

WATERPROOFING MEMBRANES FOR BRIDGES PROVEN WATERPROOFING TECHNOLOGY WITH PLASTIC MEMBRANES OF LUCOBRIDGE®





... make better bridges



GENERAL

Bridge to seal surfaces and edge caps permanently and securely is a company known for the performers difficult task. With the Lucobridge[®] Waterproofing System, we meet the high demands that are now made on bridge structures.

Economically feasible and durable

Protective layers of asphalt concrete will be applied to ensure the sealing of Lucobridge[®], as the rugged path can be driven directly with the manufacturers.

The waterproofing membrane is in the casting and Roll method on the cleaned and treated with bitumen primer concrete surface glued on.

Our membranes have been proven by millions of seals. With this experience, we also provide you with this special membrane the required security.

REQUIREMENTS

Satisfy the Bridge Waterproofing System following r equirements:

- · easily and safely be laid
- glue directly on the bridgeboard to avoid underflow
- a good connection between the bridge and covering manufacture, ie take thrust, to bypass cracks in the ground safely

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- Withstand against mechanical damage
- directly with asphalt concrete or asphalt pavers passable rot
- rot resistant
- durable to de-icing salt
- chemical resistance
- fatique-proof to vibrations of the traffic load

WE MEET THE REQUIREMENTS WITH LUCOBRIDGE®!

LAYER CONSTRUCTION

Protective layers of Mastic Asphalt be produced in thicknesses of at least 3cm. The mastic asphalt must be in relation to the stresses of the protective layer be composed accordingly. For protective layers of grains only Mastic Asphalt 0/8 (8 S MA) or 0/11 (11 S MA) allowed.

If a protective layer made of asphalt, so between the sealing of asphalt layer to arrange a suitable separation. This may for example consist of two layers of glass mat 120g/m².

The joints between the protective layers and the edge caps are pouring out with a joint sealing compound.



PRODUCTS

Lucobridge[®] PV

Lucobridge® PV is a single ply membrane with a total thickness of 2,4 mm. It exists of a Lucobridge® membrane, which is covered with a non-woven polyester fleece of 100 g/m^2 on both sides. Lucobridge® PV is conceived for single-ply sealing under stone mastics asphalt (SMA), mastic asphalt or bituminous concrete.

Lucobridge[®] PV-Bit

Lucobridge® PV-Bit is a single ply membrane with a total thickness of 4,7 mm. It exists of a Lucobridge® membrane, which is covered with a modified bituminous mass of 1,6 mm on the upper side and is covered with a non-woven polyester fleece of 1,5 mm thickness on the lower side. Lucobridge® PV-Bit is conceived for single-ply sealing under stone mastics asphalt (SMA), mastic asphalt or bituminous concrete.







Lucobridge® Bit

Lucobridge® Bit is a single ply membrane with a total thickness of 4,7 mm. It exists of a Lucobridge® membrane, which is covered with a modified bituminous mass of 1,6 mm on both sides. Lucobridge® Bit is conceived for single-ply sealing under stone mastics asphalt (SMA), mastic asphalt or bituminous concrete.

APPLICATION

- Bridge concrete or steel
- Parking levels / parking garages incl. driveways
- Tunnel
- Civil structures

PROCESSING

The surface of concrete or steel has to be prepared corresponding to the regulations (ZTV-ING Part 7, clause 1 resp. 4). Lucobridge PV has to be rolled out, free of voids with overlapping seams. Lucobridge PV may be layed all-over using epoxy resins. Details may be found in the laying instructions.

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Reinforced concrete bridge

Underside of the sealing sheet is coated with bitumen. When using Lucobridge Bit the substrate must get on a reinforced concrete bituminous pretreatment, that is a dust-binding coating. Their intention is to ensure that there is good adhesion between the waterproofing membrane and substrate.

On bottom of the geomembrane liner is a polyester fleece. hen using a Lucobridge PV has also a bituminous primer be done on the concrete, it can be reached at curling of the membrane in hot bitumen is a good bond with the concrete.

Steel Bridge

Lucobridge Bit: The surface of steel bridges must also be a primer receive, so that the waterproofing membrane has good adhesion to the steel. This is usually done with an epoxy primer, which is sanded. This rough surface may then be applied to Lucobridge Bit by flame.

Bitumen

Fleece

Lucobridge[®]

Lucobridge PV: The polyester fabric can be incorporated directly into, liquid epoxy coating or other suitable coating.

ADVANTAGES

- Easy to lay as single ply membrane for bridges
- High resistance to static loading
- High resistance to impact
- Excellent behavior in low temperature
- Highly resistant to penetration
- Excellent membrane to bridge in concrete cracks
- Extremely high adherence on pretreated subsurface
- Excellent temperature resistance









TECHNICAL DATA

EN 13967	Typical Properties	Norm	Test	Unit	Lucobridge®	Lucobridge®	Lucobridge®
EN 13956 EN 14967			method acc.		PV	PV-Bit	Bit
		EN 1850-1	bitumen sheet	-	no	no	no
5.2.1	visible defects	EN 1850-2	plastic sheet			110	110
		EN1848-1	bitumen sheet	m	7 50	7 50	7 50
	length	EN1848-2	plastic sheet		"	"	"
	width	EN1848-1	bitumen sheet	m	1.00	1.00	1.00
5.2.2		EN1848-2	plastic sheet		"		"
	straightness and flatness	EN1848-1	bitumen sheet	mm/10 m	≤ 2	≤ 2	≤ 2
		EN1848-2	plastic sheet		"	"	"
	effective thickness of membrane	EN 1849-1	bitumen sheet	mm	2,4	3,2	4,7
		EN 1849-2	plastic sheet		п		"
	effective thickness of ECB inlayer	EN 1849-1	bitumen sheet	mm	1,5	1,5	1,5
		EN 1849-2	plastic sheet		"	"	"
	mass per unit of membrane	EN 1849-1	bitumen sheet	kg /m²	1,8	3,2	5,4
		EN 1849-2	plastic sheet		"	"	"
	mass per unit of nonwoven fleece						
5.2.3	watertightness	EN 1926, proofed acc. EN 1928, Method B	bitumen sheet	-	pass 12 bar /72 h	pass 12 bar /72 h	pass 12 bar /72 h
5.2.5	water tightness	EN 1928, Method B	plastic sheet		"	"	"
			bitumen sheet				
5.2.4	exposure to liquid chemicals	EN 1847, 28 d /23°C	plastic sheet	pass	pass: kerosin, gaso-	pass: kerosin, gaso-	pass: kerosin, gasoli-
			bitumen sheet		F	F	F
5.2.5.1	external fire exposure	EN ISO 11925-2 EN 13501-1	plastic sheet	nass	F	F	F
	reaction to fire		bitumen sheet	puss	-	-	-
5.2.5.2		EN V 1187	plastic sheet	pass	t1, t2, t3, t4	t1. t2. t3. t4	t1, t2, t3, t4
5.2.6		EN	bitumen sheet	puss		(1) (2) (3) (1)	
	hail resistance	EN 13583	plastic sheet				
	peel resistance of joint	EN 12316 -1	bitumen sheet				
		EN 12316 -2	plastic sheet				
5.2.7	shear resistance of joint	EN 12317-1	bitumen sheet				
		EN 12317 - 2	plastic sheet				
5.2.8	water vapour transmission properties		bitumen sheet				
		EN 1931	plastic sheet				
	Tensile strength - longitudinal	EN 12311-1	bitumen sheet	N/ 50mm	1070	1260	1140
		EN 12311-2	plastic sheet		1280	1460	1120
	Tensile strength - transversal	EN 12311-1	bitumen sheet	N/ 50mm	720	1100	-
		EN 12311-2	plastic sheet		1220	1430	1100
5.2.9	Elongation at tensile strength - longitudinal	EN 12311-1	bitumen sheet	%	40	45	30
		EN 12311-2	plastic sheet		70	50	40
	Elongation at tensile strength - transversal	EN 12311-1	bitumen sheet	%	80	65	-
		EN 12311-2	plastic sheet		60	50	40
		EN 1201	hitum on alt ant			50	-10
5.2.10	Resistance to impact	EN 12691	bitumen sneet	mm			
		EN 12720	plastic sheet	mm			
5.2.11	Resistance to static loading	EN 12730	plastic shoot	ka			
5.2.12	Resistance to tearing	EN 12310-1	bitumen sheet	N			
		EN 12310-1	plastic sheet	N	450	450	450
5.2.13	Resistance to root penetration Dimensional stability	EN 13948	bitumen sheet		150	130	150
			plastic sheet		pass	pass	pass
		FLL - test	plastic sheet		pass	pass	pass
		EN 1107 -1	bitumen sheet				
		EN 1107-2	plastic sheet	%			
5.2.15	Foldability at low temperature (ECB inlayer)	EN 1109	bitumen sheet				
		EN 495-5	plastic sheet	°C	-40	-40	-40
5.2.17	Resistance to ozone		bitumen sheet				
		EN 1844	plastic sheet				
5.2.18	Reaction to exposure to bitumen		bitumen sheet				
		prEN 1548	plastic sheet				
		EN 1110	bitumen sheet	°C			
	Heat stability		plastic sheet	°C	>100	>100	>100
			bitumen sheet				
	Adhesive tensile strength /SMA		plastic -ht	MD-	0.5	1	1
		IF-DLE-D	plastic sneet	INIPa	0,5	1	1





Product	Tensile stress MPa	Tensile strength in N/50mm		
1 Bitumen membrane	4,1	750		
2 Lucobridge [®] Bit	4,8	1120		
3 Lucobridge [®] PV-Bit	8,0	1460		
4 Lucobridge [®] PV	10,3	1280		

TEST RESULTS LUCOBRIDGE®

In The Netherlands an asphaltic surfacing structure for orthotropic steel bridge decks mostly consists of two structural layers, see Figure 1. The upper layer consists of Porous Asphalt (PA) for noise reduction. For the lower layer a choice between Mastic Asphalt (MA) orGuss Asphalt (GA), can be made. In order to characterize the adhesive bonding strength of various membrane products utilized in the Dutch steel deck bridges, four types of specimens, i.e. steel-membrane specimen (Steel/M1), Guss Asphalt Concrete-membrane specimen (M1/G-asphalt and G-asphalt/M2) and Porous Asphalt-membrane specimen (M2/P-asphalt) were produced at Delft University of Technology (TUD).

In order to characterize adequately the adhesive bonding strength of the various membranes with surrounding materials on orthotropic steel bridge decks, a Membrane Adhesion Test (MAT) device has been developed by TUD. From the MAT tests, the strain energy release rate G of the membrane interface is utilized as a physical quantity to rank the membrane adhesive bonding strength with different substrates. Larger strain energy release rate represents better bonding strength.



Figure 1: Schematic of a typical Dutch asphalt surfacing system on a steel bridge deck

Figure 2 shows the comparison of strain energy release rate of Steel/M1 interface at temperature -5oC and +5oC, between the membrane products from LUCOBIT AG and the products from other companies.



Figure 3 shows the comparison of strain energy release rate of M1/G-asphaltinterface at temperature -5oC and +5oC, between the membrane products from LUCOBIT AG and the products from other companies.





Figure 3: Strain energy release rate of M1/G-asphalt

Figure 4 shows the comparison of strain energy release rate of G-asphalt/M2interface at temperature +5oC and +10oC, between the membrane products from LUCOBIT AG and the products from other companies.



Figure 4: Strain energy release rate of G-asphalt/M2

Figure 5 shows the comparison of strain energy release rate of M2/P-asphaltinterface at temperature +5oC and +10oC, between the membrane products from LUCOBIT AG and the products from other companies.





By considering the performance of two interfaces for each membrane,Lucobridge PV is recommended as one of the better membrane between steel deck and Guss asphalt layer; Lucobridge PV-Bit performs very well when connecting Guss asphalt and Porous asphalt layer, therefore it is recommended as one of better top membrane. In the second phase of TUD research program, Delft five Point Bending tests (5PBT) shall be performed for verification and calibration of the finite element predictions and for preliminary ranking of whole asphalt surfacing systems, see Figure 6.



Figure 6. TU Delft five point bending test (5PBT)



Finally, accelerated Loading tests shall be performed in the LINTRACK facility available at TU Delft on actual asphalt surfacing systems on typical steel bridge decks for final ranking and for verification/calibration of the finite element models for future bridge analyses, see Figure 7.



Figure 7. LINTRACK facility at TU Delft

01 STEEL DECK BRIDGE-ROAD | ONE LAYER





>2.5% (06) (07) (05) (04) -(02) (01)

Detail 01 Pavement structure

- 07 Spread (grit) 06 Seam 05 Wearing course of asphalt mastic 04 Protective coat of asphalt mastic 03 Lucobridge waterproofing 02 Primer
- 01 Steel bridge construction

Detail 02 Shaping of borders

- 07 Spread (grit)
- 06 Bituminous joint
- 05 Wearing course of asphalt mastic
- 04 Protective coat of asphalt mastic
- 03 Lucobridge waterproofing
- 02 Primer
- 01 Steel bridge construction

Detail 03 Light tower

- 07 Spread (grit)
- 06 Bituminous joint
- 05 Wearing course of asphalt mastic
- 05 Protective coat of asphalt mastic 04 Waterproofing, liquid plastic, >30 cm a. TOS
- 03 Lucobridge waterproofing
- 02 Primer
- 01 Steel bridge construction



01 STEEL DECK BRIDGE-ROAD | ONE LAYER



Detail 04 Expansion joint

- 08 Spread (grit) 07 Bituminous joint 06 Wearing course of asphalt mastic
- 05 Protective coat of asphalt mastic 04 Joint profile
- 03 Lucobridge waterproofing
- 02 Primer
- 01 Steel bridge construction



Detail 05 Bridge drains

- 10 Spread (grit)
- 09 Bituminous joint
- 08 Wearing course of asphalt mastic
- 07 Protective coat of asphalt mastic
- 06 Floor drain top section
- 05 Waterproofing, liquid plastic 04 Lucobridge waterproofing
- 03 Primer
- 02 Floor drain subpart, welded
- 01 Steel bridge construction

01A STEEL DECK BRIDGE-ROAD | DOUBLE LAYER







Detail 01 Pavement structure

- 07 Spread (grit) 06 Seam 05 Porous asphalt 04 Protective coat of asphalt mastic 03 Lucobridge waterproofing 02 primer
- 01 steel bridge construction

Detail 02 Shaping of borders

- 07 Spread (grit)
- 06 Bituminous joint
- 05 Porous asphalt
- 04 Protective coat of asphalt mastic
- 03 Lucobridge waterproofing
- 02 Primer
- 01 Steel bridge construction

Detail 03 Light tower

- 08 Spread (grit)
- 07 Bituminous joint
- 06 Porous asphalt
- 05 Protective coat of asphalt mastic
- 04 Waterproofing, liquid plastic, >30 cm a. TOS
- 03 Lucobridge waterproofing
- 02 Primer
- 01 Steel bridge construction



01A STEEL DECK BRIDGE-ROAD | DOUBLE LAYER







Detail 04 Expansion joint

- 08 Spread (grit) 07 Bituminous joint 06 Porous asphalt 05 Protective coat of asphalt mastic
- 04 Joint profile
- 03 Lucobridge waterproofing 02 Primer
- 01 Steel bridge construction

Detail 05 Bridge drains

- 10 Spread (grit)
- 09 Bituminous joint
- 08 Wearing course of asphalt mastic
- 07 Protective coat of asphalt mastic
- 06 Floor drain top section
- 05 Waterproofing, liquid plastic
- 04 Lucobridge waterproofing 03 Primer
- 02 Floor drain subpart, welded
- 01 Steel bridge construction

Detail 06 Safety curbs

06 Track bed 05 Safety curb 04 Protection mat 03 Lucobridge waterproofing 02 Primer 01 Steel bridge construction





Detail 01 Track-bridge cap

07 Spread (grit) 06 Spread (grit) 05 Bridge cap 04 Protective coat 03 Lucobridge waterproofing 02 Primer 01 Steel bridge construction



Detail 02 Bridge cap

- 05 Bridge cap, ferro-concrete 04 Protective coat 03 Lucobridge waterproofing
- 02 Primer
- 01 Steel bridge construction



Detail 03 Sealing connection beyond border cap

- 08 Cover up-bow
- 07 Sealing course
- 06 Glue mass
- 05 Cap joint band 04 Bituminous glue mass
- 03 Lucobridge waterproofing
- 02 Hot bituminous glue mass
- 01 Undercoat







Detail 04 Light tower

- 10 Spread (grit) 09 Bituminous joint
- 08 Wearing course of asphalt mastic
- 07 Protective coat of asphalt mastic
- 06 Safety curb
- 05 Protective layer
- 04 Integral flange construction with welded mast
- 03 Lucobridge waterproofing
- 02 Primer
- 01 Steel bridge construction

Detail 05 Expansion joint

- 08 Spread (grit)
- 07 Bituminous joint
- 06 Wearing course of asphalt mastic
- 05 Protective coat of asphalt mastic
- 04 Joint profilewith integral flange
- 03 Lucobridge waterproofing
- 02 Primer
- 01 Steel bridge construction

Detail 06 Bridge drains

- 11 Spread (grit)
- 10 Bituminous joint
- 09 Wearing course of asphalt mastic
- 08 Protective coat of asphalt mastic
- 07 Bridge cap, ferro-concrete
- 06 Protective layer
- 05 Waterproofing subpart flange
- 04 Lucobridge waterproofing
- 03 Primer
- 02 Floor drain subpart, integral flange
- 01 Steel bridge construction







Detail XX Completition of a open joint construction

Detail XX Completition of waterproofing

Detail XX Joint at the edge cap



luftseltig



luftseitig



Detail XX Installation variants





Detail 01 Waterproofing with plastic waterproofing courses on transient area egde cap/track





Detail 02 Completition with frame constructions

Detail 03 Closed screwed joint and transition construction



Detail 04 Transverse joints with abutment wall



Detail 05 Closed screwed joint and transition construction









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Detail 01 Connectin track/bridge cap

09 Spread (grit) 08 Bituminous joint 07 Porous asphalt 06 Protective coat of asphalt mastic 05 Bridge cap, ferro-concrete 04 Protective coat 03 Lucobridge waterproofing 02 Primer 01 Steel bridge construction

Detail 03 Mast

- 10 Spread (grit)
- 09 Bituminous joint 08 Wearing course of asphalt mastic
- 07 Protective coat of asphalt mastic
- 06 Safety curb
- 05 Protective layer
- 04 Integral flange construction with welded mast
- 03 Lucobridge waterproofing
- 02 Primer
- 01 Steel bridge construction

Detail 04 Expansion joint

- 08 Spread (grit)
- 07 Bituminous joint
- 06 Porous asphalt
- 05 Protective coat of asphalt mastic
- 04 Joint profilewith integral flange 03 Lucobridge waterproofing
- 02 Primer
- 01 Steel bridge construction



Detail 05 Bridge drains

- 11 Spread (grit)
- 10 Bituminous joint 09 Porous asphalt
- 08 Protective coat of asphalt mastic
- 07 Bridge cap, ferro-concrete
- 06 Protective layer
- 05 Waterproofing subpart flange
- 04 Lucobridge waterproofing
- 03 Primer
- 02 Floor drain subpart, integral flange
- 01 Steel bridge construction

03 CONCRETE DECK BRIDGE-RAILWAY





Detail 01 Waterproofing beyond

- bridge cap 05 Bridge cap, ferro-concrete 04 Cap joint band 03 Lucobridge waterproofing 02 Primer
- 01 Steel bridge construction

Detail 02 Connection bridge cap

- 07 Track bed, gravels 06 Bridge cap, ferro-concrete 05 XPS-stand-by stripe 04 Protective coat of concrete 03 Lucobridge waterproofing 02 Primer
- 01 Steel bridge construction

Detail 03 Super structure Connection/waterproofing conclusion

- 09 Bituminous potting
- 08 Protective concrete
- 07 Filter stone
- 06 Drip tap or bituminous waterproofing layer, mounting with terminal strip
- 05 Lucobridge waterproofing
- 04 Primer
- 03 Border construction with concrete anchor and long hole
- 02 Counterfort
- 01 Super structure



03 CONCRETE DECK BRIDGE-RAILWAY



Detail 04 Fudge counterfort support structure

- 08 Protective concrete
- 07 PE-waterproofing band
- 06 Retain element
- 05 Molded body, integrated in the waterproofing
- 04 Lucobridge waterproofing
- 03 Primer
- 02 Counterfort
- 01 Support structure

04 PARKING GARAGE









Detail 01 Ground/coating structure

- 07 Spread (grit) 06 Joint 05 Wearing course of asphalt mastic 04 Protective coat of asphalt mastic 03 Lucobridge waterproofing 02 Primer
- 01 Construction concrete with slope

Detail 02 Wall/sustain connection

- 11 Permanently elastic joint infill
- 10 Cover plate $\geq\!15$ cm high with clamping effect
- 09 Spread (grit)
- 08 Joint
- 07 Wearing course of asphalt mastic
- 06 Protective coat of asphalt mastic
- 05 Lucobridge waterproofing
- 04 EP-fillet (PCC-mortar)
- 03 Primer
- 02 Raising component (concrete wall)
- 01 Construction concrete with slope

Detail 03 Free board connection

- 07 Spread (grit)
- 06 Bituminous joint
- 05 Wearing course of asphalt mastic
- 04 Protective coat of asphalt mastic
- 04 Lucobridge waterproofing
- 03 Primer
- 02 Boarder connection profile as integrated flange, mounting according to statics
- 01 Construction concrete with slope

04 PARKING GARAGE



Detail 04 Floor drain

- 07 Spread (grit) 06 Bituminous joint
- 05 Wearing course of asphalt mastic 04 Protective coat of asphalt mastic
- 03 Primer
- 03 Lucobridge waterproofing
- 02 Floor drain
- 01 Construction concrete with slope

Detail 05 Pipe implementation

- 08 Spread (grit)
- 07 Bituminous joint
- 06 Wearing course of asphalt mastic
- 05 Protective coat of asphalt mastic
- 04 Lucobridge waterproofing
- 03 Primer
- 02 Pipe with waterproofed welded integrated flange,
- mounted according to statics
- 01 Construction concrete with slope



Detail 06 Cable implementation

- 08 Spread (grit)
- 07 Bituminous joint
- 06 Wearing course of asphalt mastic
- 05 Protective coat of asphalt mastic
- 04 Lucobridge waterproofing
- 03 Primer
- 02 Pipe with waterproofed welded integrated flange,

mounted according to statics

01 Construction concrete with slope

04 PARKING GARAGE



Detail 07 Safety curbs

09 Spread (grit)

- 08 Bituminous joint
- 07 Wearing course of asphalt mastic 06 Protective coat of asphalt mastic
- 05 Safety curb
- 04 Protection mat
- 03 Lucobridge waterproofing
- 02 Primer
- 01 Construction concrete with slope



Detail 08 Component joint, permanently elastic

- 11 Spread (grit)
- 10 Permanently elastic joint filler
- 09 Closed cell rear filling string
- 08 Bituminous joint
- 07 Wearing course of asphalt mastic
- 06 Protective coat of asphalt mastic
- 05 Integrated flange
- 04 Lucobridge waterproofing
- 03 Primer
- 02 Component joint
- 01 Construction concrete with slope
- 11 Abstreumittel (Splitt)



Detail 09 Expansion joint

- 08 Spread (grit) 07 Bituminous joint
- 06 Wearing course of asphalt mastic
- 05 Protective coat of asphalt mastic
- 04 Joint profile with integrated flange
- 03 Lucobridge waterproofing
- 02 Primer
- 01 Steel bridge construction



MAIN BRIDGE, BETTINGEN

DONNERSBERGER BRIDGE, MUNICH



MAIN BRIDGE, MARKTBREIT



GROSSHESSELOHER BRIDGE, MUNICH



ICE BRIDGE, WALLDORF





1. TEST SAMPLES

In order to characterize the thermal isolation effect of Lucobridge membrane in asphaltic sufacings on steel deck bridge, three types of surfacing structure, i.e. SMA 10 with Lucobridge PV Bit membrane (Figure 1), AC 13 with Lucobridge PV Bit membrane (Figure 3) and SMA10/AC13 with Lucobridge PV Bit and Lucobridge Bit membrane (Figure 5) were investigated. For comparison purpose, SMA 10 and AC 13 samples without membrane were also examined, see Figure 2 and



Lucobridge PV Bit Epoxy-Lucosol (white) Steel plate

Figure 1: SMA10 sample with Lucobridge PV Bit membrane







Figure 3: AC13 sample with Lucobridge PV Bit membrane

¹ All samples utilized in the tests were provided by Lucobit AG. The test results and conclusions in this report only reflect the characteristics of the test samples.

Figure 4. The temperature variations in time at the surface of the sample (point m3) and at the top of membrane or steel plate (point m2) were measured automatically. By controlling the heat source temperature under the steel plate (point m1), the samples were tested by three different heat source temperatures +50oC, +60oC and +70oC respectively.

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Figure 4: AC13 sample without membrane



Figure 5: SMA 10/AC13 sample with two types of Lucobridge membrane

2. TEST DEVICE

A thermal control device is utilized for controlling the heat source temperature by means of transferring heat from the heat source to the ambient environment, see Figure 6. When the test sample is heated to the predefined temperature, the data acquisition system is capable of measuring the in time temperature variation of the sample by using thermal meters at the predefined locations (i.e. m1, m2, m3 in Figure 1 to 5). In addition, the device is capable of controlling the temperature variation at the heat source.



Figure 6: Automatic thermal control device

3. TEST RESULTS

3.1 SMA10 samples



Figure 7: Comparison of SMA 10 with or without membrane, at heat source T=50°C



Figure 8: Comparison of SMA 10 with or without membrane, at heat source T=60°C



Figure 9: Comparison of SMA 10 with or without membrane, at heat source T=70°C $\,$

3.2 AC13 samples



Figure 10: Comparison of AC13 with or without membrane, at heat source T=50°C



Figure 11: Comparison of AC13 with or without membrane, at heat source T=60°C



Figure 12: Comparison of AC13 with or without membrane, at heat source T=70°C

Comparison of AC 13 with and without Lucobridge PV Bit, at T=50°C

3.3 SMA10/AC13 samples



SMA10/AC 13 with two layers of Lucobridge

Figure 13: SMA10/AC13 with two layers of Lucobridge membrane, at heat source T=50°C



Figure 14: SMA10/AC13 with two layers of Lucobridge membrane, at heat source T=60 $^{\circ}$ C



Figure 15: SMA10/AC13 with two layers of Lucobridge membrane, at heat source T=70 $^{\circ}$ C

3.4 Conclusions

- In general, all samples with Lucobridge PV Bit or Lucobridge Bit membrane show isothermal effect;
- By comparing the test results of AC 13, SMA 10 and SMA10/ AC13 samples at three temperature (50oC, 60oC and 70oC), it was found that the combination of asphaltic surfacings with Lucobridge PV Bit or Lucobridge Bit membranes can reduce indeed the speed of thermal flow transfer from the bottom steel plate to the surface of the asphalt layer.
- At 50oC, the AC13 with Lucobridge PV Bit membrane can reduce the rate of temperature rise 36% than the one without membrane. The SMA 10 with Lucobridge PV Bit membrane can reduce the rate of temperature rise 18% than the one without membrane.
- At 70oC, the AC13 with Lucobridge PV Bit membrane can reduce the rate of temperature rise 32% than the one without membrane. The SMA 10 with Lucobridge PV Bit membrane can reduce the rate of temperature rise 17% than the one without membrane.
- However at 60oC, the AC13 with Lucobridge PV Bit membrane can reduce the rate of temperature rise 25% than the one without membrane. The SMA 10 with Lucobridge PV Bit membrane can reduce the rate of temperature rise 33% than the one without membrane.
- The average rate of temperature rise in SMA10/AC13 sample with two layers of Lucobridge membrane is two times lower than the other two types samples with one layer Lucobridge membrane.

PRODUCTS FOR ASPHALT AND BITUMEN MODIFICATION











PRODUCTS FOR ASPHALT AND BITUMEN MODIFICATION



It[®] – the polymer ined for the n road.

Lucocell®

Lucocell® FG3000 micro grains – cellulose additives for Stone Mastic Asphalt.

Lucosol®

Lucosol[®] is a solvent based bitumen road binder made out of selected modified bitumen qualities and hydrocarbon solvents.

Lucolor®

Lucolor® is a color batch for color asphalt (bitumen) with good properties to modify bitumen and asphalt.



















LOCATIONS



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