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Life Cycle Assessment (LCA) and Life Cycle Cost Analysis (LCCA) of Asphalt Mixture Containing Natural Rubber Latex

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INTRODUCTION

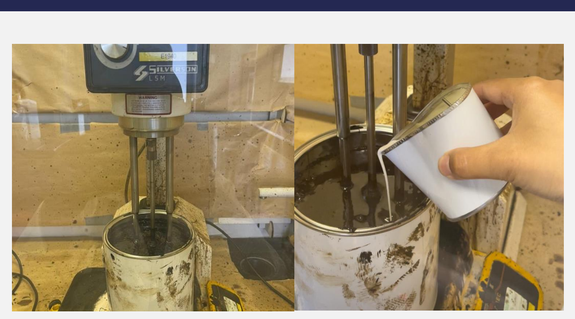
Summary

Natural Rubber Latex (NRL) modified asphalt has several beneficial effects on the asphalt performance. However, research on the life cycle assessment (LCA) and life cycle cost (LCCA) to evaluate environmental impacts and cost of asphalt mixtures containing NRL is not yet available.

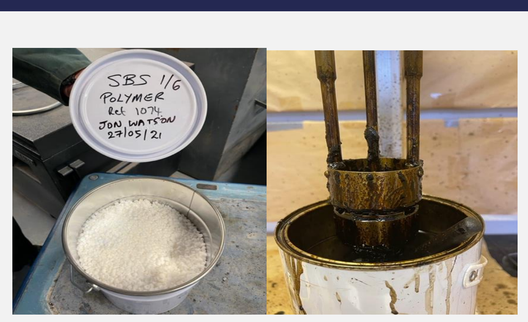
Objective

- Assess pavement performance modelling of NRL compared with unrenewable SBS polymer
- Evaluate LCA and LCCA of mixtures specimen includes all the activities that encompass during pavement lifetime.

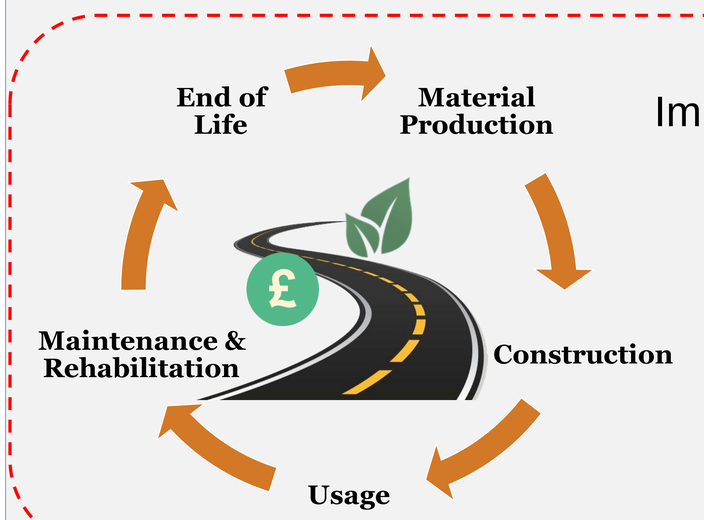
METHODOLOGY



NRL Binder Mixing Process



SBS Binder Mixing Process



Impact Analysis :

- Global Warming Potential (GWP)
- Energy Demand
- Agency Cost
- User Cost

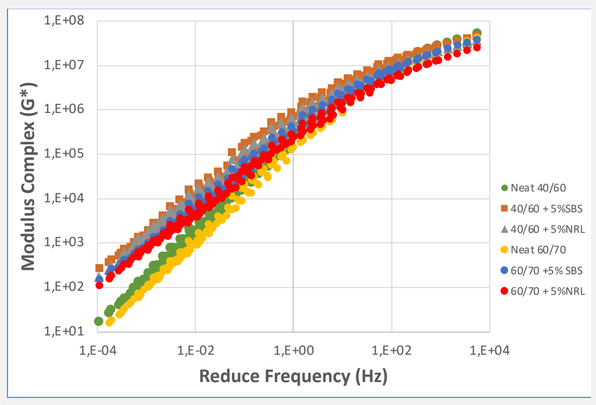
Laboratory Test

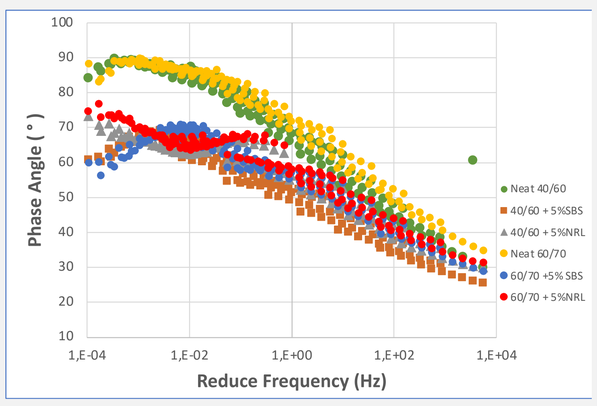
Dynamic Shear Rheometer

Nottingham Asphalt Tester

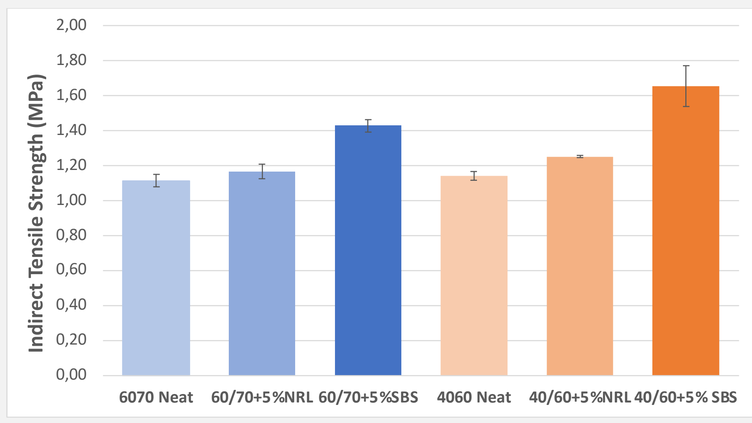
Indirect Tensile Strength

CURRENT WORK

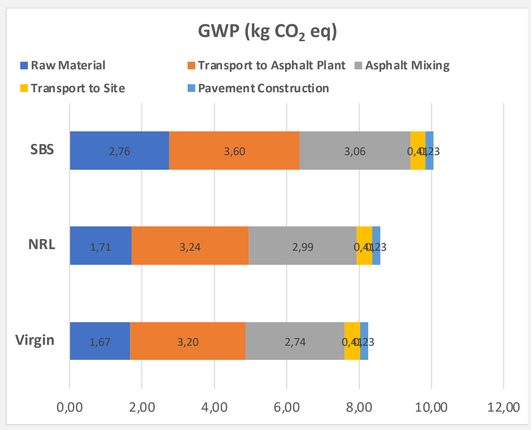


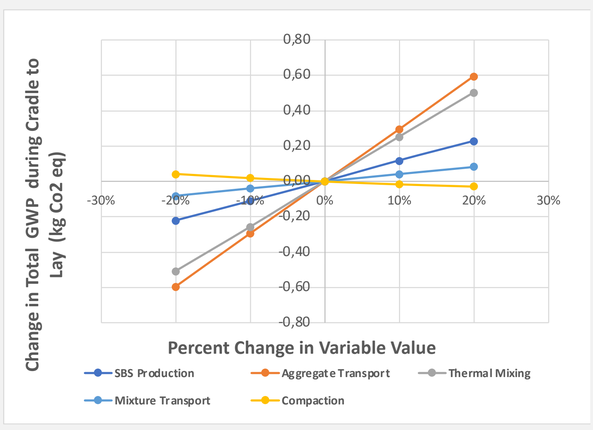


- NRL provides higher stiffness and gives higher elastic response than neat binder, with the value almost the same with SBS modifier.



NRL asphalt mixture has higher Tensile Strength than Neat Asphalt. However, has lower value compare with SBS





SBS has the highest total GWP impact during material production until asphalt construction (A1-A5). Conversely, NRL have low impact on GWP value

In the LCA analysis, Aggregate transportation hold the most sensitive parameter and followed by Thermal mixing parameter.

CONCLUSION AND FUTURE WORK

- In the Laboratory, NRL binder have advantage in terms of cracking and rutting resistant. NRL also have lower the GWP impact compared to SBS during production and construction phase. Long term analysis is required to understand how the mixture would affect the pavement's service life.

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