Zukunft Bau

STRUCTURE ABSTRACT

Heading

Proof of wear resistance of surface protection systems in car parks under realistic test requirements

Occasion/ initial situation

The durability of drivable coatings is essential limited by wear stress. Surface protection systems in car parks and underground garages are highly stressed by mechanical influences. The current test methods for qualifying the abrasion resistance of surface protection systems are not realistic because they are borrowed from other fields. In this research project a test method close to reality was developed.

Object of the research project

The research project is divided into five work packages (modules) building on each other. In module A, the existing standardized and non-normatively regulated test procedures were compiled and evaluated regarding to their practicability of surface protection systems in car parks. The standard test methods the “Pendulum method” (DIN EN 660-1), the Taber method (DIN EN ISO 5470-1), the BCA method (DIN EN 13892-4), the RWA method (DIN EN 13892-5) and the wear resistance according to Böhme (DIN EN 13892-3) were compared to each other. These methods simulate the abrasion of materials that are not comparable with a coating system used in car parks. The non-standard test methods, as the Aachener-Ravelling-Tester (ARTe), the Bottroper wheel, the Parking Abrasion Test (PAT) and the Driving Abrasion Test (DAT) were examined more closely. In comparison only the non-normative regulated methods are evidently suitable for testing surface protection systems for car parks. For the research project the PAT and the DAT were selected because the high loads through parking and turning on the coating system can be analysed with these tests.
The following module B deals with the evaluation of the Parking Abrasion Test (PAT) of pilot test. The development of the temperature of the individual coating layers, which are produced by the rotary motion of the test wheel, were checked in this test. According to that, the test method was adjusted. The assessment of the wear behaviour of the coatings was performed by visual inspection and by taking cores according to defined numbers of cycles. For visual inspection, the test surface must be cleaned, photographed and assessed on the basis of its appearance. High wear behaviour followed a core removal, in which the layer structure of the stressed surface was compared to the unstressed one. As soon as the maximum of the load cycles was reached, the samples were classified into the appropriate wear resistance categories. On the basis of the tests it became apparent that this method, using visual inspection, is only suitable for systems with significant wear damage.
In module C, a finite element model was developed that describes the tire-road interaction under various loads. Then, the stress distributions of the tire and the road as well as the surface pressure were calculated as a function of different tire pressures and superimposed loads. The results of the PAT were used as a basis for this.
The main focus of the research work was on Module D. It includes the implementation of the wear tests with the Parking Abrasion Test and Driving Abrasion Test at the University of Kaiserslautern. A total of 16 integrated

systems (OS 8, OS 11a and OS 11b as well as OS 10 and OS 13) of five different manufacturers were tested. The evaluation was performed, similar to module B, using visual inspection and drill cores. In addition, the wear was documented in a non-destructive way by a magnetic-inductive and a laser-based measurement method.
In module E, an investigation plan was developed from the results gathered so far, that should function as a standard template. The parameters as superimposed load, interval time and laboratory climate were determined. There were also compiled evaluation criteria for the evaluation and the classification of the damage categories to ensure better comparability. The new developed testing bench will be a part of section 4 in “Guidelines for the Protection and Repair of Concrete Components” of the German committee of reinforced concrete which are currently being revised.

Conclusion

The aim of this research project was to develop a suitable realistic test method for abrasion testing of surface protection systems of parking decks and evaluate this with non-destructive measurement methods. In the test series, there were carried out two different test methods (PAT and DAT) and several measurement methods to determine the wear of the tested surface protection systems. The experiments showed that the tested systems have different wear resistances. A differentiation of coating thickness and laser scanning is possible. By combining the measurement methods the wear is well quantified and qualified.

Key data

Short title:
Proof of wear resistance of surface protection systems in car parks under realistic test requirements

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Images:

Image 1: Wear of surface protection systems in the range of ramps and curves in a car park

Image 2: Test bench Parking Abrasion Test (PAT)

Image 3: Test bench Driving Abrasion Test (DAT)

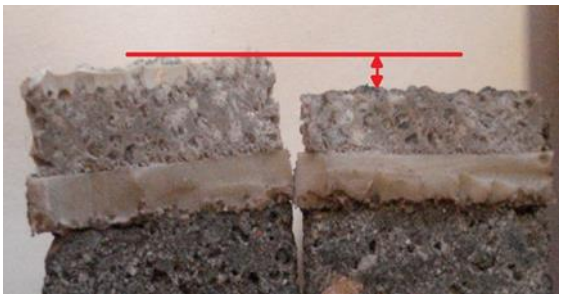

Image 4: Comparison of fine-cuts before and after the test execution. Significant abrasion of the wear layer on the right fine cut visible.

Image 5: Magnetic inductive method – device for coating thickness measurements