

Strength of asphalt emulsion treated marl for road bases

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January 1985

Abstract

The study reports the results of an extensive laboratory investigation designed to evaluate the engineering properties of asphalt emulsion treated marl (AETM) with a view to determining its adequacy for use in road bases. Based on the experimental results and the elastic analysis of multi-layered pavement system, thickness design charts for AETM base courses have been evolved.

The study is broadly divided into three phases. Phase I described in chapter 2, deals with the mix design procedure by which the optimum proportioning for AETM was determined. Marl was blended with 30% wind blown sand to improve its gradation. Portland cement, upto 5% by weight, was also added as a stabilizer to improve the strength characteristics. Illinois method, which makes use of Marshall equipment, was employed for the mix design. Optimum asphalt emulsion content of 14%, yielding residual asphalt cement of 8.2% was arrived at which was found to satisfy the mix design criteria. Phase II, described in Chapters 3 and 4, deals with advanced characterization tests to predict the behavior of AETM under inservice conditions. AETM with 2% and 5% cement additions, hereafter abbreviated as AETM-C2 and AETM-C5, respectively, were subjected to regorous testing, both under static as well as repetitive loading. Indirect split tensile testing on Marshall size specimens as well as repeated load flexure tests on beam specimens 16 in. 3 in. x 3 in. were conducted under varying temperature conditions, simulating the seasonal pavement temperatures in the Kingdom. AETM-C5 mixture showed overall superiority over AETM-C2 mixture and possessed engineering properties comparable to those of conventional hot mix.

Phase III, as described in Chapter 5, deals with the design applications, wherein results of laboratory studies obtained in Phase II were applied to develop thickness design charts for AETM-C5 pavement base courses. BISAR computer package was used to carry out stress-strain analyses of elastic multi-layered pavement system. The critical strain values were applied to experimentally developed repeated load curves to determine critical pvement life from fatigue cracking as well as pavement rutting points of view. Design charts have been evolved which can yield AETM-C5 base thickness, given the subgrade CBR and the design life of the pavement in terms of equivalent 18 kips single axle load applications. Field trials are strongly recommended to verify the excellent laboratory results achieved with AETM-C5. This will help in drafting of final specifications for AETM mixtures.