FEM Modeling for Enhancing Fatigue Strength of Asphalt Pavements through an Optimum Tack Coat Layer Insertion

1. Introduction

Interlayer fatigue resistance is crucial for stable asphalt pavements, hinging on strong interlayer bonding. Poor bonding causes cracking, debonding, and deformation, especially from vehicle braking/turning. Tack coats like emulsified, modified, and hot asphalt combat this. Five interlayer bonding types were studied: no tack coat, SBS-modified hot asphalt, SBS-modified asphalt emulsion, epoxy resin, and SK-90 hot asphalt. Shear fatigue was tested using Abaqus software, revealing SBS-modified hot asphalt as optimal. Tack coat thickness (6 mm) also enhanced fatigue life, reducing the rutting depth, and preventing interlayer fatigue failure in the pavement's design life.

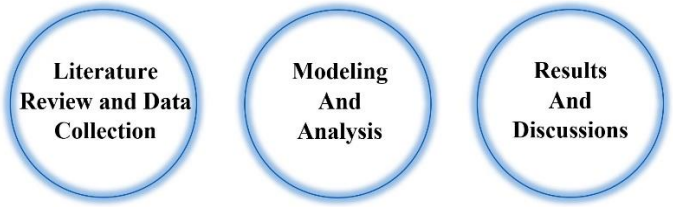
Objectives

- Improving Shear Fatigue Resistance
- Optimal Placement of Tack Coat Layer

Resources Used

SIMULIA ABAQUS MATLAB MENDELEY

Research Methodology



2. Modeling and Analysis

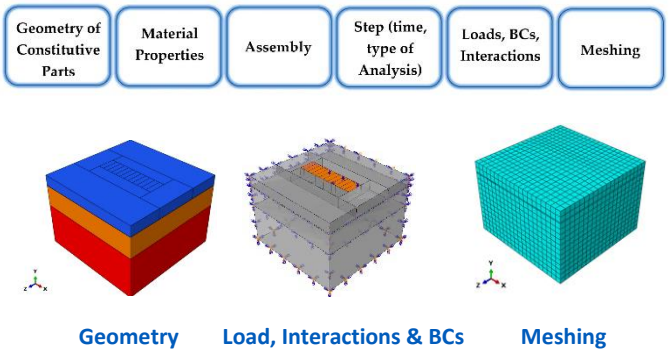
A model was generated in Abaqus without a tack coat and four others with a tack coat layer.

2.1 Description of Model

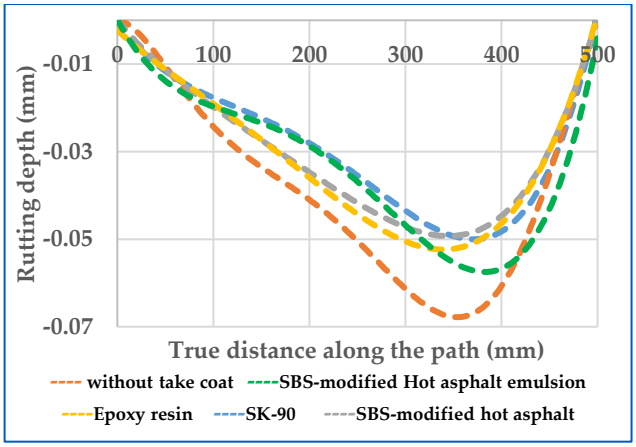
Geometry

Layers	Length (mm)	Width (mm)	Depth (mm)
Asphalt	500	500	50
Tack Coat	500	500	5
Subbase	500	500	100
Sand Dunes	500	500	200

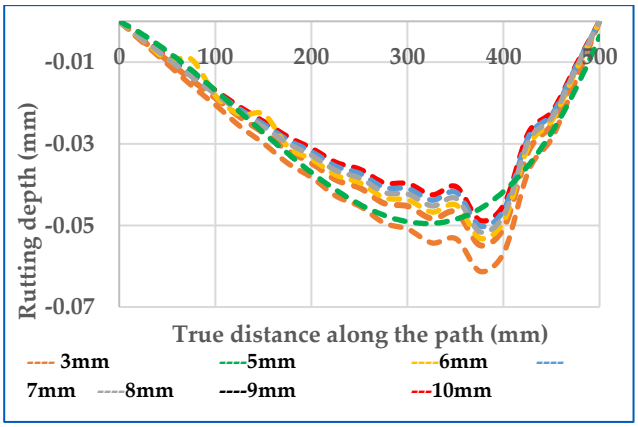
2.2 Modeling steps in ABAQUS



2.3 Results



1 Comparison of rutting depth using FEM.



2 Thickness variation of SBS-modified hot Asphalt.

3. Conclusion

The study highlighted a 3mm thick SBS-modified asphalt tack coat as optimal for reducing rutting depth and improving bonding in pavement design.

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