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
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INTRODUCTION TO THE PROJECT

The Markusberg 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

<table>
<thead>
<tr>
<th>Pavement Type</th>
<th>Clarity Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asphalt, dark aggregates</td>
<td>0.13</td>
</tr>
<tr>
<td>Normal asphalt</td>
<td>0.15</td>
</tr>
<tr>
<td>Concrete, dark cement</td>
<td>0.18</td>
</tr>
<tr>
<td>Asphalt, clear aggregates</td>
<td>0.18-0.24</td>
</tr>
<tr>
<td>Concrete, white cement</td>
<td>0.24</td>
</tr>
<tr>
<td>Clear asphalt</td>
<td>0.3-0.4</td>
</tr>
</tbody>
</table>

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, 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**.

Table 5: Markusberg Tunnel details

<table>
<thead>
<tr>
<th>Length (m)</th>
<th>No. Lanes</th>
<th>Traffic (n.p.m)</th>
<th>Max Speed (km/h)</th>
<th>Luminance (n.p.m)</th>
<th>Hr</th>
<th>Ll</th>
<th>Ll</th>
</tr>
</thead>
<tbody>
<tr>
<td>1575</td>
<td>2</td>
<td>unidirectional</td>
<td>90</td>
<td>3600/2000</td>
<td>144/7</td>
<td>88 cm²/m²</td>
<td>4/2/1</td>
</tr>
</tbody>
</table>

Table 6: Markusberg Tunnel calculation for tunnel lighting parameters

<table>
<thead>
<tr>
<th>Type</th>
<th>Power (kW)</th>
<th>Qty</th>
<th>Total (kW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black asphalt</td>
<td>150</td>
<td>66</td>
<td>9900</td>
</tr>
<tr>
<td>White asphalt</td>
<td>150</td>
<td>66</td>
<td>9900</td>
</tr>
</tbody>
</table>

References:


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

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


*** Ministère De L’équipement, Des Transports Et Du Logement Direction Des Routes Dossier Pilote des Tunnels equipement section 4.2 eclairage, Novemeber 2000