

# Performance Testing of Hot Mix Asphalt Containing Biochar

Project 1935  
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When the roads and highways across the nation were first paved, their designers could not project the almost endless heavy traffic volumes roads carry today. Pavement are deteriorating before their design life, sometimes creating unsafe situations. Limitations on existing natural materials and the increasing need to produce more environmentally-friendly materials drive national and state agencies to push researches to explore better alternatives. Biochar is a bio-modified binder, by-product of the thermochemical process of converting swine manure into bio-oil, which could be used as an asphalt additive in hot mix asphalt. This study explored the effects of biochar on rutting and cracking resistance along with color degradation on flexible pavement.

*The addition of biochar on HMA mix improved the performance and durability of HMA mix over time.*

## Study Methods

Researchers prepared the hot mix asphalt (HMA) samples with and without biochar according to standard test methods, and conducted the tests. For cracking resistance, researchers conducted a test with Semi-Circular Bend (SCB) test, according to the ASTM D8044, and for rutting resistance, Hamburg Wheel Tracking (HWT) test was conducted according to the AASHTO T324. Similarly, ASTM G155 was followed for color degradation. Researchers then compared the results from the standard test methods of HMA samples with and without Biochar to draw the conclusions.

## Findings

The key findings:

- The addition of biochar helped to attain higher strain energy values for virgin and rubberized mixture after aging.
- Biochar reduced the effect of aging. Thus, aged biochar mixtures achieved higher rut depth (less hardening) compared to the virgin aged mixture.
- Biochar helped to decrease the color degradation of the asphalt mixtures compared to the control mixture.

## Recommendations

The addition of Biochar on virgin and rubberized mixture showed better resistance against cracking and color degradation on the aged mixture. Biochar can be used to increase the performance and durability of the HMA mixture. Since biochar is an environmentally-friendly material and a by-product of bio-oil, it can reduce the materials cost and encourage the use of sustainable materials in the pavement project.

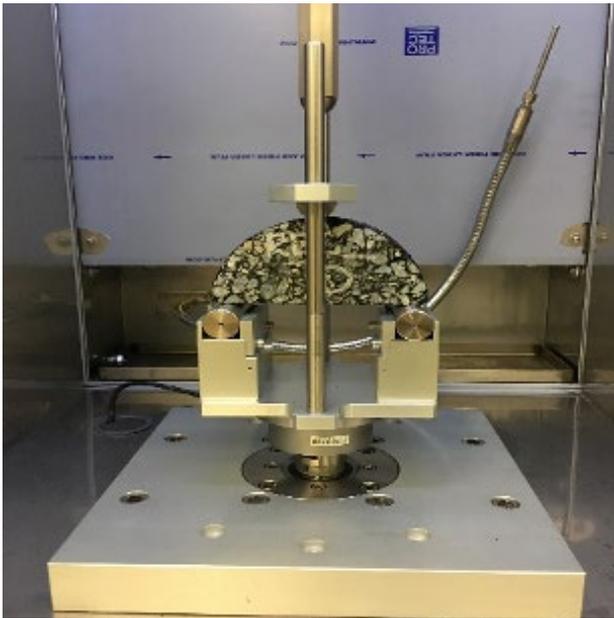


Figure 1. SCB Samples During Testing



Figure 2. HWT Samples During Testing

#### About the Principal Investigator

Dr. Shadi Saadeh is a professor at California State University Long Beach. He holds a Bachelor's Degree in Civil Engineering from the University of Jordan, a Master's Degree in Civil Engineering from Washington State University, and a Ph.D. in Civil Engineering from Texas A&M University.

#### To Learn More

For more details about the study, download the full report at [transweb.sjsu.edu/research/1935](https://transweb.sjsu.edu/research/1935)



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