used is 40 - 45 kg/m^3 (2% cement).

vi If a decomposed dolerite is to be used, replace the cement with lime (2% lime).

vii Mix the lime OR cement into the gravel dry (in some cases, lime and cement can be used in equal amounts).

viii Cut the emulsion back with water in the ratio of one part of emulsion to four parts of water, and mix in the diluted emulsion to $\pm$ 2% over optimum moisture content of the gravel/crusher run mixture.

M01.1 BASE & SURFACE REPAIR (REPAIR OF SUBBASE)

Description

The repair of subbase layer due to failure probably resulting from infiltration of ground or surface water.

LABOUR		PLANT/EQUIPMENT		MATERIAL	
N°	Class	N°	Type	Qty	Description
	As with base and surface repair		*Plant and equipmen*t As with base and surface repair	$0,6m^3/m^2$ of surface area 1 pocket As req	Approved selected subgrade material Road lime Water

Method and procedure			M01.1 pg 1
STEP		KEY POINTS	
1	Refer M01		
2	Refer M01		
3	Excavate area.	1 2	Use picks or pavement breakers to excavate down to the top of the underlying layer. Minimum 150mm. Trim all edges vertical.
4	Refer M01		
5	Refer M01		
6	Prepare approved subbase quality material.	1	Mix 1 x 25 kg pocket of lime to nine concrete wheelbarrows of approved subbase material. The quantity of lime used must be pre-determined. (Normally = 2%). Add water and bring to optimum moisture content. On mixing - make certain that the lime is distributed evenly, and to the full depth of the layer.
7	Place stabilised material into hole and compact.	1	If the material is too wet prior to compaction, allow it to dry. Compact in three equal layers until a uniformly hard appearance is achieved. The top of the fully compacted layer should be 150mm below the finished road surface.

Method and procedure			M01.1 pg2
STEP		KEY POINTS	
8	Remove all loose material.	1	All uncompacted loose material should be removed from the top of the completed subbase. Prepare to commence the construction of the base. See method M01.

Trigger condition

i Subgrade which is soft and spongy after the excavation of the base.

ii Subgrade which is wet.

Quality standard

On completion of the repair there should be no signs of water, and the layer should feel firm and hard with a uniform compacted surface.

M01.2 BASE AND SURFACE REPAIR (REPAIR OF SUBGRADE)

Description

The repair of the subbase layer due to failure probably resulting from the infiltration of ground or surface water through the base or subbase.

LABOUR		PLANT/EQUIPMENT		MATERIAL	
N°	Class	N°	Type	Qty	Description
	As with base and surface repair.		*Plant and equipment* As with base and surface repair.	0,6 m^3/m^2 of surface area 1 pocket As req	Approved selected subgrade material. Road lime. Water.

Method and procedure			M01.2 pg 1
STEP		KEY POINTS	
1	Refer M01		
2	Refer M01		
3	Excavate area.	1 2	Use picks or pavement breakers to excavate down to the top of the underlying layer. Min. 150mm. Trim all edges vertical.
4	Refer M01		
5	Refer M01		
6	Prepare approved selected subgrade material.	1 2 3 4	Mix 1 x 25 kg pocket of lime to nine concrete wheelbarrows of approved, selected material. The quantity of lime must be predetermined. Normally = 2%. Add water and bring to optimum moisture content. On mixing - make certain that the lime is distributed evenly, and to the full depth of the layer.
7	Place stabilised material into hole and compact.	1 2 3	If the material is too wet prior to compaction, allow to dry. Compact in three equal layers until a uniformly hard appearance is achieved. At this stage the top of the compacted layer should be 300mm below the finished road surface.
8	Remove all loose material.	1	All uncompacted loose material should be removed from the top of the completed selected subgrade layer. Prepare to commence the construction of the subbase. See method M01.1.

Trigger condition

i Subbase which is soft and spongy after excavation of the base.

ii Subgrade which is wet.

Quality standard

i On completion of the above, all water related problems must be solved, the finished layer must be hard with a uniform compacted appearance.

M02 POTHOLE REPAIR

Description

The repair of potholes on blacktop roads exposing the base layer with no evidence of base failure.

LABOUR		PLANT/EQUIPMENT		MATERIAL	
N°	Class	N°	Type	Qty	Description
1	Driver (truck)		*Plant*	As req	Asphalt
		1	Truck with amber		
4	General assistants		flashing light	As req	60% Cationic spray grade emulsion
2	Traffic controllers		*Equipment*		
		4	Picks		
		4	Shovels		
		1	Bass broom		
		1	Tar bucket		
		1	Black brush		
		1	Wooden float		
		1	Rake with metal straight edge		
		2	Red flags		
		2	Safety vests		
			Signs		
		2	Road workmen		
		1	Road narrows (LHS		
		1	Road narrows RHS		
		2	Stop/Go control ahead		
		2	Stop/Go control boards		
		10	Traffic cones		

Method and procedure			M02 pg 2
STEP		KEY POINTS	
1	Set out traffic signs.	1	According to nationally approved road signs manual.
2	Prepare the pothole.	1	Trim away any cracked edges and loose material.
		2	Potholes greater than 300mm to be made rectangular in shape with corners slightly rounded off.
		3	Ensure a minimum depth of 50mm for asphalt.
		4	Sweep area clean.
3	Prime the pothole.	1	Use block brush to apply 60% cationic spray grade emulsion.
		2	Wait for prime to break (turn from brown to black).
4	If necessary, prepare cold asphalt	1	Prepare cold asphalt according to Activity M08, Cold Asphalt Preparation.
5	Place asphalt in pothole and compact.	1	Place asphalt to approximately 10mm above road surface.
		2	Compact asphalt ensuring pothole is level with surrounding road surface.
		3	When using hot asphalt, compact using a hand rammer.
6	Load up equipment and remove signs	1	Remove signs starting in the middle and moving towards the outermost signs.

Trigger condition

i Potholes on blacktop roads exposing the base layer with no evidence of base failure.

ii Potholes must be patched as soon as possible before they get bigger or cause damage to the base layer.

Quality standard

i The potholes must look neat with a flat, level surface to coincide with the surrounding road surface.

ii Potholes greater than 300mm must be made rectangular in shape.

M03 BLACKTOP EDGE REPAIR

Description

The repair of ravelled edges on blacktop roads using asphalt. Where the edge has ravelled more than 150mm into the road surface, the repair should be treated as pothole repair M02.

LABOUR		PLANT/EQUIPMENT		MATERIAL	
N°	Class	N°	Type	Qty	Description
1	Driver (truck)		*Plant*	As req	60% Cationic spray grade emulsion
		1	Truck with amber flashing light		
	General assistants				
		1	Hand rammer	As req	Asphalt
	G.A.	Opt.	Small vibratory roller		
	(Traffic controllers)			As req	Water
			Equipment		
		7	Picks	As req	Selected gravel
		7	Shovels		
		2	Bass broom		
		2	Wheelbarrows		
		2	Tar bucket		
		2	Metal rake with metal straight edge		
		1	2m straight edge		
		1	30m measuring tape		
		1	Stringline		
		2	Block brush		
			Signs		
		2	Road workmen		
		1	Road narrows LHS		
		1	Road narrows RHS		
		10	Traffic cones		
			If necessary		
		2	Red flags	As req	
		2	Safety vests		
			Signs		
		2	Stop/Go control ahead		
		2	Stop/Go control boards		

Method and procedure			M03 pg 2
STEP		KEY POINTS	
1	Set out traffic signs	1	According to nationally approved road signs manual.
2	Examine cause of failure	1 2 3	Vehicle driving off edge. Lack of side support for road edge. Drainage scour
3	Prepare area to be repaired	1 2 3 4 5	Trim loose and cracked edges back to solid surfacing. Trim edges vertical. Excavate down to solid base. Minimum excavated depth below road surface is 25mm. Remove loose material and sweep area clean.
4	Mark the edge of the road	1 2 3 4	On straight, pull a stringline between correct, existing edges and on curves measure from white/yellow line. Road must never be widened or narrowed. Pick a 25mm deep groove on correct edge line. Sweep area clean.
5	Prime area	1 2 3 4	If very dry, slightly damp area to be primes. Use block brush to apply 60% Cationic Spray Grade Emulsion. Prime: i The prepared area ii. The vertical edges iii 50mm border on existing surface Wait for prime to “break” (turn from brown to black).
6	Place asphalt and compact	1 2 3 4 5	In layers not exceeding two fingers deep (40mm). Use rakes to screed final layer to a height of approximately 5mm above existing road surface. Use straight edge to check that loose asphalt corresponds with road crossfall. Compact asphalt ensuring pothole is level with surrounding road surface. When using cold asphalt, wipe diesel onto plate of compactor to stop asphalt sticking. When using hot asphalt, compact using a hand rammer and sprinkle water on asphalt to stop sticking. After compaction, add asphalt to low spots and compact.
7	Building up edge support	1	Use selected gravel and build gravel shoulder to level with road surface. If necessary, add water to obtain correct moisture content. Compact using roller or vibratory compactor.
8	Tidy area and load equipment		
9	Remove traffic signs	1	Remove signs starting in the middle and moving towards the outermost signs.

Trigger condition

i Ravelled edges less than 150mm wide on blacktop roads.

Quality standard

i The edge reinstated to its original position and the road not widened or narrowed.

ii The surface of the prepared area to be a continuation of the existing road crossfall.

iii Sufficient side support along edge of blacktop road.

iv Earth shoulder correctly shaped to allow water to drain away from the road surface.

M04 CRACK SEALING (3mm or less)

Description

The sealing of cracks on blacktop roads using cold bitumen.
Cracks 3mm or less.

LABOUR		PLANT/EQUIPMENT		MATERIAL	
N°	Class	N°	Type	Qty	Description
1	Driver (truck)		*Plant*	As req	Latex emulsion or specialised crack sealand.
		1	Truck with flashing amber light		
3	General assistants				
		1	Watering can	As req	Crusher dust.
2	General assistants (Traffic controllers)	2	Small drum		
		3	Wire brushes	As req	Diesel (for cleaning equipment)
		2	Squeegees		
		Op	Agricultural pressurised spray can with long lance and 2mm nozzle		
			Signs		
		2	Road workmen		
		1	Road narrows LHS		
		1	Road narrows RHS		
		2	Stop/Go control ahead		
		2	Stop/Go control boards		
		10	Traffic cones		

Method and procedure			M04 pg 1
STEP		KEY POINTS	
1	Observe the weather and roasd surface conditions.	1 2	Crack sealing should be done during warm, dry weather. Surface should be free of oil and dust.
2	Position the traffic control signs.	1	Position the traffic control signs in accordance with nationally approved signs manual.
3	Prepare crack sealant.	1	Use purpose made crack sealant.
4	Prepare the crack.	1 2	Use wire brushes or compressed air to clean out crack and remove all loose particles. Sweep away all dust and loose particles from alongside the crack.
5	Apply crack sealant.	1 2 3	Use watering can or pressurised spray can to pout crack sealant on affected area. Brush into crack. Spread 5mm dust over affected area.

Method and procedure			M04 pg 2
STEP		KEY POINTS	
6	Where a large number of crocodile cracks occur, apply appropriate sealant over the affected road surface.	1 2 3 4 5	Clean out cracks thoroughly. Apply first coat working it well into the cracks with squeegees. Allow to dry for at least two hours. Applu sealant as a second coat using squeegees. Blind the final surface with crusher dust.
7	On completion of work, clean the equipment.	1	Clean equipment with diesel.
8	Remove traffic control signs.	1	Remove traffic control signs by starting in the middle and moving to the outermost signs.

Note: Some crack sealant will require the crack to be primed first, and this should be allowed to cure for 1 - 2 weeks.

Trigger condition

i Clearly visible cracks appearing in the road surface.
ii Cracks less than 3 mm.

Quality standard

i Sealed cracks to be watertight.
ii Sealed cracks to look neat.
iii Sealant to be level with road surface.
iv The sealing of crocodile cracks by spreading sealand onto the road surface should be in a rectangular shape level with the road surface.

Materials

i A crack sealant can be made using stable grade emulsion (anionic 60%) modified with 8% anionic emulsified rubber.

M05 CRACK SEALING (wider than 3mm)

Description

The sealing of cracks on blacktop roads using cold bitumen.
Cracks wider than 3mm.

LABOUR		PLANT/EQUIPMENT		MATERIAL	
N°	Class	N°	Type	Qty	Description
1	Driver (truck).		*Plant*	As req	Crack sealant as for M04.
		1	Truck with amber flashing light.		
3	General assistants.	1	Tin for pouring.	As req	Crumb slurry (see below).
2	General assistants (traffic controllers).	3	Pieces of wire.		
		3	Wire brushes.		
				As req	Diesel for cleaning equipment.
			Signs		
		2	Road workmen		
		1	Road narrows LHS		
		1	Road narrows RHS		
		2	Stop/Go control ahead		
		2	Stop/Go control boards		
		10	Traffic cones		

Method and procedure M05 pg 1

STEP		KEY POINTS	
1	Observe the weather and road surface conditions	1 2	Crack sealing should be done during warm dry weather. Surface to be free of oil and dust.
2	Position the traffic control signs	1	Position the traffic control signs in accordance with nationally approved road signs manual.
3	Prepare crack sealant	1	As for M04
4	Prepare the crack		As for M04
5	Apply one layer of crack sealant		As for M04
6	Apply crumb slurry		Wait until crack sealant is dry. Squeegee crumb slurry into cracks.
7	On completion of work clean the equipment		Clean equipment with diesel.
8	Remove traffic control signs		Remove the traffic control signs by starting in the middle and moving to the outermost signs.

Trigger condition

i Clearly visible cracks wider than 3mm appearing in the road surface.

Quality standard

i Sealed cracks to be watertight.
ii Sealed cracks to look neat.
iii Sealand to be level with road surface.

Materials

Crumb slurry is prepared with:

i 4 parts of fine rubber crumbs.
ii 1 part 60% anionic stable grade emulsion with 8% anionic emulsified rubber.
iii + 1 part water.
iv 0,04 parts cement.

M06 SLACK REMOVAL

Description

The placing of asphalt in layers into slacks in the road surface which cause an uncomfortable ride for the motorist.

LABOUR		PLANT/EQUIPMENT		MATERIAL	
N°	Class	N°	Type	Qty	Description
1	Driver (truck)		*Plant*	As req	Asphalt
		1	Truck with amber flashing light.	As req	60% cationic spray grade emulsion
	General assistants	1	Twin drum flat vibrating roller (500 kg).		
	General assistants (traffic controllers)		*Equipment*	As req	Water
		2	Wheelbarrows		
		2	Tar bucket	As req	Diesel for cleaning
		7	Picks		
		4	Shovels		
		3	Bass broom		
		4	Metal rake edge		
		1	50m nylon line (thick)		
		2	5mm spacer blocks		
		7pr	Safety goggles		
		2	Red flags		
		2	Safety vests		
			Signs		
		2	Road workmen		
		1	Road narrows LHS		
		1	Road narrows RHS		
		2	Stop/Go control		
			Stop/go control boards		
		10	Traffic cones		

Method and procedure			M06 pg 1
STEP		KEY POINTS	
1	Set out traffic control signs	1	Set out traffic control signs in accordance with nationally approved road signs manual.
2	Mark the extent of the slack	1	Stretch a nylon line criss-cross over the slack. Mark crosses on the road where the line touches the road surface. Use straight edge to draw lines to mark the edge of the area to be repaired.

Method and procedure			M06 pg 2
STEP		LEY POINTS	
3	Prepare area to be repaired.	1	Use picks and goggles and chip out a key approx. 50mm wide and 25mm deep along the inner edge of the market line, ensuring that the outer edge is vertical.
		2	Pick pock marks at random centres on the road surface to be patched.
		3	Sweep the area clean.
4	Prime area to be repaired.	1	Dilute 60% cationic spray grade emulsion 50/50 with water.
		2	Apply a thin layer of diluted emulsion to the whole area to be repaired.
		3	Wait for emulsion to break.
5	Prepare cold asphalt.	1	Prepare cold asphalt in accordance with M08.
6	Stretch nylon line criss-cross over slack.	1	Stretch nylon line tautly across the slack. criss-cross the slack from the outer edge of the key. (Refer Step 2, Keypoint 1).
		2	Sprinkle lightly with asphalt to prevent workmen's boots sticking to the prime.
7	Spread asphalt.	1	Start at the deepest, spread 40mm of asphalt and compact with vibrating roller.
		2	Use minimum amount of diesel on roller drum to prevent asphalt from sticking.
		3	Roll outer edge first then gradually move across the uncompacted area keeping 2/3 of the drum on the compacted area and 1/3 on the uncompacted asphalt.
		4	Repeat Step 7, Key points 1, 2 and 3 until the asphalt is level with the road surface.
		5	Sprinkle asphalt on any low spots to bring the final level up to that of the road surface. Recompact.
8	Tidy up area.	1	Sweep loose material away and dispose of.
		2	Ensure drainage channels clean.
9	Remove traffic control signs.	1	Remove traffic control signs by starting in the middle and moving to the outermost signs.

Trigger condition

i Depression or slack in the road resulting in an uncomfortable ride for the motorist.

Quality standard

i Final surface to be smooth and level with the surrounding road surface. (When tested with a 3m straight edge the surface should not deviate from the underside of the straight edge by more than 10mm at any point).

ii Drainage channels clean of any loose material.

M07 SLURRY SEAL

Description
The repair of damaged road surfaces.

LABOUR		PLANT/EQUIPMENT		MATERIAL	
No	Class	No	Type	Qty	Description
1	Driver		*Plant*	110	Crusher dust
		1	Truck with amber		
	General assistants		flashing light.	3,5 kg	Portland cement
	General assistants		*Equipment*	25 ℓ	Stable mix grade
	(traffic controllers)	2	Wheelbarrows		emulsion (60%)
		2	Shovels		
		2	Chalk	18 ℓ	Water
			Squeegees		
		1	25 ℓ bucket	As req	Oil stain remover
		1	Measuring tape		
		1	2m straight edge		
		1	Watering can with rosehead		
		2	Bass brooms		
			Signs		
		2	Road workmen		
		1	Road narrows LHS		
		1	Road narrows RHS		
		2	Stop/Go control ahead		
		2	Stop/Go control boards		
		10	Traffic cones		

Method and procedure			M07 pg 1
STEP		KEY POINTS	
1	Set out traffic control signs and cones	1	Set out according to nationally approved road signs manual.
2	Mark the proposed area with chalk	1	Mark rectangular shape around area to be repaired.
3	Sweep the area	1	Sweep the area clean of any foreign loose material with bass broom.
		2	If oil spillage on the road surface, wash off with suitable oil stain removers and brooms.
4	Prepare the surface	1	Make certain no free water is present when the application of slurry begins.

Method and procedure			M07 pg 2
STEP		KEY POINTS	
5	Mix the slurry seal	1 2 3 4	The crusher dust is first mixed thoroughly with water and cement. The bitumen emulsion is added, and the mixing process is continued. If the mix appears too dry, small quantities of water should be added. When a creamy, workable consistency is obtained, mixing must stop.
6	Application of slurry	1 2	The slurry is now poured into the prepared area. With the use of squeegees it is evenly spread over the area to a thickness of 5mm.
7	Remove traffic control signs	1	Remove by starting in the middle and moving to the outermost signs.

Note: Under no circumstances must river sand be used instead of crusher dust.

Trigger condition

i Presence of surface voids due to loss of stones.

ii Evidence of lack of bitumen.

iii An alternative treatment (although not especially labour based) is to apply a fog spray or enrichment coat.

Quality standard

i The finished seal should not bleed or flush.

ii Have an adequate bitumen content to enrish weathered road surfaces.

M08 COLD ASPHALT PREPARATION

Description

The mixing and preparation of cold asphalt at the depot, which can be used for all blacktop asphalt surface repairs, and has a stockpile life of 1 - 2 weeks.

LABOUR		PLANT/EQUIPMENT		MATERIAL	
No	Class	No	Type	Qty	Description
1	Supervisor		*Equipment*	1m^3	6,7mm stone
		8	Shovels	0,4 m^3	Crusher dust
8	General assistants	2	Builders wheelbarrows		
		2	20 ℓ tin		*Summer mix*
		2	10 ℓ tin (for emulsion)	120 ℓ	Cationic asphalt grade emulsion
		2	1 ℓ tin (for measuring emulsion and water)	36 ℓ	Water
					Winter mix
				180 ℓ	Cationic asphalt grade emulsion
				72 ℓ	Water
				1 ℓ	Paraffin (for cleaning)
				As req	Cleaning cloth

Method and procedure			M08 pg 1
STEP		KEY POINTS	
1	Sweep mixing area clean	1	Use concrete area for mixing.
2	Measure out the 6,7mm stone and crusher dust into small piles for mixing.	1	Mixing pilkes to be placed in a circle around a central area which can be used to stockpile the mixed asphalt.
		2	Size of mixing pile: (i) Stone (6,7mm) 1 x struck builder's wheelbarrow + 1 x 20 ℓ tin (ii) Crusher dust 11/2 x 20 ℓ tins of crusher dust.
3	Measure out cationic asphalt grade emulsion and add water.	1	Measure out using either: (i) Summer mix 10 ℓ emulsion 3 ℓ water (ii) Winter mix 15 ℓ emlusion 6 ℓ water

Method and procedure			M08 pg 2
STEP		KEY POINTS	
4	Pour the emulsion mixture onto the mixing pile.	1	Ensure emulsion does not run out of the mixing pile.
	Mix material together.	1	2-3 general assistants to mix using shovels until all the material is covered with emulsion.
	Spread the mix and wait for the emulsion to break.	1	Mix will turn from brown to black in approximately five minutes.
	Place mix on central stockpile area.	1	Form a heaped stockpile.
	Repeat steps 2 - 7 until sufficient cold asphalt has been mixed	1	
	Place a tarpaulin over the stockpile.	1 2	To protect it from the weather. Stockpile can last for 1 - 2 weeks.

Trigger condition

i When it is much more economical to use cold asphalt than hot asphalt (because of travelling and wastage etc.)

ii Areas which are unable to purchase hot asphalt.

Quality standard

i The cold asphalt must be properly mixed with all the stone well covered with emulsion.

ii When opening the asphalt stockpile, the asphalt must look alive.

Material

i Cold asphalt has some limitations; it is relatively open graded and allows water to seep through; it has low strength and even if it is sealed over, the seal does not always perform satisfactorily.

Materials and quantities	M08 pg 3
Summer Mix	*Winter Mix*
80 ℓ 6,7mm stone 30 ℓ crusher dust 10 ℓ Cationic asphalt grade emulsion 3 ℓ water	80 ℓ 6,7mm stone 30 ℓ crusher dust 15 ℓ Cationic asphalt grade emulsion 6 ℓ water

M09 PRE-PACKED COLD ASPHALT

Description

The mixing on site of pre-packed cold asphalt for blacktop repairs.

LABOUR		PLANT/EQUIPMENT		MATERIAL	
No	Class	No	Type	Qty	Description
1	Supervisor		*Equipment*	As req	Pockets of pre-packed asphalt.
		4	Shovels		
	General assistants	2	Builders' wheelbarrows	1	Mixing agent per pocket.
		1	Watering can with rose head	bottle (small)	
		1	Bass broom	1 bottle (large)	Emulsion per pocket
				As req	Water

Note:
i When stored, pockets should not be stacked more than five high.
ii Care must be taken in handling so as not to split the pockets.
iii One pocket of pre-packet cold asphalt contains 25 ℓ of aggregate.
iv One pocket is required per $1m^2$ for every 25mm of thickness.

Method and procedure			M09 pg 1
STEP		KEY POINTS	
1	Select and prepare area for mixing.	1	To be close to the work area on blacktop surface.
		2	To be fairly level.
		3	To be broomed clean.
2	Prepare aggregate.	1	Open the required number of bags and remove plastic bottles. (See note for estimation of required quantity).
		2	Empty aggregate into a heap on the prepared surface.
		3	If the aggregate is dry, mix in sufficient water to dampen the mix.
3	Mix contents of bottles into the aggregate.	1	Add mixing agent from small bottles first, spreading it evenly over the aggregate.
		2	Thereafter, add emulsion from large bottles in the same manner as above.
		3	Use shovel and mix thoroughly to ensure that all the aggregate is coated with emulsion.

Method and procedure			M09 pg 2
STEP		KEY POINTS	
4	If necessary correct the mix	1	If the aggregate is not coated, add small quantities of water and remix until satisfactory coating is obtained. If cold asphalt slumps on placing in a heap, too much water has been added and the asphalt must be allowed to dry before using.

Trigger condition

i When a small wuantity of asphalt is required.
ii Used as an alternative to preparing cold asphalt as described in M08.

Quality standard

i The pre-packed cold asphalt must have all the aggregate coated after mixing.
ii It must not slump when placed in a heap.

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