Irish Branch
INSTITUTE OF ASPHALT TECHNOLOGY

Mastic Asphalt in the Road Network.

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Commercial & Technical Manager.

TARSTONE LTD
ROAD MAINTENANCE

Hodson Bay Hotel, Athlone, Co.Roscommon - 13th March 2018.

Tarstone Road Maintenance Limited

Tarstone Road Maintenance Limited.

Offices / depot in Navan, Co. Meath & Woodford, Co. Galway.

Family-owned and operated.

Legacy of continuous product improvement and innovation.

What is Mastic Asphalt ?

Mastic asphalt (MA) is a dense mixture consisting of coarse aggregate, and/or sand, and /or limestone fine aggregate, and/or filler and bitumen, which may contain additives (for example polymers, waxes).

The mixture is designed to be of low void content. The binder content is so adjusted that the voids are completely filled and that even a slight excess of binder may occur.

Mastic asphalt is pourable and able to be spread in its working temperature condition. It requires no compaction on site.

What is Mastic Asphalt ?

The strength of the mixture is from the bitumen rather than any aggregate interlock.

The binder content is adjusted so that the voids are completly filled.

Texture (Skid Resistance) can be improved by embedding skid resistant pre-coated chippings or fine aggregate into the surface.

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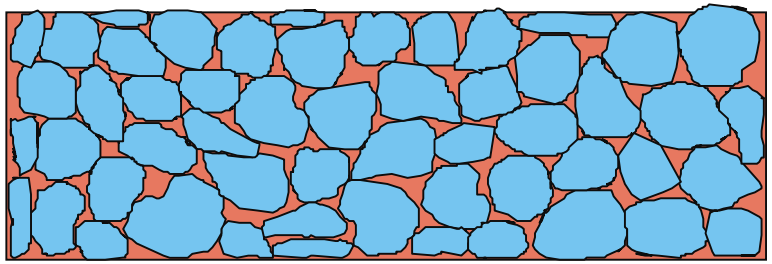
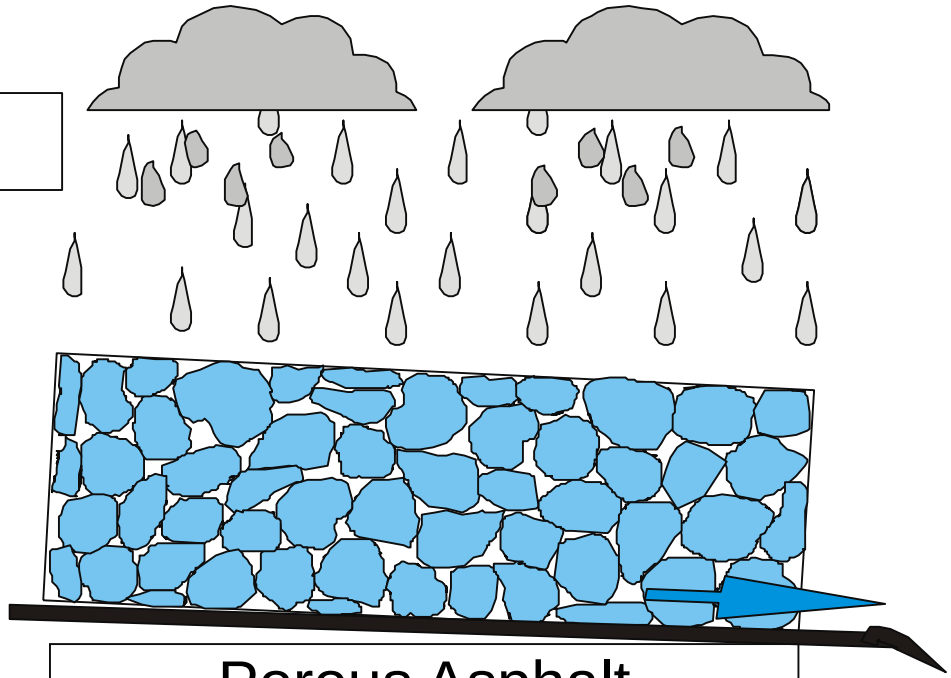
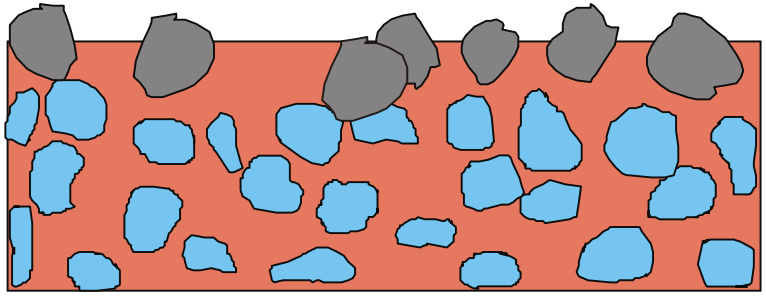
Structure of Asphalt Mixtures



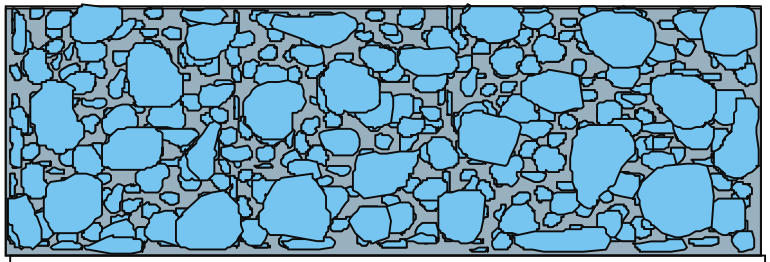
Stone Mastic Asphalt



Porous Asphalt



HRA & Mastic Asphalt



Asphalt Concrete

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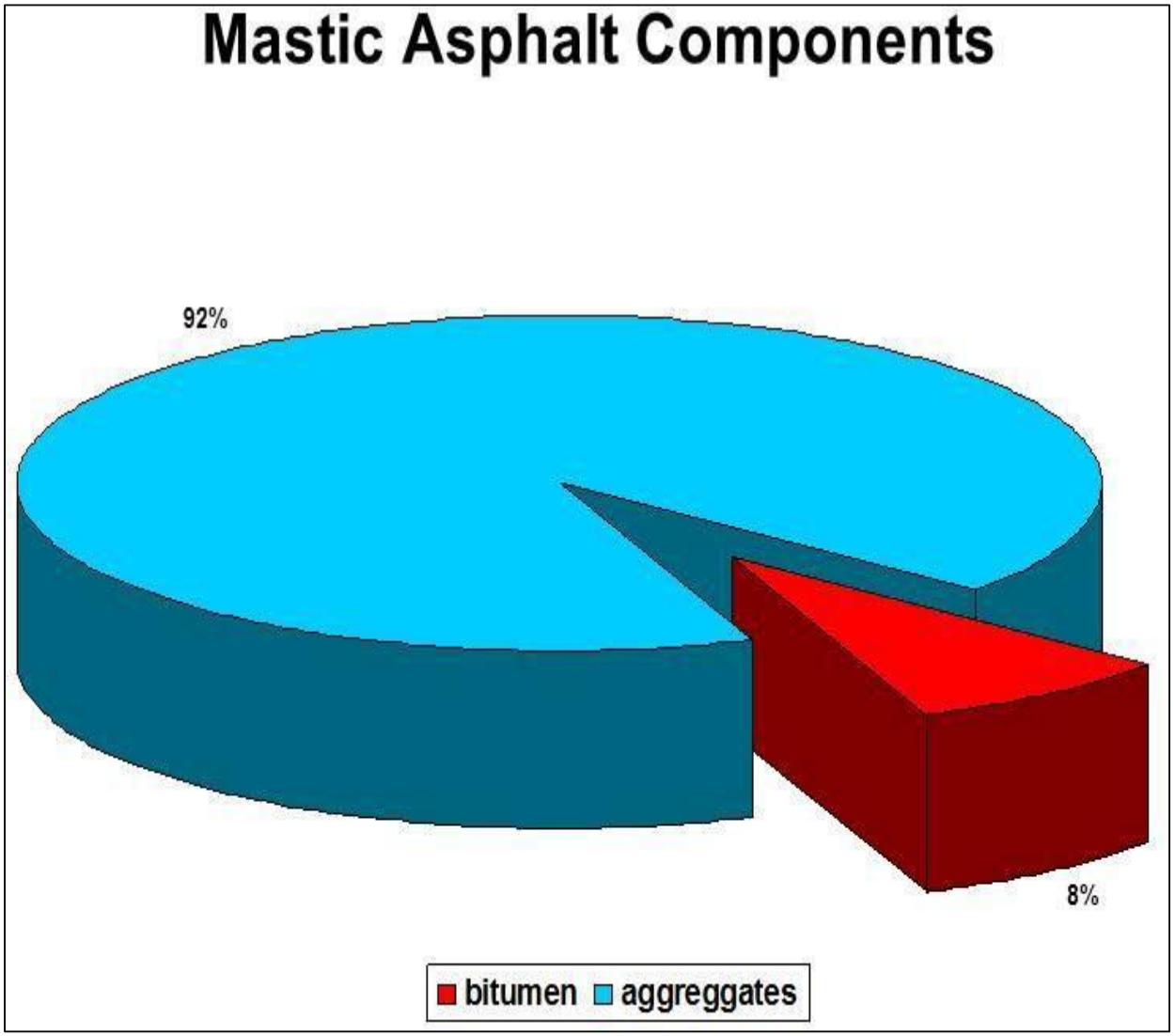
Mastic Asphalt Components



History of Mastic Asphalt.

Mastic Asphalt is one of the oldest construction products, and the oldest waterproofing and road surfacing material, in use for centuries.

Mastic Asphalt was the first asphalt mixture used for road pavements.

Hand-laid Natural Rock Asphalt was first applied successfully as a covering for footways in Paris in 1835.

A material that can boast a history dating back to Greece a thousand years ago, the product was patented for use in Britain & Ireland by Richard Claridge in London and Dublin in 1837 & 1838 and the ***natural rock mastic asphalt*** became known as *Claridge's Patent Asphalt*.

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South of Ireland Asphalt Company (SIAC)

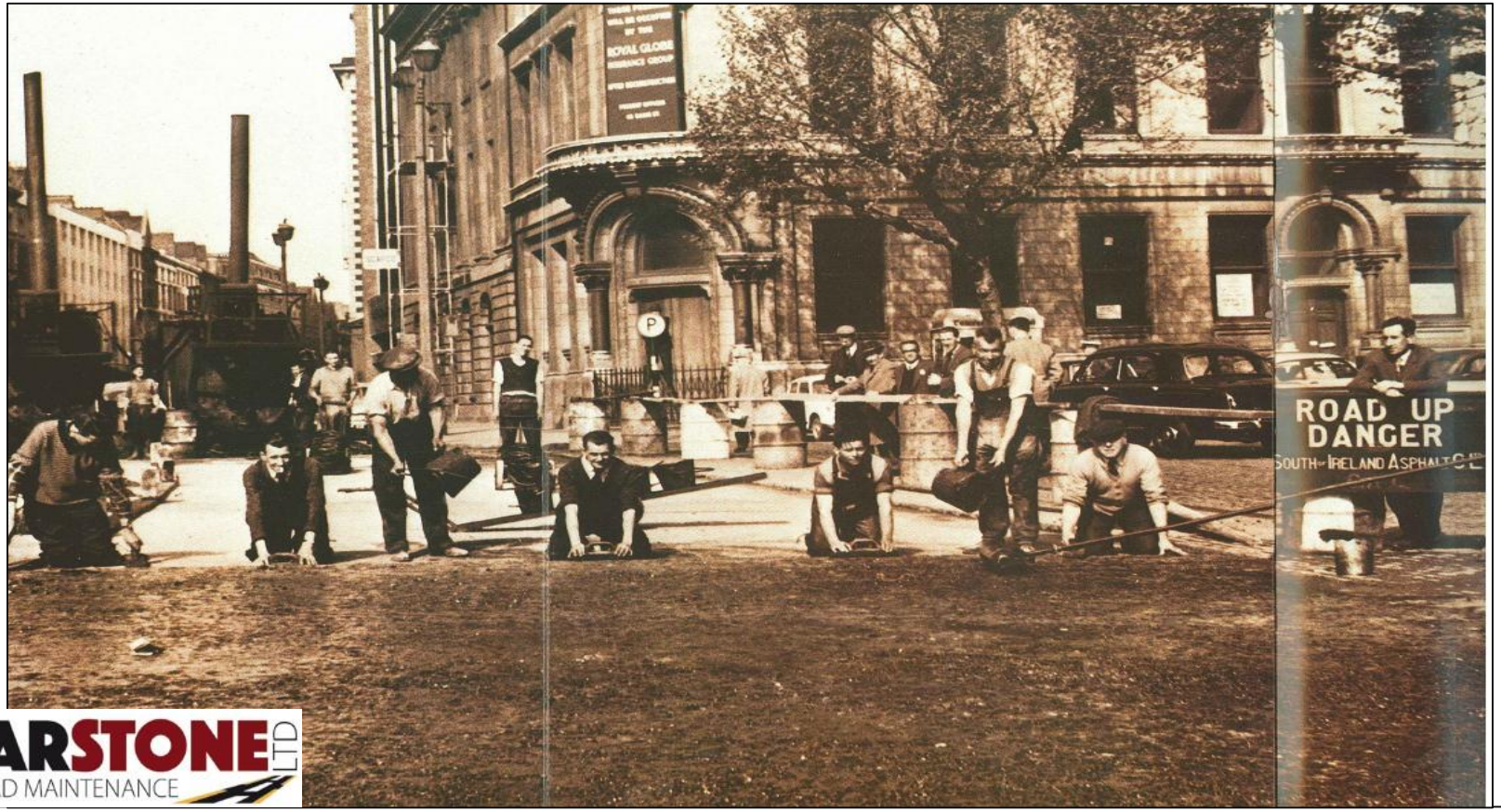
Laying Mastic Asphalt by hand floats in College Green, Dublin circa 1950's.

Note the two large mastic asphalt mixers in the background.

Drums and planks used as pedestrian barriers.

Buckets used for transportation of material from mixer to laying area.

Roller with long handle for pre-coated chipping embedment.



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Mastic asphalt plant was located in Clondalkin Co.Dublin.

Timeline of Standardisation for Paving Mastic Asphalt in Ireland.

BS 1446:1948 Mastic asphalt ***(natural rock asphalt aggregate)*** for roads and footways

BS 1447:1948 Specification for mastic asphalt (limestone fine aggregate) for roads and footways

BS 1446:1962 Mastic asphalt ***(natural rock asphalt aggregate)*** for roads and footways

BS 1447:1962 Specification for mastic asphalt (limestone fine aggregate) for roads and footways

BS 1446:1973 Specification for mastic asphalt ***(natural rock asphalt fine aggregate)*** for roads and footways

BS 1447:1973 Specification for mastic asphalt (limestone fine aggregate) for roads and footways

BS 1447:1988 Specification for mastic asphalt (limestone fine aggregate) for roads, footways

EN 13108-6:2016 Bituminous mixtures. Material specifications. Mastic Asphalt

The NSAI or BSI have not included Part 6 of the European Standard in National Guidance publications.

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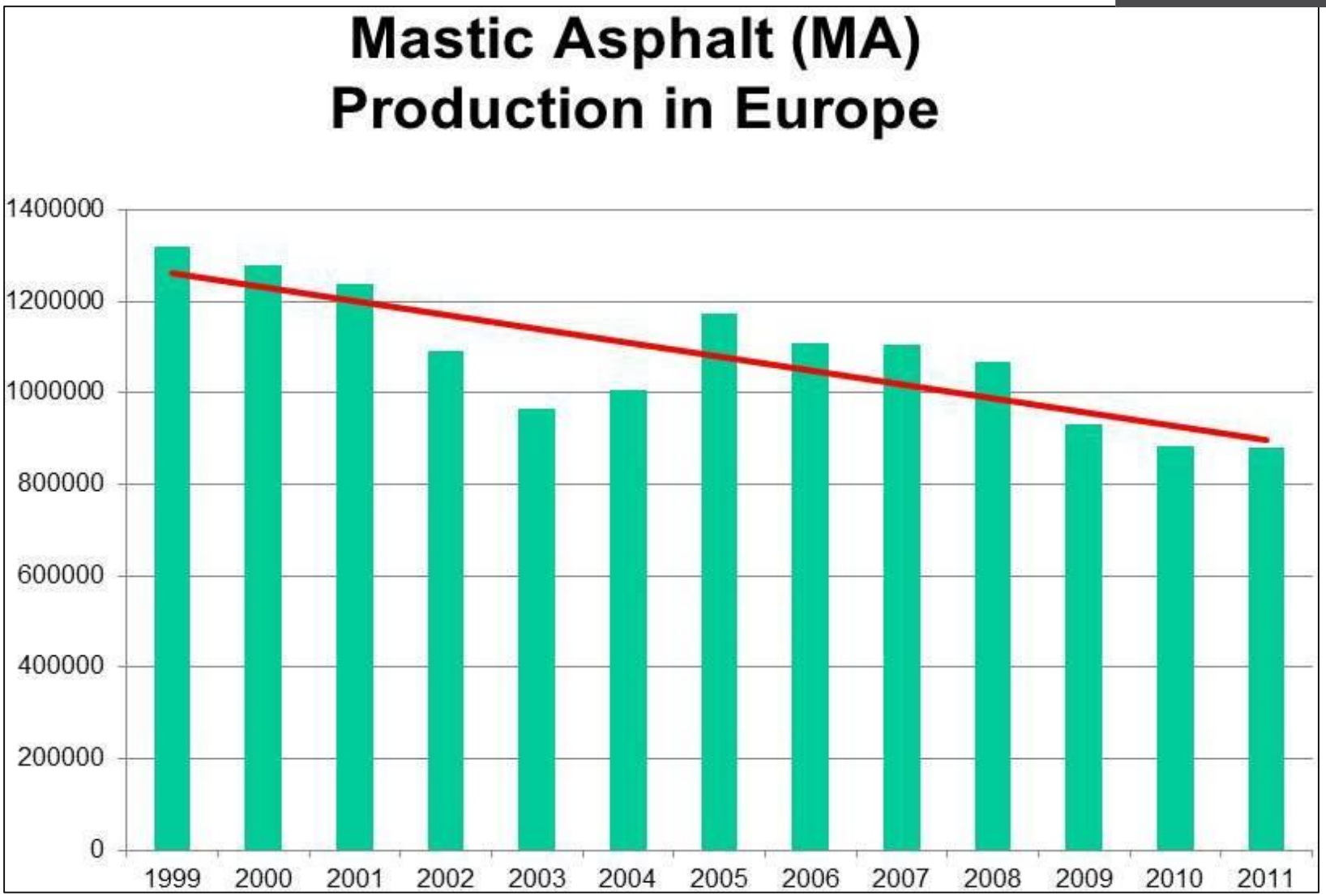
Mastic Asphalt (MA) Production in Europe



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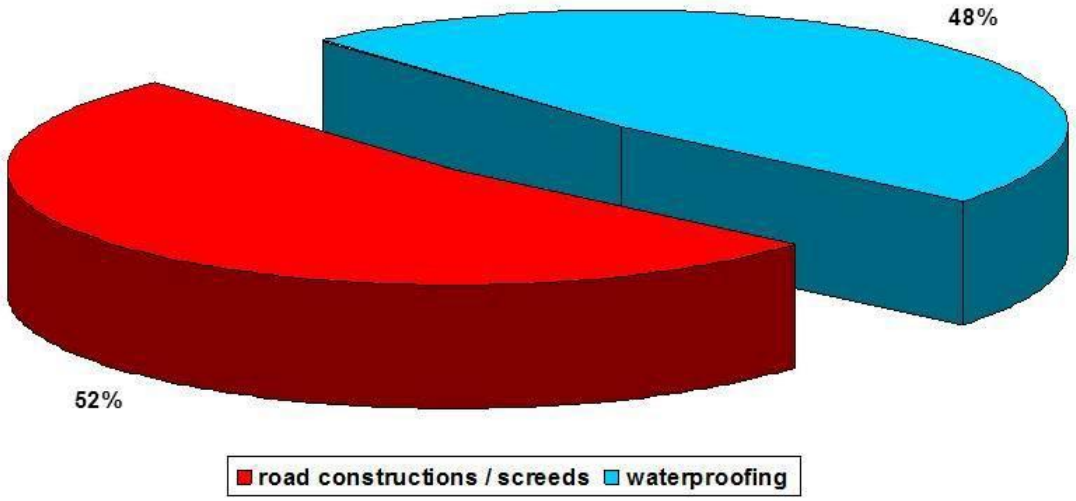
Mastic Asphalt Application Fields



Selection of the type and grade of bitumen is important because mastic asphalt is essentially a mortar of binder and aggregate and filler. (similar to HRA).

The grades may be:

Paving grade (EN 12591)

Hard grade (EN 13924)

Polymer modified (EN 14023)

May contain additives
(to lower application temperature)

May contain natural asphalt
(e.g. Trinidad Lake Asphalt)

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Mix design considerations for EN mixture

Mixture should be similar to existing BS mixture

Mixture should be suitable for high road temperatures and heavy traffic

Bitumen grade and content are important factors

A PMB 25/55-60 was selected because of proven performance

The target bitumen content was selected at 9.5% after considering workability, coating trials and indentation values

Modifier	Deformation resistance	Mix Stiffness	Cracking resistance	Ageing resistance	Moisture damage	Workability
PMB25/55-60	✓		✓	✓	✓	✓

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Selection of target grading

EN 13108-6

Table 2 — Overall limits of target composition – basic sieve set plus set 2

D	**4**	**6 (6,3)**	**8**	**10**	**12(12,5)**	**14**	**16**
Sieve mm	Percentage passing by mass						
1,4 *D*	**100**	**100**	**100**	**100**	**100**	**100**	**100**
D	**90 to 100**	**90 to 100**	**90 to 100**	**90 to 100**	**90 to 100**	**90 to 100**	**90 to 100**
2	**50 to 80**	**45 to 70**	**45 to 70**	**40 to 70**	**40 to 70**	**35 to 55**	**35 to 55**
0,063	**20,0 to 45,0**	**20,0 to 40,0**	**20,0 to 40,0**	**18,0 to 35,0**	**18,0 to 35,0**	**18,0 to 28,0**	**18,0 to 28,0**

Where the sieve calculated as 1,4 *D* is not an exact number in the basic set plus set 2 series then the next nearest sieve in the set shall be adopted.

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EN 13108-6

Table 2 — Selected nominal size

D	**4**	**6 (6,3)**	**8**	**10**	**12(12,5)**	**14**	**16**
Sieve mm	Percentage passing by mass						
1,4 *D*	**100**	**100**	**100**	**100**	**100**	**100**	**100**
D	**90 to 100**	**90 to 100**	**90 to 100**	**90 to 100**	**90 to 100**	**90 to 100**	**90 to 100**
2	**50 to 80**	**45 to 70**	**45 to 70**	**40 to 70**	**40 to 70**	**35 to 55**	**35 to 55**
0,063	**20,0 to 45,0**	**20,0 to 40,0**	**20,0 to 40,0**	**18,0 to 35,0**	**18,0 to 35,0**	**18,0 to 28,0**	**18,0 to 28,0**

Where the sieve calculated as 1,4 *D* is not an exact number in the basic set plus set 2 series then the next nearest sieve in the set shall be adopted.

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Target composition of mixture

Sieve designation	Sieve (mm)	Declared target	Conformity tolerances	Conformity limits		
1.4D	8	100	(-2,+0)	98	-	100
D	6	93	(-8,+5)	85	-	98
C.coarse sieve	4	73	(+/-8)	65	-	81
2 mm	2	65	(+/-8)	57	-	73
C.fine sieve	0.5	54	(+/- 6) voluntary	48	-	60
0.063 mm	0,063	29	(+/-4)	25	-	33
Soluble binder		9.5% min	(+/-0.5)	9.0	-	10.0

EN 12697-21

Bituminous mixtures - Test methods for hot mix asphalt

Part 21: Indentation using plate specimens

EN 12697-21: Table 1 - Test conditions

Parameter	Type			
	Test W [a]	Test A [a]	Test B [a]	Test C [b]
Temperature	25°C, 35°C, 45°C	25°C	40°C	25°C, 35°C, 40°C
Surface of pin	31.7mm ^{2}	500mm ^{2}	500mm ^{2}	500mm ^{2}
Applied load	(311 +/- 2) N	(515 +/- 3) N	(515 +/- 3) N	(515 +/- 3) N
Duration of loads application	70s	6min	31min	31min
Measuring between	10s and 70s	1min and 6min	1min and 31min	1min and 31 min

a The test W, A and B concerning mastic asphalts are used for paving and roofing layers.

b The test C concerning mastic asphalts is used for floor-screeds and in-situ floorings in buildings and certain paving applications.

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EN 12697-21

Bituminous mixtures - Test methods for hot mix asphalt
Part 21: Indentation using plate specimens

EN 12697-21: Table 1 - Test conditions selected

Parameter	Type			
	Test W [a]	Test A [a]	Test B [a]	Test C [b]
Temperature	25°C, 35°C	25°C	40°C	25°C, 35°C, 40°C
Surface of pin	31.7mm ^{2}	500mm ^{2}	500mm ^{2}	500mm ^{2}
Applied load	(311 +/- 2) N	(515 +/- 3) N	(515 +/- 3) N	(515 +/- 3) N
Duration of loads application	70s	6min	31min	31min
Measuring between	10s and 70s	1min and 6min	1min and 31min	1min and 31 min

a The test W, A and B concerning mastic asphalts are used for paving and roofing layers.

b The test C concerning mastic asphalts is used for floor-screeds and in-situ floorings in buildings and certain paving applications.

Type test selected for paving mastic asphalt : Test W
Temperature: 25° C and 35° C
Conformity limits: 25 maximum @ 25° C
60 maximum @ 35° C

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CE Marking Certificate for Roadmastic Paving Mastic Asphalt

CE

0050

Tarstone Road Maintenance Contractors
Deanhill
Hayestown
Navan
Co. Meath
14
0050-CPR-0281

IS EN 13108-6 2006 + AC 2008
Mastic Asphalt
For use on roads, airfields and other trafficked areas
MA 6 25/55-60
Surface course
Deanhill plant
Mix number 139

Product Type: Bituminous material **DOP No. 271114**

General requirements **Grading**	**Sieve**	**Per cent passing**
	8mm	100
	6mm	93
	4mm	73
	2mm	54
	0,063mm	29
Binder content	Binder content, B_{min}	9.5%
Resistance to abrasion by studded tyres	NPD	
Reaction to fire	NPD	
Temperature of mixture	170°C – 220°C	
Indentation EN 12697-21 **Test W at 25 °C** **Test W at 35 °C**	 25 maximum 60 maximum	
Dangerous substances	NPD	

Note: **This CE marking covers only those properties included in Table ZA.1 of the relevant harmonised EN product Standard (i.e. harmonised/mandated properties).**
Information regarding other properties of this Product Type is available on request.

Modern Mastic Asphalt Production Plant - Germany

Modern Mastic Asphalt Paving Machine - Germany

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Modern Mastic Asphalt Paving Machine - Germany

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Modern Mastic Asphalt Paving Machine - Germany

Modern Mastic Asphalt Paving Chipping Spreader - Germany

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Mastic Asphalt Production Plant - Ireland

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Mastic Asphalt Production Plant - Ireland

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Mastic Asphalt can be delivered from the main production plant to site in a hot charge delivery tipping truck - Ireland

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Mastic Asphalt Mixer / Tipper Truck - Ireland

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Mastic Asphalt Mixer / Tipper Truck - Ireland

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Mastic Asphalt is manufactured and packaged into blocks for heating up and mixing on site.

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Mastic Asphalt is pourable.

The German word ‘gussasphalt’ means ‘poured asphalt’

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Mastic Asphalt on bridge decks – Kessock Bridge Inverness Scotland

Object	Kessock-Bridge
Location	Inverness, UK
Date of completion	2013 - 2014
Area	22'000m2
Works	MA protecting and binder course, MA surface course

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Mastic Asphalt paving has demonstrated to be particularly suitable as a result of its visco-elastic properties.

By installing relatively thin pavements it becomes possible to economically design and build bridges, because the permanent load of the paving is restricted.

Mastic Asphalt Hot Charge Mixer Trucks – Kessock Bridge Inverness Scotland

Paving machine running on rails

Note the skid resistant precoated chipping or fine aggregate embedment roller to the rear of the paving machine.

Machine Laid Mastic Asphalt in Paris.

Hong Kong-Zhuhai-Macao-Bridge China 2017

Artificial islands, tunnels and bridges – Length 55 km.

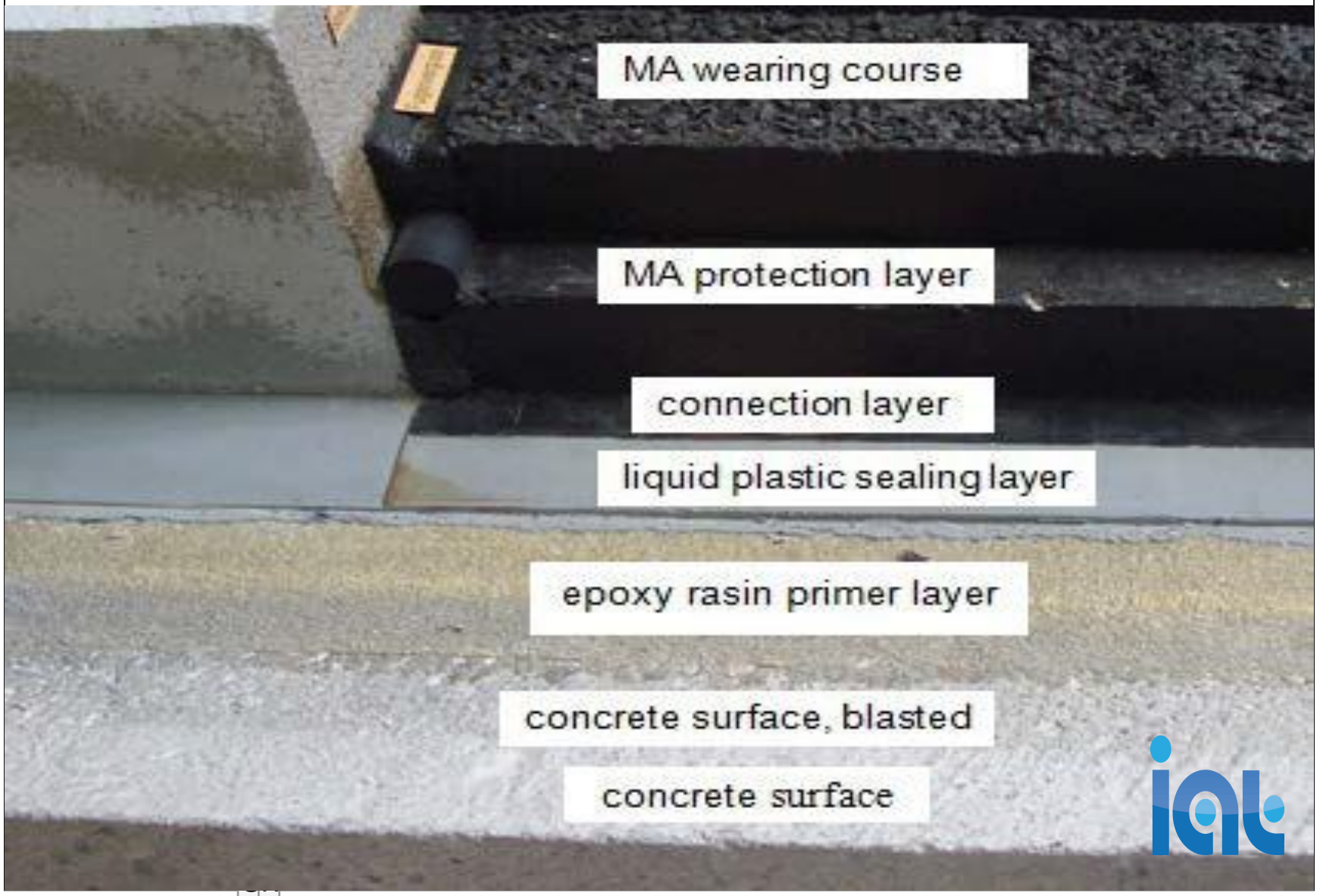
Hong Kong-Zhuhai-Macao-Bridge China 2017

Link length - 55 km – Bridges length - 29 km.

Hong Kong-Zhuhai-Macao-Bridge China 2017

Opening July 2018.

Typical detail for Mastic Asphalt Bridge Deck Waterproofing & Surfacing.



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Samuel Beckett Bridge Dublin

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Supplied and laid by Pure Asphalt Company Lancashire.

Samuel Beckett Bridge Dublin

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Supplied and laid by Pure Asphalt Company Lancashire.

Mastic Asphalt Ironwork Installation and Refurbishment.

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Polymer Modified Mastic Asphalt is increasingly used in Ireland as a reinstatement alternative to hot mix asphalt, particularly around ironworks.

Precoated chippings can be applied to the surface to match surrounding hot mix asphalt although this Polymer Modified Mastic Asphalt product also contains high PSV grit within the mix to improve skid resistance.

The Polymer Modified Mastic Asphalt is heated on site using a mastic asphalt mixer and laid by hand, floated, chipped and finished. Roller compaction is not required. It is good practice to paint the edges of ironwork and surrounding asphalt with a bituminous liquid.

The main advantages of Polymer Modified Mastic Asphalt over hot mix asphalt are:

- Heated on site in quantities as required.
- Left over material can be re-heated.
- No need for rollers or large pieces of plant on site.
- No travelling to or waiting at asphalt mixing plant.

The raw material is delivered on one tonne pallets, with each block weighing c. 12kg.

The product is "Mastic Asphalt for use on roads, airfields and other trafficked areas produced in accordance with EN 13108, Part 6".

Roadmastic Polymer Modified Mastic Asphalt is CE Marked under certificate 0050-CPR-0281.

Backed up by Research.

- Nottingham Centre for Pavement Engineering (Nottingham University) whose findings in their report

  Mechanical Performance of Road Ironwork / Pavement Systems - full scale field and laboratory trials

- The report states that "The use of flexible material in the manhole construction was found to reduce the abrupt change in stiffness between the manhole and the surrounding pavement. It helps distribute the displacement over a larger area both horizontally and vertically...

Backed up by Research.

...as well as significantly decreasing the tensile strain on the top surface of asphalt layer, near the manhole cover. Hence, the development of cracks and eventual failure of the pavement near the manhole is reduced."

An important aspect of the road ironwork installation is the reinstatement around the frame and cover..

It adds that..

"Mastic asphalt surface reinstatement is effective in improving the load response over the transition from pavement to ironwork"

Mastic Asphalt Bridge Joints.

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Ennis Farmers Market - Mastic Asphalt infill.

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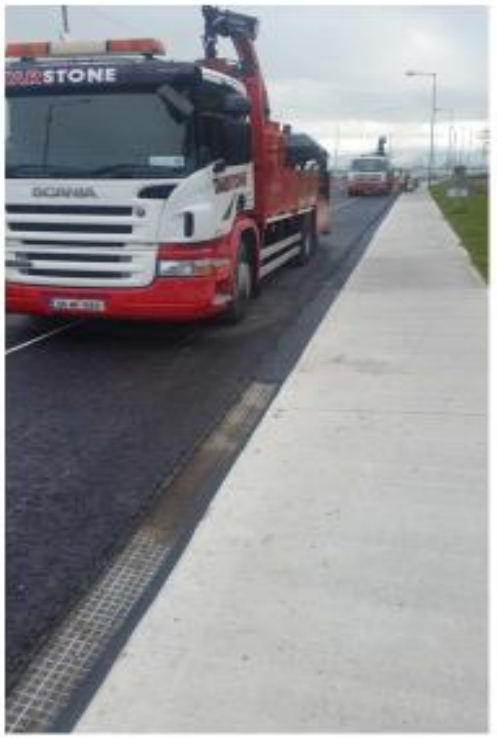
Mastic Asphalt Channels.



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Mastic Asphalt Channels

Dublin Port - Crane Rails.

Luas Cross City

Mastic Asphalt Patching

Imprinted Mastic Asphalt.

Thank You.

Any Questions.