

Measuring Illinois Pavement's Performance in Response to Hydrometeorological Changes

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Introduction

Due to the hydrometeorological changes in the globe, the performance of transportation infrastructure has been abridged. The increase in high temperatures and precipitation are plummeting the performance of the roads. To mitigate the influence, it is essential that new pavement designs be resilient to the hydrometeorological events. Resilient infrastructures minimize the cost of repair and maintenance of transportation infrastructure assets.

Background

Flexible pavements are composed of asphalt concrete (AC) layer(s) above a base, sub-base, and a subgrade layer. Flexible pavements are able to efficiently transfer the wheel loads to the layers below (Figure 1), however, the performance of the pavements degrades due to continuous exposure to traffic and environmental exposures [1]. The pavement condition is assessed by evaluating the ride quality that is represented by the International Roughness Index (IRI). An IRI of 100 in./mile is considered the roughest and with 175 in./mile the pavement needs to be rehabilitated [2]. Typically, maintenance is required when IRI reaches 100 in./mile.

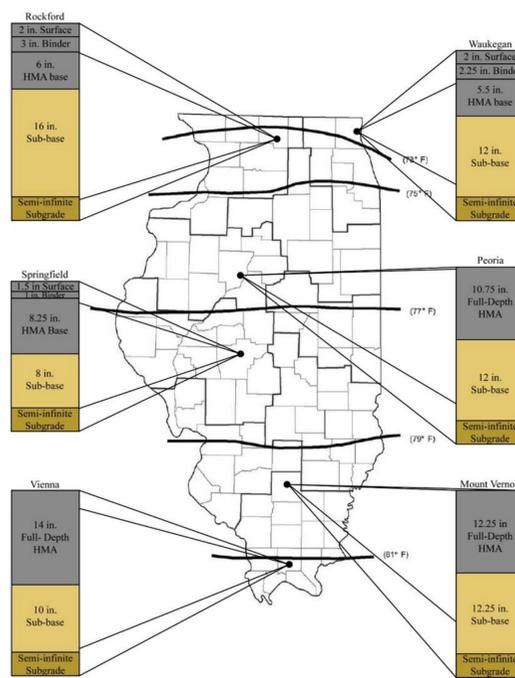


Figure 2 - Illinois Temperature Map Zone [2]

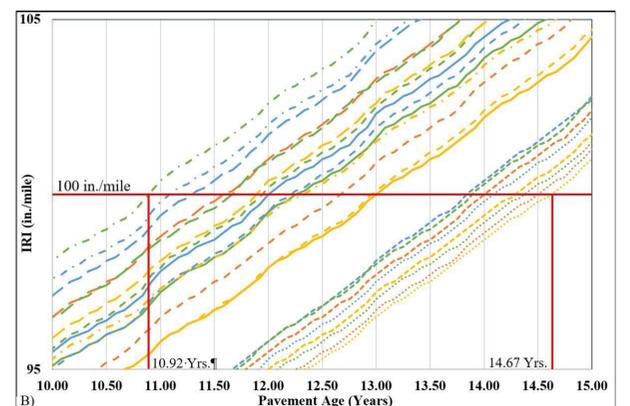
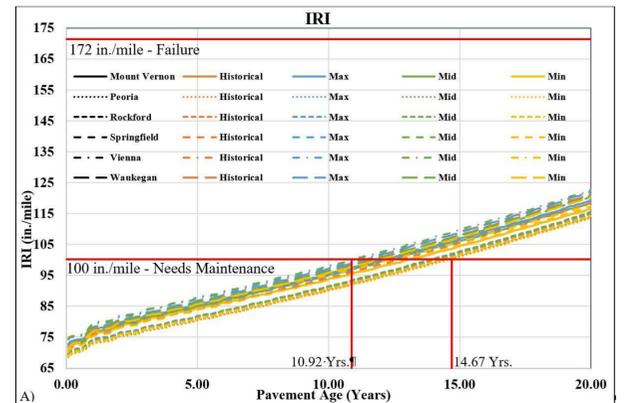


Figure 3 - A) IRI Values; and B) IRI Zoom to 100 in./mile

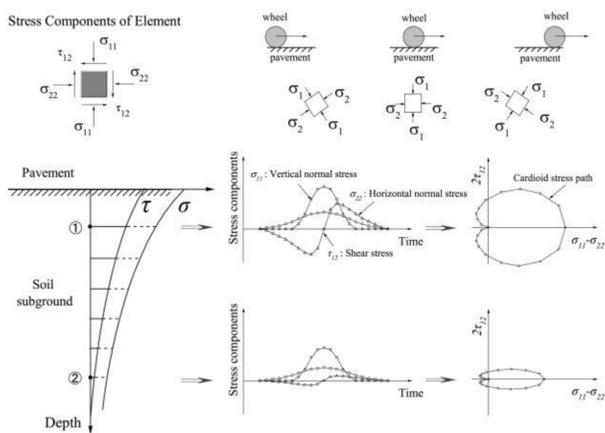


Figure 1 - Stress State of Pavement Interface Under Wheel Loading [3]

Procedure

- ❖ The pavement data and the traffic data were obtained from Illinois DOT website.
- ❖ The climate data was simulated by models from North American Regional Climate Change Assessment Program (NARCCAP).
- ❖ Obtaining all three requirements, the pavement performance was predicted using the Mechanistic-Empirical Pavement Design Software.

Results

With an earliest maintenance of one year and a half, the results suggest that the change in climate will influence IRI and maintenance years will depend on the future climate models. Also, the influence of climate change is lesser in the northern region (Figures 3 - A & B).

Objective

Evaluate the performance of Illinois pavements from six locations (Figure 2) with simulated increase of temperature and precipitation.

For this objective three items were required:

- 1 - Pavement Data
- 2 - Traffic Data
- 3 - Climate Data

Conclusion

As the results prove, hydrometeorological changes are degrading the quality of Illinois pavements causing earlier maintenance than expected. Anticipating and adopting especially for critical infrastructure will reduce carbon footprint and enhance efficiency.

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References

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