Granulate Rubber Modified
High Performance Solutions
GRM by CTS

Properties of rubber-modified asphalts and bitumen

according to TL RmB-StB, By compared with PmB A / Bitumen 50/70

The properties of the rubber modification of bitumen and asphalts are very similar to those of PmB A. Because both polymers belong to the same chemical group. It is the group of thermoplastic elastomers.

The properties the thermoplastic polymers (regardless of the origin and structure of the polymers) give to “normal” road construction bitumen are well-known. But which properties are so outstanding specifically in connection with the modification with the polymers from the rubber?

1. Ageing behaviour
    a. Induced by the extremely strong viscosity increase of the rubber modification
    b. *The* key property for particularly thick binding agent films
    c. Higher resistance of the polymers made of natural rubber towards oxidative influence and higher thermal and mechanical stability
    d. Associated with this, significantly higher permanence, i.e.:
        i. longer lay times
        ii. reduced maintenance effort
        iii. extended renovation intervals
        iv. as result: higher economic efficiency
2. Low-temperature behaviour
3. Significantly higher cohesion

In a series of analyses, these properties were confirmed and compared directly with the properties of PmB A.

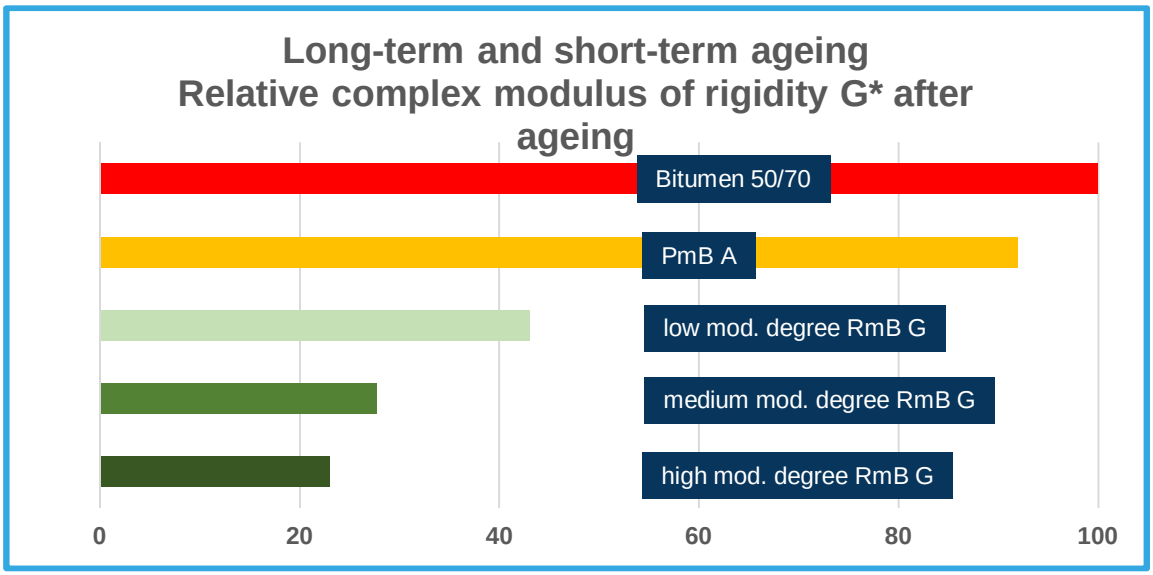
Ageing behaviour

In the laboratory

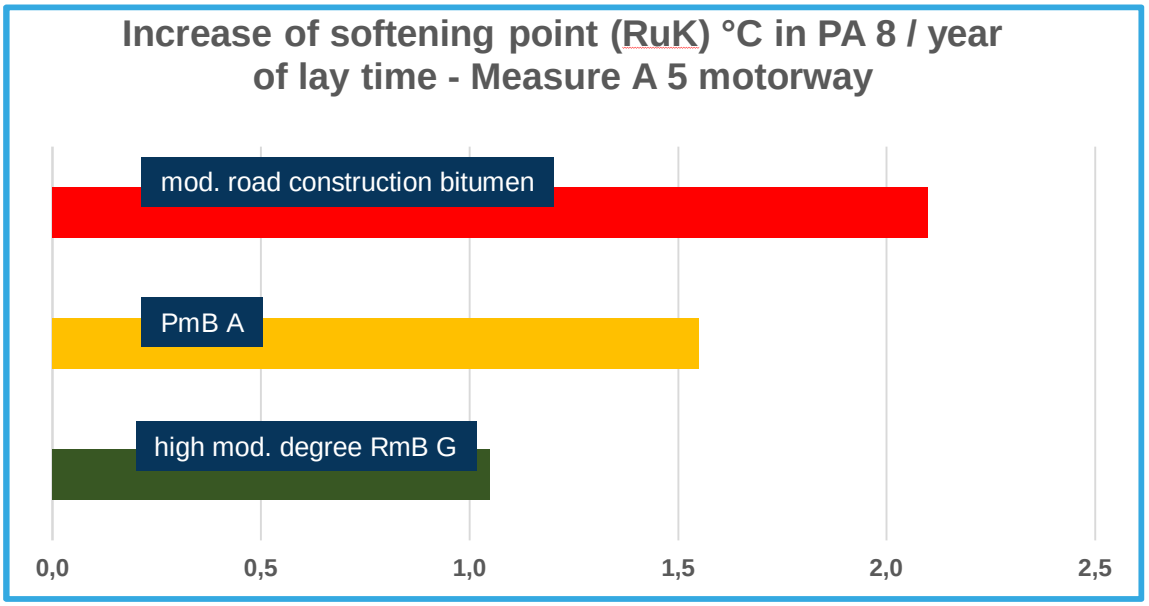
At the PTM Institute (Ingenieurgesellschaft Dortmund GmbH), various binding agents were subjected to artificial ageing as part of a research work. In each case, the ageing includes long- and short-term ageing. (RTFOT and PAV) Subsequently, the complex modulus of rigidity G* (T = 60° C) was determined.

The results are clear. The determination of the modulus of rigidity G* in the case of usual road construction bitumen 50/70 and a PmB A differs significantly from rubber-modified binding agents.

However, there is also a clear trend in the case of rubber modification: “A lot helps a lot.” The higher the respective modification degree, the higher the resistance towards oxidative ageing. In this case, the change to the G* value is determined. Aged product in relation to non-stressed material. The biggest change is experienced by road construction bitumen 50/70. This value was equated to 100%. The other binding agents in relation to it. Conclusion: The rubber-modified binding agent with the highest modification degree experiences the smallest change – i.e. it changes the least.



In a series of DAV events, the results of the 2014 analyses were presented. (RmB G = rubber modified bitumen)



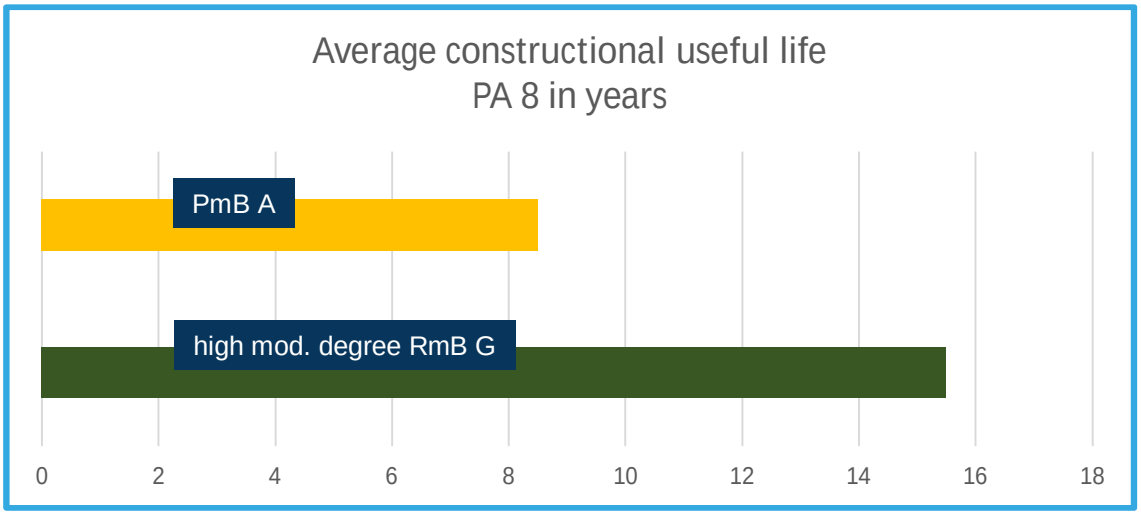
RmB G = Rubber modified Bitumen

In practice

In a test section on the A5 motorway at Raststatt, the increase of the softening point, ring and ball, in ° C per year of lay time after a 10-year lay time was measured.

The analyses were carried out by the Dr Ing. Gauer Institute (IFB) in Regenstauf.

These analysis results were confirmed by measurements of the LfU, State Office of the Environment in Augsburg. Here, more favourable values were even determined for the increase in the softening point in PA 8. (Values from different construction measures: 0.7 to 1.0 °C increase in the softening point (RuK) / per year of use duration, CTS GRM 40/20)



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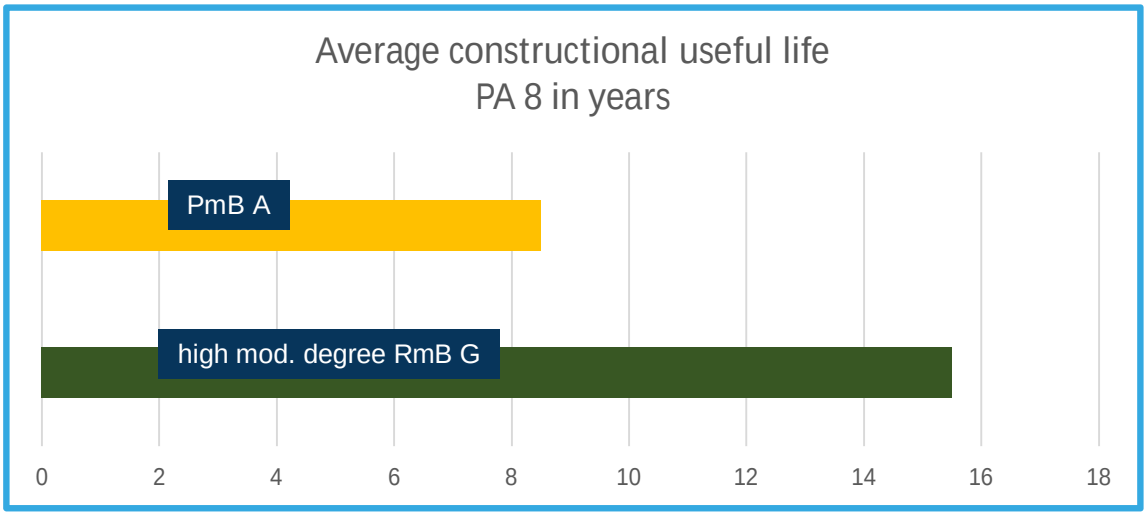
In accordance with the measurements of the hardening per year of lay time, the average constructional useful life of PA 8 stands. A variety of individual measures can be used to derive an average useful life of the variant with rubber modification of 15.5 years. PmB A, on the other hand, has an average lay time of only 8.5 years.

A reason why OPA roads are tendered and designed only as rubber-modified in Bavaria (currently with GRM 40/20) and in Baden-Württemberg.

The average lay times are based on extensive market analyses and/or knowledge of many measures.

Explicably (lower influence of aerial oxygen), the resistance towards ageing performs much more favourably in the case of PmB in closed asphalt structures. Example: asphalt concrete. However, in the case of rubber modification the outstanding resistance towards oxidative influences remains visibly intact. Ultimately decisive, however, is the considerably longer possible use of the rubber-modified asphalt concretes.



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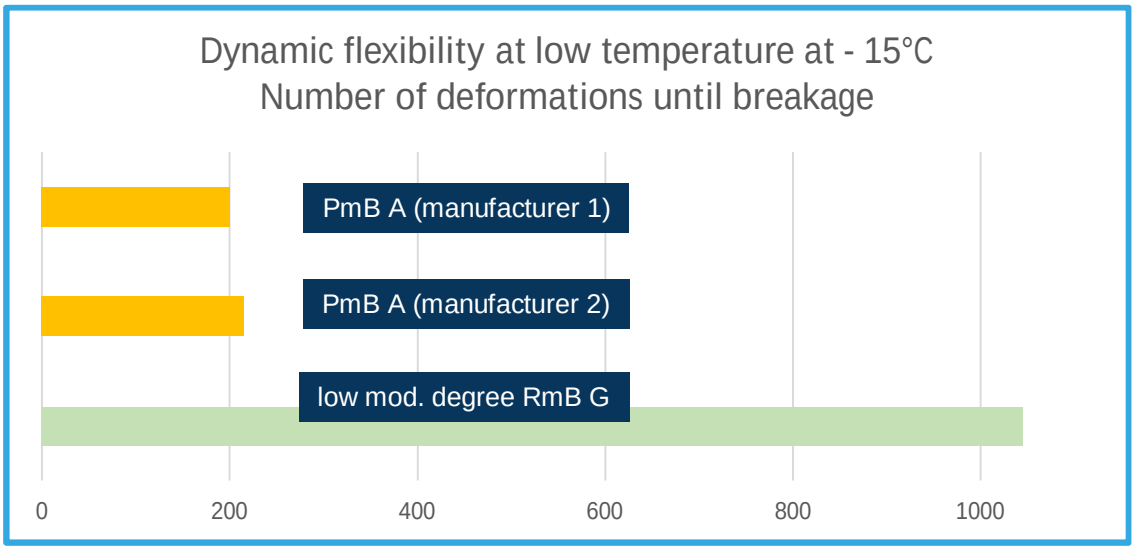
Low-temperature behaviour

A particular test is addressing the fatigue behaviour at low temperatures. Here, the testing institute IFTA GmbH used a modified breaking point apparatus according to Fraaß and deformed the test sheet at – 15 ° C up to the breakage of the bitumen layer. Rubber modification set standards in this “dynamic low-temperature trial”. It comes to 5-times the quantity of deformations compared to a traditional PmB A.



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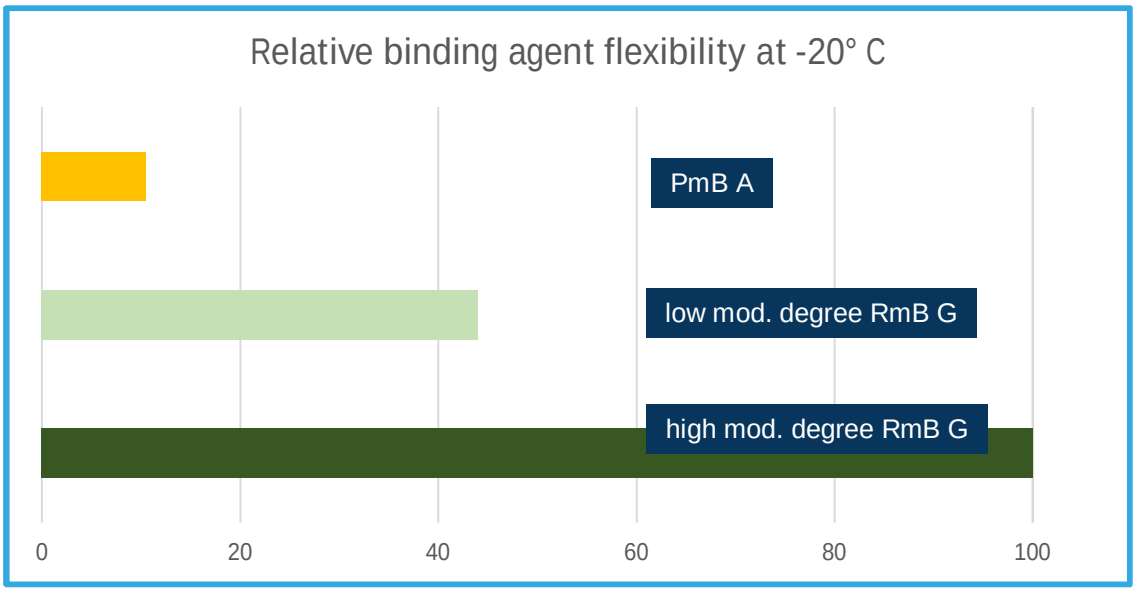
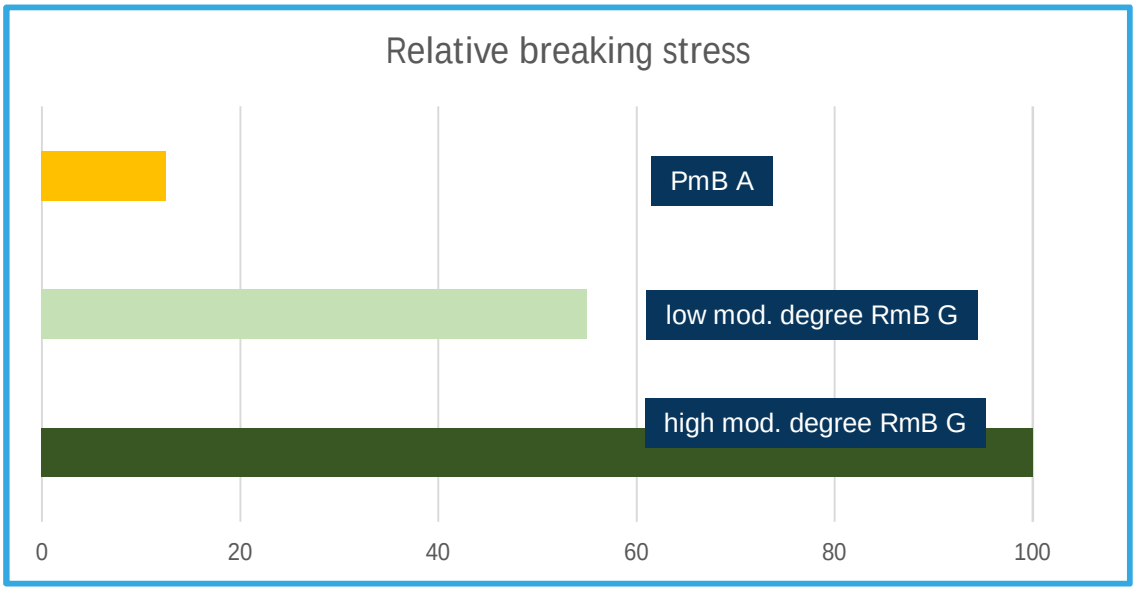
The binding agent flexibility and breaking stress were determined based on the testing of joint sealing compounds. (Standard: SNV 671 and 625a) - comparison PmB A (test report IFTA-GmbH No. 88417)





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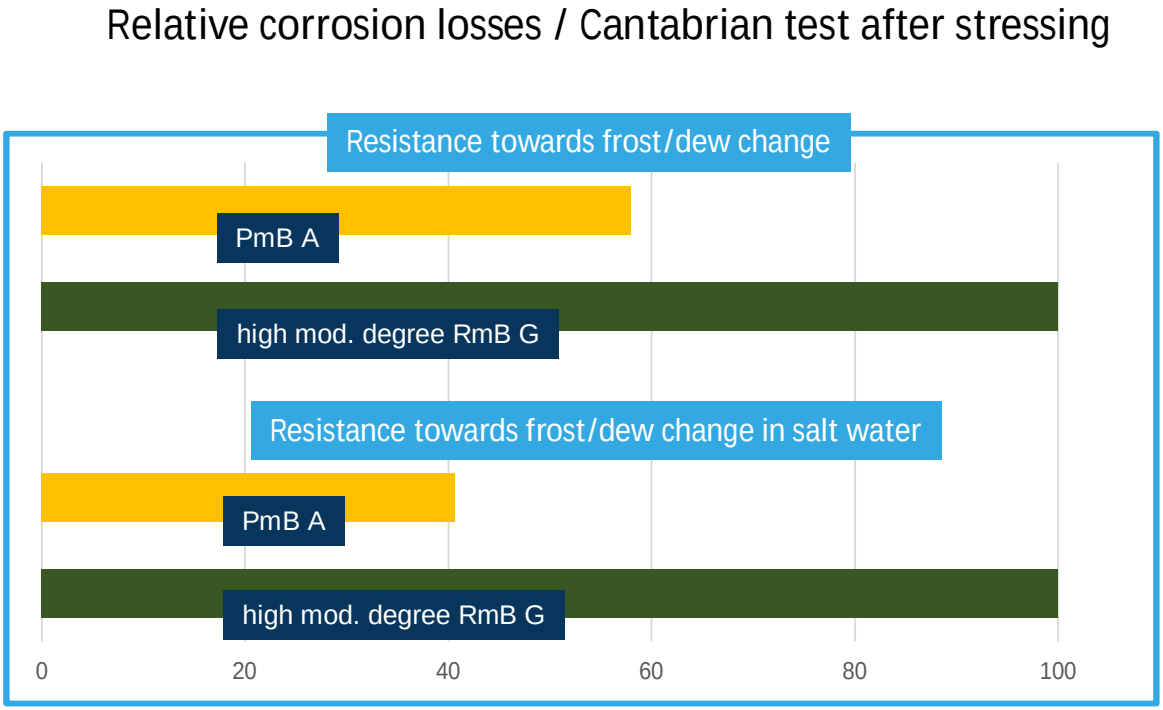
As a conclusion, the report forecasts a considerably more favourable behaviour in practice of rubber-modified binding agents in the long term compared to PmB A when used in PA 8. In the presentation of the measurement results, the best values were achieved by a rubber-modified binding agent with a high modification degree (equivalent to 100%). In relation to it, the results of the other binding agents were presented graphically.

Cohesion

In order to determine cohesive forces of the binding agent, the performance of the Cantabrian test has established itself in many countries. Here, the corrosion behaviour of Marschall

test bodies is determined in the Los Angeles drum. Additionally, the test bodies can be stressed in advance of the measurement. In analysis report 900501 of IFTA GmbH, the test bodies were stressed by means of frost-dew change and additionally through storage in dew-saline solution.



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It remains to be noted that a less strong differentiation of the test results is to be observed without further stressing. Conversely, however, the advantageousness of rubber modification also becomes particularly clear in the case of stronger stressing.

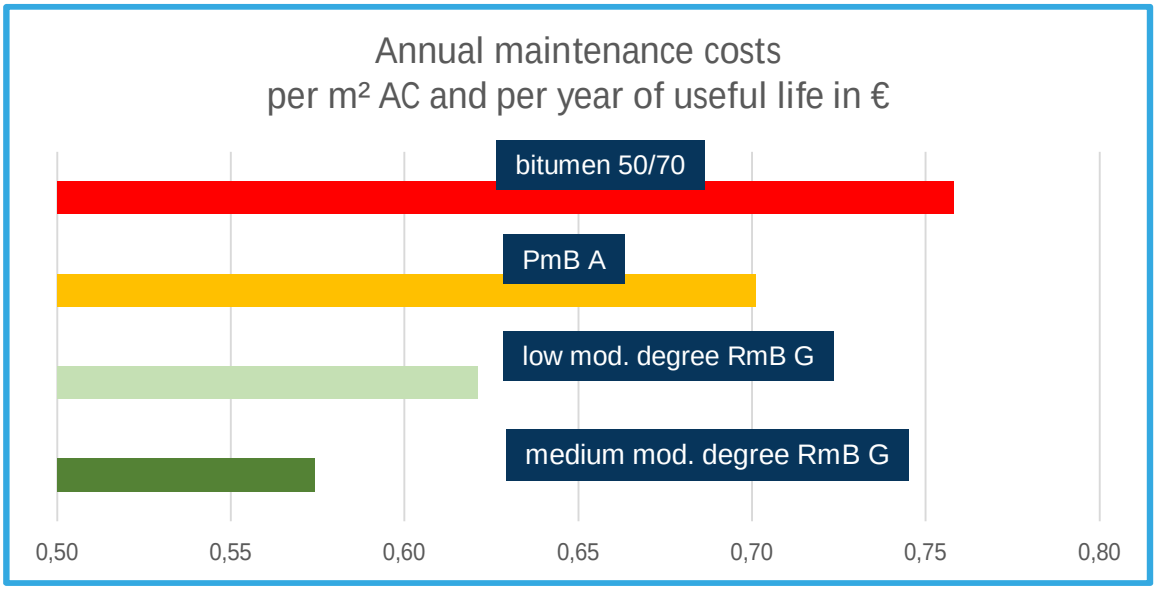
And here the rubber-modified binding agent with a high modification degree was set as the benchmark (corresponds to 100% of the possible resistance towards corrosion in the Cantabrian test after different stressing).

Economic efficiency

A higher ecological sustainability can also be derived from the established significantly longer useful lives of the rubber-modified asphalts. There was already a reaction in the case of the PA asphalts. A use of PmB has been ruled out in Baden-Württemberg and Bavaria. The big question is: What about closed asphalt layers? Is a higher efficiency to be accounted for there as well?

Example of asphalt concrete: An AC with bitumen 50/70 and an assumed useful life of 12 years serves as a reference point. (Knowing well that this has not always been achieved in

recent times), in the case of PmB A a use of 14 years is assumed, 16 in the case of rubber modification with a low modification degree and 18.5 years with a medium modification degree. Real production, transport and installation costs were taken into account in the calculation. Not, however, costs for the setup of a building site. The costs were calculated as m² of installed asphalt concrete / year of useful life in €.



The statement of Prof Schmuck of Munich University has lost none of its meaning to this day: Only roads that last long are the most economically efficient.

R. Reiter

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