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Evaluation Of Crack Propagation Phenomenon In Bituminous Mix

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Abstract: *Crack propagation was experimentally simulated using semicircular specimen with a crack initiated on one side. The work shows that the rate of crack propagation can be described by a power relationship between the stiffness of the mixture and the number of cycles to failure, which is mixture and binder dependent.*
Keywords - *pavement, gyratory specimens, bituminous, predictive models*

I. INTRODUCTION

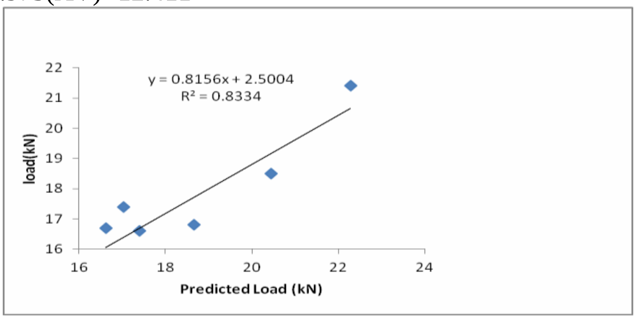
Fatigue cracking generally occurs in the asphalt pavement due to repetition of loads, It includes two steps one is crack initiation another is crack propagation. Once the crack initiated it grows in different direction due to various effect. In order to take any preventive measure we need to find out what are effects that influence the growth of crack. In this paper I have discussed how to measure the crack propagation by semicircular bending test and how different components are affecting the propagation once it's initiated. I have also added lime as additive in order to see the result. Method-Gyratory specimens, 150-mm diameter, were compacted to a height of 63.5 mm and an air void content of 4 ± 0.5%. The circular specimens were then cut along the center diameter of the specimen yielding two semi-circular halves. Each half of the specimen was designated with the same notch depth about 2mm that indicates the crack initiation. The virgin binder utilized has a viscosity grade (VG) of 30. Lime was added as additives 1%, 1.5%, 2% and2.5% of the mixture by mass.

Afterward, specimens were placed under the UTM-25kN and allowed subsequently, and specimens were set up on a three point bending test fixture to perform the test. The fixture has two cylindrical supports of 25 mm in diameter at each end, separated by a 67mm span length. The load-line displacement in the vertical direction was record by the loading actuator. As they started to show up we noted down the load at which crack initiated and then the maximum load up to which the failure of sample occurred. With each percentage there were two samples so we can have two values. After getting the values we had find the average of two and the load was determined.

II. FRACTURE LOAD PREDICTIVE MODEL

The predictive model for the fracture load (F) combining the different asphalt mixtures totaling 48 sample data points is given by the equation below and here the parameters are bitumen, lime, air void.

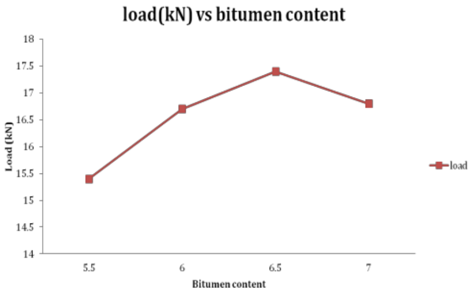
$F= 2.820(B) +3.496(L) +2.973(AV) -12.411$

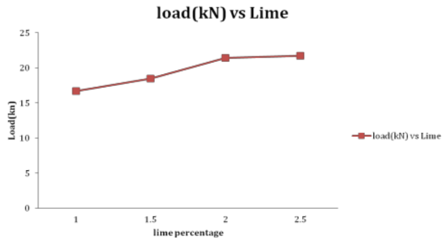


The statistical goodness of fit measures of the model, namely, R^2 adj was 0.8334, the statistical measures were in the very good regime exemplifying that the model can be used to understand the total fracture load of the different asphalt mixtures.

III. SENSITIVITY ANALYSIS OF THE PREDICTIVE EQUATIONS

The sensitivity analyses of the material parameters were performed in this study by varying one factor within its full range while keeping all the other input variables constant. From the figures we can clearly see that at 6.5 bitumen content and at 2.5 lime content the mixture is taking the highest possible load so they are the optimum values.





IV. CONCLUSION

The main objective of this study was to evaluate crack propagation potential of different asphalt mixtures, including different percentage of lime through a simple but rational technique using the Semi-Circular Bending (SCB) test. The SCB test parameters obtained in this study was used to develop crack propagation predictive models based on the various asphalt materials properties. A total of 48 samples were prepared two sample replicates per mix type.

Using the SCB crack propagation test parameters obtained in this study, predictive models were developed based on material properties in case of using those equations to predict crack propagation potential of asphalt mixtures when testing is not practicable.

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