

ABSTRACT

Pavement rehabilitation using enhanced recycled asphalt mixtures started to be developed in the early seventies in USA, forested by the petroleum crisis, which raised strong concerns on both the energetic sustainability issues and on the main fields of application of the petroleum based products, such as the bitumen. This historical reasoning behind the interest on this procedure has, however, lost most of its sense since then, given the world-wide decrease verified on the petroleum prices, and thus on its based products.

Notwithstanding, an increased environmental conscience amongst road administrators in the last years has promoted once again the recycling techniques and has hindered the disposal of road construction waste. Furthermore, the lack of aggregates of adequate quality in some areas has fostered the development of such recycling procedures.

Although there are several techniques to recycle the material reclaimed of the concrete pavement, the hot-in-plant recycling procedure is the one that has biggest potential of development because of its high capability of material re-use, the final product quality and the environmental advantages. These advantages had pushed the constructor companies to invest in hot-in-plant machinery and to increase the machinery stocks to mill the old bituminous mixtures.

The main problem is the lack of specific standards to test and to design hot-in-plant recycled mixtures. At present, it is used the same criteria that applies to conventional mixtures. Envisaging to establish a new methodology allowing to guarantee a suitable performance of the recycled mixtures, the Road Technology Laboratory of the Transport Engineering Department of The Universidad Polit cnica de Catalu a is currently carrying on a comprehensive research programme approaching a complete mechanical characterisation of the different sorts of hot recycled mixtures.

Stone Mastic Asphalt for thin wearing courses or hot discontinuous microconglomerates are found within these mixtures and they will be the subject of this thesis. These are bituminous mixtures containing aggregates with a maximum size of 12 mm, manufactured and placed at a temperature higher than 120 C on medium thickness wearing courses either lower or equal to 3,5 cm. These mixtures are applied on wearing courses which, in spite of not permitting to resolve roadbeds structural problems due to their small thickness, provide or restore their superficial features at a reduced cost as corresponds to its small thickness both contributing to optimise the performance of the roadbed in whole and improving remarkably the comfort and security of the user.

Thus the present thesis is included into the global study of the recycled mixtures though it is focused in the particular case of hot discontinuous microconglomerates. Its purpose is to lay the basis for optimising the service behaviour of roadbeds constituted by a thin wearing course whose materials originating in the pavement recycling. Moreover, the influence of kind and content of bitumen will be analysed since this variable plays a strong hand in the mechanic and functional response of the pavement wearing course.

Methodology has consisted of carrying out three different tests in order to characterise the mechanics of the analysed mixtures, evaluating variables like stability, content of gaps, cracking strength, tenacity and plastic strains resistance. Marshall, Direct Tensile Strength - BTD and Laboratory Wheel Tracking have been the performed tests.

The results achieved in the tests allow us to conclude that both 30% RAP mixtures and 10% RAP mixtures fulfil the established specifications for conventional mixtures and also that the more content of added binder the more flexible mixture with a greater area of plastic strain is obtained.

Finally, one must mention that both strain at break and strain at crack are reduced as the content of RAP is increased. On the other side, rejuvenating agent in the binder makes decrease tensile strength of the mixture and also makes increase maximum strain and breaking specific energy.