SUMMARY

Effect of the type and amount of binder on certain low-temperature properties of Stone Mastic Asphalt containing an increased amount of bituminous mastic (SMA-MA)

This doctoral dissertation deals with evaluation of low-temperature resistance of asphalt mixtures designed for construction of bridge pavements. In accordance the Polish guidelines, only mastic asphalts are an acceptable material for construction of protective layers on bridges. In the recent years an innovative SMA mixture for this application was developed at the West Pomeranian University of Technology, Szczecin, Poland, referred to by the acronym SMA-MA, which contained an increased amount of bituminous mastic. Its advantages include better performance parameters, faster placement on bridges and easier application.

One of the challenges during design and construction of bridge pavements is to ensure problem free operation for as long as possible. For obvious reasons, it is of primary importance to minimise, as far as practicable, any works that could significantly disrupt traffic carried by such bridges. For this reason, surface courses designed for bridges must feature superb durability and resistance to damage to ensure continuity of protection of the bridge deck from corrosion. The specific exposure conditions, including traffic loading and harsh weather make it an even more important issue.

The material under analysis were mixtures designed for construction of protective layers. Generally these were innovative SMA mixtures containing a higher amount of mastic, referred to by the acronym SMA-MA and a conventional mastic asphalt (MA). The test specimens contained different types and, in the case of SMA-MA, also different amounts of bituminous binders. The specimens were subjected to a wide range of temperatures below freezing, applied in a few different uniaxial tension tests. The focus was on describing two parameters: resistance to low-temperature cracking and stress relaxation ability. The Stress Restrained Specimen Test (TSRST) was used to determine the first od them. Rheological properties were determined by measuring stress relaxation times in the Tensile Creep Test (TCT) and Relaxation Test (RT). Maxwell and Burgers models were used for theoretical description of the low-temperature properties under analysis. The evaluation based on the results of RT and TCT tests was performed for three temperatures: -10°C, -15°C, -25°C. The test results and analyses led to the

conclusion that the type of bituminous binder is the primary factor determining the low-temperature performance of the asphalt mixtures under analysis. Generally these were innovative SMA mixes containing a higher amount of mastic, referred to by the acronym SMA-MA and a conventional mastic asphalt (MA) mixture. This is due to much softer bitumens used in SMA-MA mixes. On the other hand, the effect of the amount of bitumen has not been determined definitely. The analysis performed as part of this research allow us to conclude that there is an optimum content of bitumen in terms of low-temperature performance of SMA-MA mixtures.

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