

## Laboratory Investigation of the Pavement Condition in Lebanon: Implementation of Reclaimed Asphalt Pavement in the Base Course and Asphalt Layer

**Authors :** Marinelle El-Khoury, Lina Bouhaya, Nivine Abbas, Hassan Sleiman

**Abstract :** The road network in the north of Lebanon is a prime example of the lack of pavement design and execution in Lebanon. These roads show major distresses and hence, should be tested and evaluated. The aim of this research is to investigate and determine the deficiencies in road surface design in Lebanon, and to propose an environmentally friendly asphalt mix design. This paper consists of several parts: (i) evaluating pavement performance and structural behavior, (ii) identifying the distresses using visual examination followed by laboratory tests, (iii) deciding the optimal solution where rehabilitation or reconstruction is required and finally, (iv) identifying a sustainable method, which uses recycled material in the proposed mix. The asphalt formula contains Reclaimed Asphalt Pavement (RAP) in the base course layer and in the asphalt layer. Visual inspection of the roads in Tripoli shows that these roads face a high level of distress severity. Consequently, the pavement should be reconstructed rather than simply rehabilitated. Coring was done to determine the pavement layer thickness. The results were compared to the American Association of State Highway and Transportation Officials (AASHTO) design methodology and showed that the existing asphalt thickness is lower than the required asphalt thickness. Prior to the pavement reconstruction, the road materials were tested according to the American Society for Testing and Materials (ASTM) specification to identify whether the materials are suitable. Accordingly, the ASTM tests that were performed on the base course are Sieve analysis, Atterberg limits, modified proctor, Los Angeles, and California Bearing Ratio (CBR) tests. Results show a CBR value higher than 70%. Hence, these aggregates could be used as a base course layer. The asphalt layer was also tested and the results of the Marshall flow and stability tests meet the ASTM specifications. In the last section, an environmentally friendly mix was proposed. An optimal RAP percentage of 30%, which produced a well graded base course and asphalt mix, was determined through a series of trials.

**Keywords :** asphalt mix, reclaimed asphalt pavement, California bearing ratio, sustainability

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