Shell Bitumen

LOW TEMP CLEAR BITUMEN FOR SAFETY AND ENERGY SAVINGS

PROJECT: Markusbierg Tunnel

CITY/REGION: Near the Town of Schengen

COUNTRY: Luxembourg

KEY FACTS:	
Benefits:	■ Better visibility for improved driver safety ■ Reduction in power for lighting ■ High performance ■ Lower working temperatures for reduced emissions
Application:	Markusbierg Tunnels
Product Family:	Shell Mexphalte C LT
Client:	Luxembourg Government

FOR FURTHER INFORMATION

Please contact your Shell Bitumen representative or visit: **www.shell.com/bitumen**

INTRODUCTION TO THE PROJECT

The Markusbierg tunnels are a pair of parallel tunnels that form the most easterly section of the A13 motorway through Luxembourg. They are 1575 metres long and were built at a cost of €65m. Shell Mexphalte C LT was the binder of choice to create a lighter coloured asphalt surface within the tunnels. After 8 years of construction, the tunnels opened to public traffic in 2003.

"When producing coloured asphalt for use in tunnels, other clear binders are available but Shell Mexphalte C is one of the longest standing in its field, is designed to perform to a very high standard and is widely used in materials that have to withstand heavy duty traffic. Alternative clear binders available are suitable for aesthetic use but do not have the proven long history of Shell Mexphalte C in this application."

Lee O'nions, Shell Bitumen Technical Manager. UK, Ireland & Nordics

TECHNICAL AND LOGISTICAL CHALLENGES

With a gradient of 5%, safety was a key consideration – the tunnel had to be designed in a way that was easy for drivers to see the road. Conventional black asphalt would have required intensive lighting which would have been costly and still not as effective as a lighter coloured material in terms of visibility.

THE SOLUTION

Clarity per pavement type

Pavement Type	Clarity Value
Asphalt, dark aggregates	0.13
Normal asphalt	0.15
Concrete, dark cement	0.18
Asphalt, clear aggregates	0.18-0.24
Concrete, white cement	0.24
Clear asphalt	0.3-0.4

Source: International Commission of Illumination***

Shell proposed a lower temperature polymer-modified synthetic clear binder, Shell Mexphalte C LT, for the project. This product is formulated for lower working temperatures compared to conventional black asphalt, so enabling a consequent reduction in laying emissions and an improvement in worker comfort when operating in a confined space. Decreases in laying temperature of 10-12°C when using the binder have been observed to have reduced emissions by half. By using Shell Mexphalte C LT, the contractor was able to produce a light coloured asphalt, resulting in lighting energy savings and improved visibility for drivers compared to a conventional black asphalt.

THE RESULTS

By using a lighter coloured asphalt, power for lighting was reduced by c. 75kW, a reduction of 40%, totalled to about 400,000 kWh per year of savings. At the time of construction, combined electricity and lighting maintenance cost savings were calculated at c. €55,000 per year. Using less energy contributes to reduced emissions of air pollutants, including CO2, equivalent to 132 tonnes per year**.

Length	No. Lanes	Traffic	Max Speed	Luminance L20	Lfe	Lfi	Ti
1575 m	Two	unidirectional	90 km	3600/2000 cd/m² (west/east)	144/ 88 cd/m²	4/2/1 (day/ evening/ night)	<15%

Table 5: Markusberg Tunnel details

	Black asphalt	White asphalt	Wall
Class	R4	R3	R1
Q0	0.07	0.15	0.22

Table 6: Markusberg Tunnel calculation for tunnel lighting parameters

	Black asphalt				White Asphalt			
	Type	Power (W)	Qty	Total (W)	Type	Total (W)	Qty	Total (W)
Inside	FL58	116	1092	126672	FL58	58	1092	63336
Threshold Zone	SONT 400	400	82	32800	SONT 400	400	36	14400
	SONT 250	250	90	22500	SONT 250	250	104	26000
	SONT 150	150	46	6900	SONT 150	150	66	9900
				188872				113636

Table 7: Lighting calculations were conducted for this tunnel to compare a light coloured asphalt versus black asphalt

References:

Brandt, H. C. A. and De Groot, P. C.,"A laboratory rig for studying aspects of worker exposure to bitumen fumes." American Industrial Hygiene Association Journal (1999), 60(2), 182-190.

P13, CETU Guide* Dossier pilote des tunnels, 4-2 Eclairages".

Mr. Seburger R. Ponts et Chaussées
DCV - Service électro-mécanique- Luxembourg.

**Using methodology calculation from http://www.carbonfootprint.com/calculator.aspx CO2 savings equivalent to 132 tonnes per year.

*** Ministere De L'equipment, Des Transports Et Du Logement
Direction Des Routes
Dossier Pilote des Tunnels equipement section 4.2 eclairage, Novemeber 2000