Characterization of joint sealants through an innovative test procedure

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ABSTRACT

Joint sealants are indispensable components of jointed plain concrete pavements (JPCP), which is the standard construction method in Germany. During their service life, the joint filling system is subjected to various loads, which in practice leads to a regular renewal of the sealing after about 7 to 10 years. Nevertheless, it needs to be ensured that the joint sealant shows an adequate durability, since it is a crucial element for the life cycle costs of concrete pavements.

Against this background, current problems with hot-applied joint sealant compounds were analysed and subsequently a holistic test procedure was developed within this BASt funded research project. This test procedure uses a scientific approach to depict the decisive effect on the overall system “joint”, considering the cut concrete joint flanks, the primer and the joint sealant. This approach allows a reliable and more realistic characterization of joint sealants. In addition to the horizontal and vertical stress (static/cyclic), various aging influences in the joint system were included. Within the different investigated variations, the joint sealants were subjected to long-term aging (temperature conditioning) and the specimens were subjected to UV-conditioning as well as freeze-thaw cycles. After conditioning, the residual tensile strength was assessed in a tensile/shear test with and without prior cyclic loading. Herein, a significant influence of the entire ageing process on the overall system “joint” became apparent. The additionally determined rheological properties of the joint sealants before and after aging by means of the dynamic shear rheometer also confirmed the material changes due to the artificial aging. Furthermore, the artificially achieved aging in the laboratory was compared with in situ aged and extracted samples. A reliable correlation was established between in-situ and laboratory specimens.

Taking into account the systematic tests on laboratory and in-situ samples, an initial evaluation method was developed that enabled an evaluation of joint sealant compounds using scientifically based parameters and limits in their original reference state and in their artificially aged state. The characteristic parameter was established as expansion at 80% of maximum tension in the declining stress branch.

Through a holistic characterization of the joint system and the joint sealants, including significant aging effects, it should be possible to carry out joints much more permanently in the future and thus make the JPCP overall more robust and more economical.