Field Construction and Laboratory Performance Comparison of Conventional, Rubber Modified, Tire Fiber and Rubber Modified Asphalt Mixtures

International Association of Chinese Infrastructure Professionals

THE 13th IACIP Annual Workshop:
Adaptive Infrastructure under Climate Change

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1. Introduction and Motivation

The ground tire rubber (GTR) and tire fiber are waste materials. And they have limited application in cold and frozen region in Michigan. The objective of this study is to investigate the performance of rubber and tire fiber-modified hot asphalt mixture (HMA) by comparing it with conventional HMA. And the compound modification of scrap tire rubber and tire fiber has never been implemented in pavement modification. Therefore, A high-quality pavement with scrap tire rubber and tire fiber was constructed in Saint Clair County and a series of lab test were conducted for evaluation the asphalt mixture performance.

2. Project Background and Information

2.1 Project Construction Schedule

Three test section: control pavement section, rubber modified asphalt pavement section, rubber and fiber modified asphalt pavement section. Truck volume is 3600 in I 69, Truck volume is very high in project location.

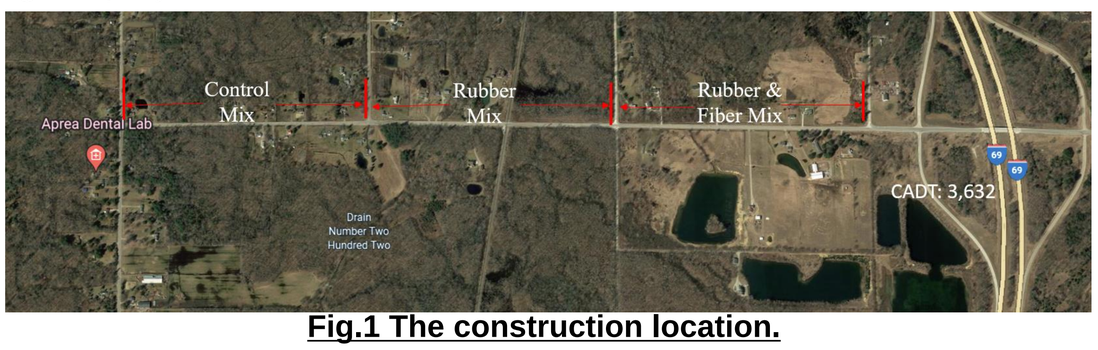


Fig.1 The construction location.

2.2 Pavement Structure and Thickness

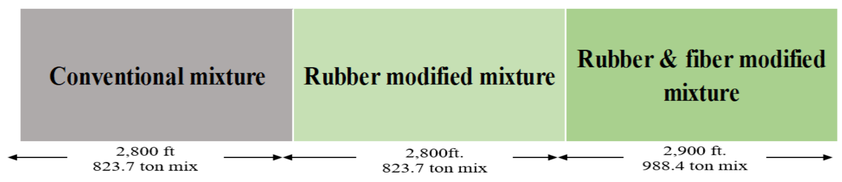


Fig.2 The proposed construction sections (Not to scale).

2.3 Dry Process Rubber & Fiber Mix Preparation in the Asphalt Plant

Aggregates are temporarily stored in cold feed bins (for use in production) before being released in precise amounts onto the main conveyor as specified by the job mix formula (JMF). In general, the aggregate mix is transported to the drum, where it is heated and the other components such as bitumen and crumb rubber are added. The ground tire rubber (GTR) feeder system will interlock with the asphaltic cement pump at the asphalt plant in order to maintain the correct proportions of crumb rubber for all rates of production and batch sizes. Finally, before being transported to the paving site, the prepared rubber modified hot mix asphalt is kept in silos.

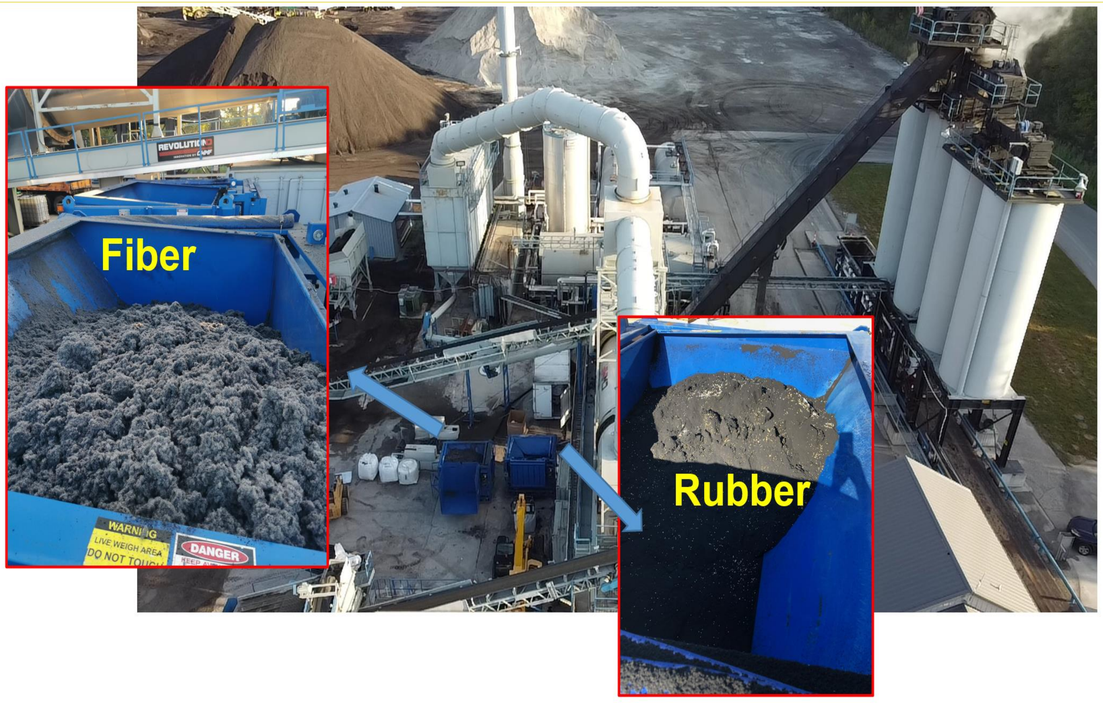
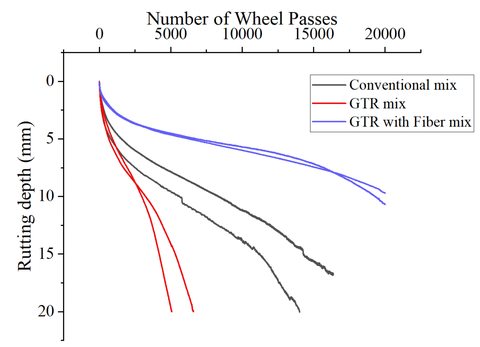
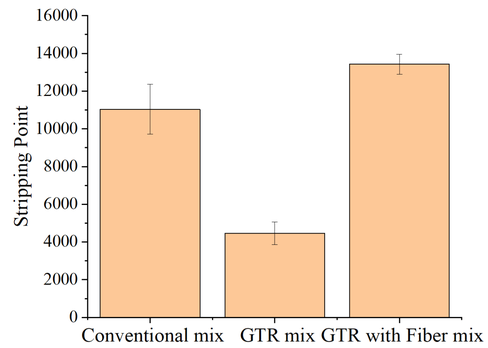


Fig.3 Demonstration Project in Saint Clair County plant.

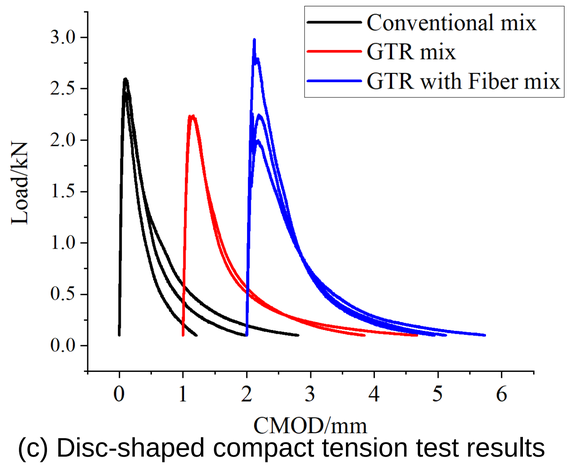
3. Results Analysis



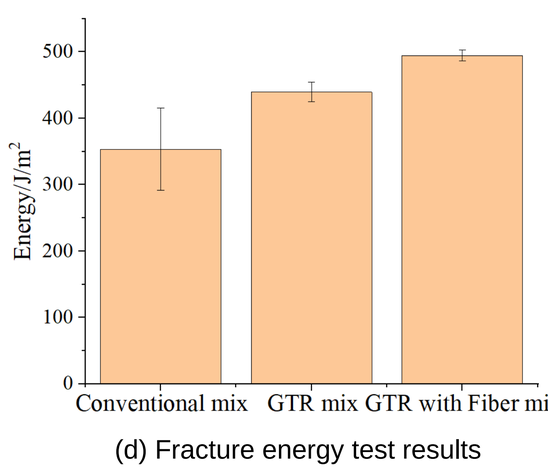
(a) Hamburg Wheel Tracking Device test results



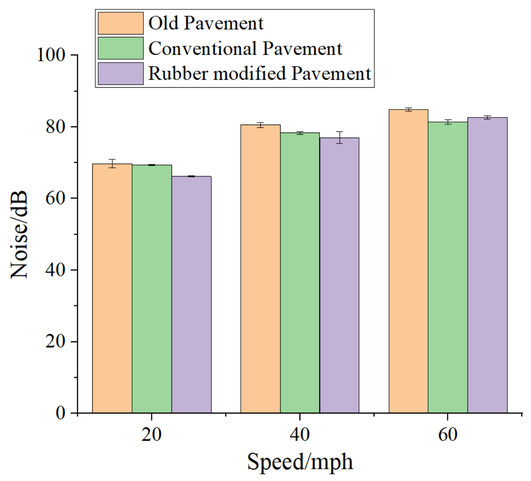
(b) Anti-stripping performance results



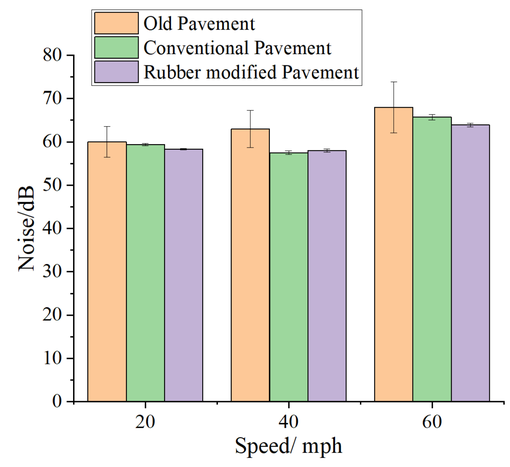
(c) Disc-shaped compact tension test results



(d) Fracture energy test results



(e) Pavement noise outside the truck



(f) Pavement noise inside the truck

Fig.4 Lab experiment data and Field view results

4. Summary and Conclusion

- The HWDT results showed that the failure passes of the conventional HMA are 177.9 % higher than that of the

rubber-modified HMA and 24.1 % lower than that of the rubber and tire fiber-modified HMA.

- The DCT results showed that the fracture energy of the rubber and tire fiber-modified HMA and rubber-modified HMA is 36.5 % and 21.4 % higher than conventional HMA, respectively.
- The field noise results showed that the rubber-modified asphalt pavement significantly mitigated the noise level by 2-3 dB on the road at various vehicle speeds. In summary, Rubber and tire fiber-modified asphalt mixture has better pavement performance compared with conventional asphalt mixture in cold regions and it provides a quitter pavement. And a total of 3,837 passenger tire equivalents were recycled in this project.