Evaluate the Effect of Segregation in Road Materials on Performance of a Road

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Abstract

Gradation is a key parameter when selecting a suitable road material for sub-base, base, and asphalt courses. Selected gradation of the pavement material considerably affects the performance and service life of a pavement. Even though many studies had focused on the effect of segregation in asphalt mix; only few studies found the evaluation of sub-base and base materials. This paper presents research aiming to evaluate the effects of gradation segregation on individual properties in base, sub-base, and asphalt wearing coarse materials. Since segregation in each material may possible in different forms and due to difficulties in simulating in a laboratory as it is to site condition; segregation levels are defined as the difference between segregated and controlled gradations. For sub-base soil; center, lower limit (coarser mixtures), upper limit (fine mixtures), 5% coarse and 5% fine gradations are selected while for base material (Aggregate Base Coarse-ABC) 10% coarse and 10% fine gradations are also selected than that of sub-base. Since simulating of gradual change in segregation of asphalt is difficult; total mix separated through each sieve and individual asphalt coated aggregates blended for Marshall specimens. Then the levels of segregations are found by bitumen extraction tests and those are from fine side 56%, 44%, 34% and from coarse side 15%, 7%, and 6% relative to the trial mix gradation. Based on those segregation levels; California Bearing Ratio (CBR) values and Maximum Achievable Degree of Compaction (DOC) values are observed for sub-base and base materials while cantabro loss and Marshall properties are observed for asphalt wearing coarse. The results are compared to requirements stipulated in Standard Specifications for Construction and Maintenance of Roads and Bridges (ICTAD, 2009). CBR values are gradually decreased from coarse segregation to fine and at 5% fine segregation; CBR drop from the required limit of 30% for sub-base soil. For ABC; CBR values drop from both coarse and fine sides than the center and at 5% fine segregation drops from minimum limit of 80%. Maximum achievable degree of compaction drops from both fine and coarse segregations of ABC; while gradually increase from coarse side to fine side than that of for sub-base. In the case of asphalt, cantabro loss increases from fine to coarse segregation on average. Bitumen content increases gradually from coarse to fine segregation and at both ends exceeds the minimum and maximum requirements respectively. Marshall stability increases at coarse segregation than that of fine segregation and vice versa in the case of Marshall flow values. According to this study; fine segregation (increase of fines) of sub-base and base materials negatively effect to the layer strength. Fine segregation of asphalt leads to corrugation and coarse segregation leads to raveling during the service.

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