

The Bitumen Additive for Highly Stable Easily Compactible Asphalts

1. SASOBIT®

What is SASOBIT®?

SASOBIT® is a long-chain aliphatic hydrocarbon that is produced by Sasol Wax in South Africa using the Fischer-Tropsch process. Its molecular chain length lies in the range of 40 to more than 115 carbon atoms. In contrast the molecular chain lengths of paraffins naturally found in bitumen range from 22 to 45 carbon atoms. This explains why SASOBIT® has quite different physical properties to the paraffins normally present in bitumen. Therefore, they are not directly comparable. The melting point range of SASOBIT® is between 85°C - 115°C.

How does SASOBIT® work?

SASOBIT® is completely soluble in bitumen at temperatures in excess of 115°C. It forms a homogeneous solution with base bitumen on stirring and produces a marked reduction in the bitumen's viscosity. This enables mixing and handling temperatures of the asphalt to be reduced by 10 – 30°C. Temperature reductions of up to 50°C can be reached by process optimisation between the mixing plant and paving (Fraport Runway North).

This in turn results in a significant reduction of bitumen fumes emissions and CO₂ (= energy savings) during such operations.

During cooling the SASOBIT® crystallizes out and forms a lattice structure in the bitumen which increases the asphalt stability.

Packaging

SASOBIT® in Pastillen

600 kg big bags on pallets

20 kg PE bags shrink-wrapped on 720 kg pallets

5 kg PE bags in cartons on 660 kg pallets for direct dosage in the gussasphalt boiler

2 kg PE bags in cartons on 640 pallets for direct dosage in the gussasphalt boiler

On request SASOBIT® can also be supplied in flakes or powdered form.

THE SUCCESS FORMULA FOR BETTER ASPHALT

SASOBIT
modified



2. SASOBIT[®]-Modified Bitumens (SmB)

2.1. Manufacture of SmB

SASOBIT[®] can be blended into hot bitumen at the asphalt blending plant using a simple stirrer. A high shear mixer is not required. The resultant bitumen-SASOBIT[®] blends are completely stable during hot storage and exhibit no tendency for phase separation.

ATS (The Fayat Group) and LT Linnhoff have developed a system which enables in-line blending of the molten SASOBIT[®] with the bitumen stream at the asphalt plant.

The companies G&P, VAM and ANA have also developed a system for direct dosage of SASOBIT[®] pastilles in the bitumen stream.

Direct blending of solid SASOBIT[®] at the asphalt plant for hot rolled asphalt is not recommended for quality reasons since it cannot be relied upon to give a homogeneous distribution of SASOBIT[®] in the asphalt.

In all cases so far evaluated, the optimal addition of SASOBIT[®] has been found to be 3 %, taking the additive's effectiveness and the overall economics into account.

2.2. Physical Properties of SmB Blends Compared to Basic Bitumen

	B 30/45	SmB 25	B 50/70	SmB 35	B 70/100	SmB 45
Base Bitumen		30 /45		50 /70		70/100
Bitumen content (% W)	100	97	100	97	100	97
SASOBIT [®] content (% wt)	-	3	-	3	-	3
Softening point R&B (°C)	53 – 59	80 – 90	48 – 54	75 – 85	43 – 49	70 – 80
Penetration at 25°C (1/10 mm)	30 – 45	20 – 30	50 – 70	30 – 50	70 – 100	35 – 55
Fraass break point (°C, max)	-5	-5	-8	-8	-10	-10

2.3. SASOBIT[®]-modified PmB

The advantageous properties of SASOBIT[®]-modified bitumens, as described above, may be combined synergistically with the elastic properties of polymer-modified bitumens. This is especially beneficial when a highly modified bitumen or stiff PmB is required for selected applications. BP Olexobit NV 25 and BP Olexobit BP 25 have been used successfully for such applications. The combination of SASOBIT[®] and elastic polymers can also improve stability during hot storage. The addition of SASOBIT[®] to rubber bitumens drastically reduces the emission of blue smoke during processing owing to the lower temperatures that may be employed.

3. SASOBIT®-Modified Asphalts

SASOBIT®-modified asphalts have been successfully used since **1997** in a wide range of applications.

Mix types: stone mastic asphalt (SMA) 0/5 – 0/8 – 0/11
asphalt binder 0/16 – 0/22
guss asphalt (mastic asphalt).
asphaltic concrete

In addition SASOBIT® has proved itself in the following special applications:
asphalt thin layer coatings, asphalts used in waste containment systems, surfacing of container storage areas, other highly loaded asphalt surfacings

3.1. Manufacture of Mixes, their Application and Compaction

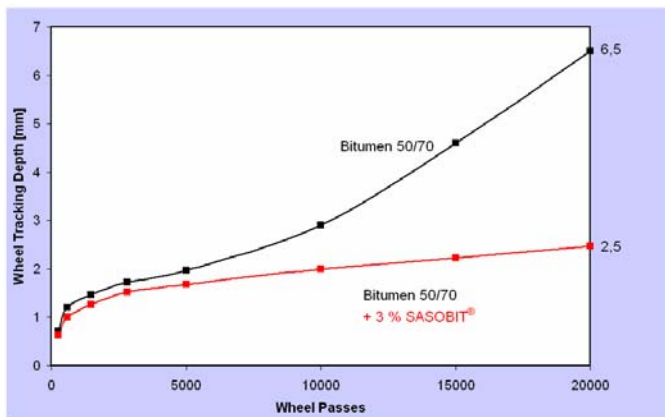
The reduction in viscosity produced by the addition of SASOBIT®, as referred to above, leads to an improvement in the handling and compaction of the resultant asphalts.

The resistance to compaction is reduced.

SASOBIT® content (% wt)	Compaction Resistance D
0	41,6
2	39,7
3	36,3
4,5	33,0

3.2. Deformation Resistance of SASOBIT[®]-Modified Asphalts

At service temperature, SASOBIT[®]-modified asphalts display an increased resistance to permanent deformation. This effect is clearly illustrated by the results of the wheel tracking test.



Rutting Depth Tested
in Hamburg Wheel Tracking Tester:
SMA 0/11 S in a water bath at 50°C

3.3. Low Temperature Behaviour of SASOBIT[®]-Modified Asphalts

The low temperature behaviour of SASOBIT[®]-modified asphalts is determined by the nature of the base bitumen that is used. SASOBIT[®] does not significantly affect this property. This is demonstrated by the results of a series of Arand cooling tests simulating service conditions in which rigidly-mounted asphalt test samples were subjected to cooling at the rate of 10°C/h. The tensions created by thermal shrinkage and the break temperatures were measured.

	Max Thermally Induced Tension (N/mm ²)	Break Temperature (°C)
SMA 0/11 S; B 50/70	4,4	-25,0
SMA 0/11 S; B 50/70 + 3 % SASOBIT [®]	4,5	-24,5
Gussasphalt 0/11; B 30/45	6,0	-26,5
Gussasphalt 0/11; B 30/45 + 3% SASOBIT [®]	5,9	-25,5
Gussasphalt 0/11; PmB 45	6,8	-30,0
Gussasphalt 0/11; PmB 45 + 3% SASOBIT [®]	7,0	-30,0

4. Laboratory Tips

Softening Point R&B

In accordance with DIN-EN 1427 the R&B softening point above 78°C must be determined using glycerol in water bath.

Extraction

If SASOBIT®-modified binder is to be recovered from asphalt by the extraction method, we recommend cold extraction with the use of ethylene trichloride. We further recommend pre-soaking the sample. The extraction process must be continued for 70 minutes plus a further drying time of 20 minutes. This ensures that the colourless SASOBIT® is fully recovered despite its low solubility. Deviating from other regulations we also recommend ethylene trichloride as a solvent for the arbitration analysis

Checking the Presence of SASOBIT® in Bitumen

The high softening points of SASOBIT®-modified bitumens may be used as an indicator of the presence of SASOBIT®. Precise checks, as well as a quantitative determination, may be carried out by DSC (differential scanning calorimetry). Details of the test method are obtainable from Sasol Wax on request.

The softening point of the original binding agent must also be taken into account when evaluating the R&B softening point increase in order to avoid an incorrect assessment as otherwise the impression could be caused that the binding agent and/or mixed components are thermally overburdened.

5. Research Reports and Independent Assessments

Several well-known Research Institutes, Universities and asphalt test laboratories have investigated extensively the mechanisms by which SASOBIT® functions to achieve significant improvements in asphalt quality.

These studies have been accompanied by road construction research work and the observation of road trials that have confirmed the laboratory results under practical conditions.

The following institutions participated in the researches:

Germany:

Asphaltlabor, Wahlstedt
Asphalta, Berlin
Hansa-Bau-Labor, Hamburg
Institut für Erdöl-und Erdgasforschung, Clausthal
IFM, Rottweil
IFM, Leipheim
IFTA, Essen
LGA, Nürnberg
Dr. Löffler Baustoffprüfung, Hannover
Nordlabor, Pinneberg
Sbt, Trier
TU, Darmstadt

International:

Technical University Vienna, Austria
MAPAG, Gumpoldskirchen, Austria
PRI Asphalt Technologies, Tampa, USA
NIEVELT-Laboratory, Prague, Czech Republic
University of Putra, Malaysia
Xian University, China
Tongji University, Shanghai, China
RTA, Australia
MASZ Budapest, Hungary
Road & Bridge Research Institute, Warsaw, Poland

6. References

SASOBIT® has been used in numerous construction projects with great success. The following list represents a few of the important references.

Germany:

Boehringer AG:	Waste containment lining
Hamburg Neuhof:	Waste covering / container storage area
Motorway A1, Maschen-Harburg:	Thin layer asphalt
Hamburg Port:	Container storage area, road access spur
Motorway A1, Euskirchen:	Surface coating (SMA)
Motorway A111, Berlin:	Binder course
Hamburg Airport:	Runway
Motorway A8 Steel Bridge Friedrichsthal:	SMA 0/8S with BP Olexobit NV 45
Motorway A 8 Munich - Karlsruhe:	Asphalt binder 0/16S + SMA 0/11 S with BP Olexobit NV 45
Car park + side street, Passau:	BP NV 70/100
Bypass, Niederhöft:	BP NV 70/100
AUDI factory driveway, Ingolstadt:	BP NV 50/70
Motorway A1 Euskirchen:	Top layer Gussasphalt (BAST trial road)
Motorway A7 Rader High Bridge:	Gussasphalt 0/11 S with BP Olexobit NV 45
Motorway A3 Danube Bridge, Passau:	Gussasphalt 0/8 S with BP Olexobit NV 45 + 3% SASOBIT®
Munich Airport:	Top layer AB 0/11 S with BP Olexobit NV 45
Motorway A25 Hamburg:	Binder Course 0/16 S with PmB 25 RC + 1,5% SASOBIT®
	SMA 0/8 S with PmB 45 + 1,5% SASOBIT®
Fraport, Runway North Frankfurt:	ATS CS 0/32 30/40 + 4% SASOBIT®
	Asphalt binder 0/22 S Caribit 25 + 4% SASOBIT®
	SMA 0/11 S Caribit 45 + 4% SASOBIT®
Recklinghausen, K5 Haltern:	AiF Research AB 0/11 NT
	Nytemp 30/45
Freiheit, Berlin	Asphalt binder 0/16 S PmB 25 + 3% SASOBIT®
	SMA 0/11 S PmB 25 + 3% SASOBIT®
OD Hohn, Schleswig-Holstein	AB 0/11 S NT SmB 35

International:

China:	Motorway
Denmark:	Trunk road
France, Paris:	City roads
Hungary:	Trial Road Szekesfehervar
Italy:	Piemont, national road
Malaysia, Kuala Lumpur:	Highway No. 1
Malaysia, Sengalor	Kajang Ring Road
Norway	Motorway Oslo-Drammen
Russia, Moscow	City Motorway
Sweden (Near Arctic Circle)	Military Airport
Switzerland:	Stallikon, national road
South Africa, Johannesburg:	Ben Schoemann Highway
South Africa, Johannesburg:	Christian de Wet Road
United Kingdom:	Cambridge Airport
United Kingdom:	Cardiff Docks
United States of America:	Trial roads

7. Literature and Patents

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- I. Rahimian, I Sachs: *Ersatz des Paraffingehalts als optimales Anforderungskriterium im Rahmen der europäischen Normung, (Substitute of the paraffin content as optimal requirement criteria within the framework of the European standardization)*, Finishing Report of the research FE 07.169 G 95 of the BAST 1998
- T. Butz, I. Rahimian, G. Hildebrandt: *Modifikation von Straßenbaubitumen mit Fischer-Tropsch Paraffin, (Modification of road construction bitumens with Fischer-Tropsch waxes)*, Bitumen 2000, P. 91-96
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SASOBIT® has been patented in many countries. For further information please contact our product management.