Comparative Study of Asphalts Modified by SBS and LDPE (LD-LH0075)

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Abstract:
In order to study the performance of SBS modified asphalt and the low-density polyethylene (LDPE), one type of SBS and LDPE and one kind of base asphalts are selected according to SHRP index, and performances of combination of modified asphalt at different percents are evaluated.
The properties of the LDPE-modified bitumen and asphalt mixtures were compared to different contents of styrene-butadiene-styrene (SBS) modified-bitumen. The tests showed that to achieve the same performance, as with SBS-modification, the LDPE-content must be used a bit higher than SBS. 6%-LDPE(LD-LH0075) modification was determined as the most suitable content according to both binder and mixture tests. But LPDE is an internal(Iran) production and a very cheap polymer by comparison with SBS.

Keywords: styrene-butadiene-styrene (SBS), modified-bitumen, low-density polyethylene (LDPE), SHRP index

1. INTRODUCTION:

Asphalt is an organic mixture that is widely used in road pavement due to its good viscoelastic properties [1]. Unfortunately, asphalt becomes brittle at lower temperature and is a liquid at higher temperature, which can result in low-temperature cracking of pavement and high temperature rutting. This temperature susceptibility limits its application. Therefore, in order to enhance the aggregate performance of asphalts, it is necessary to modify asphalts by adding modifiers such as polymer, rubber and clay [2], [3], [4], [5] and [6].
Two classes of polymers, elastomer and plastomer, are typically used in asphalt modification. It has been identified that styrene–butadiene–styrene triblock copolymer (SBS) can obviously improve the mechanical properties and rheological behavior of conventional asphalt compositions [7]. As it is provided with a two-phase morphology consisting of glassy polystyrene (PS) domains connected together by the rubber polybutadiene (PB) segments at the temperatures between glass transition temperatures of PB and PS, SBS shows itself crosslinked elastomer network behavior. Above the glass transition temperature of PS, the PS domains soften and SBS becomes melted to suitable for process. This property of a thermoplastic elastomer has allowed SBS to become one of the promising candidates in asphalt modification [8]. Also there has been modifying asphalt with polyethylene materials, which are a major plastic waste substance, especially low-density polyethylene (LDPE). Polyethylene film is probably the largest volume polymeric product, which has a great demand in very large number of sectors such as agriculture, building, and especially packaging. Almost 70% of the commercial LLDPE and LDPE are used in the form of blown films, cast films, or both [9, 10].

In this study, combinations of tow recycled LDPE(LD-LH0075) and SBS polymer materials were used as asphalt modifiers. The modified asphalts were studied using the Superpave index and has been comparison of results.

2. MATERIALS AND TEST METHODS

Eleven unmodified bitumen samples, including 60–70 penetration grades, and the Superpave testing protocol (ASTM D6373) were used to evaluate the bitumen samples [11].