Distresses within Asphalt Concrete Pavements and use of rePave tool for Pavement Distress Management

Paige Jordan

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Bradley University

Introduction:

Distresses

A distressed pavement is created when the pavement experiences a decline in its surface condition or structural load-carrying capacity. This declination of pavement strength is due to the pavement experiencing rutting, cracking, distortion and/or other types of surface deterioration.

Fatigue/ Alligator Cracking: Fatigue cracking, also known as alligator cracking, is caused due to failure of the asphalt concrete surface that is under repeated traffic loading. Fatigue cracking is measured in area of the cracks and more specifically square feet. The scaling for this distresser is as follows: any crack with a width of .25 inch or less is of low severity, a crack between .25 inch to .75 inch in width is medium severity and a crack with a width of more than .75 inch is of high severity.

Figure 1 – Fatigue Cracking

Block Cracking: Block cracking is produced from the daily fluctuations in temperature causing a shrinkage in the asphalt concrete resulting in a daily stress and strain within the pavement. Block cracking is measured through area and is figured by determining the square feet within a surface area. The severity for this distresser is gauged as follows: a crack with a width of .25 inch or less is of low severity, a crack above .25 inch in width is of medium severity and to be considered high severity the road must be majorly spalling.

Figure 2 – Block Cracking

Longitudinal Cracking: Longitudinal cracking is triggered by a poorly constructed paving lane joint, cracking beneath the surface, or shrinkage within the asphalt concrete due to low temperatures and the asphalt hardening. Similar to the fatigue cracking, longitudinal cracking is measured in length through linear feet. The scaling for this distresser is such that any crack with a width of .25 inch or less is of low severity, a crack between .25 inch to .75 inch in width is medium severity and a crack with a width of more than .75 inch is of high severity.

Figure 3 – Longitudinal Cracking

Potholes: Potholes are created through traffic loading, asphalt concrete fatigue and inadequate strength. Potholes are measured through square feet and are scaled by being present within the pavement or not.

Figure 4 – Potholes

Raveling: Raveling is caused by the asphalt binder being insufficient, the mixture is of poor quality, and there is insufficient compaction, segregation or stripping of the mixture. Reveling is measured with area through square feet in surface area. The severity of raveling is determined through the amount of lost binder and aggregate. Roads with less than 20 aggregate particles missing per square yard are considered as low severity, while medium severity is between 20 to 40 aggregate particles missing per square yard, and high severity is anything more than 40 missing aggregate particles per square yard.

Figure 5 – Raveling

Rutting: Rutting is produced by traffic compaction or displacement of unstable material. The measurement for rutting is with area and more specifically is square feet of surface area. The severity is concluded through the depth of the crack. Low severity is considered between cracks with depths between .25 inch to .5 inch. This leads to medium severity to have depths between .5 inch to 1 inch, while high severity will be more than an inch deep.

Figure 6 – Rutting

Transverse Cracking: Transverse cracking is created by the changing in temperature as well as the asphalt aging with time which directly causes movement within the asphalt. Transverse cracking is measured with length through linear feet. The scaling for this distresser is as follows: any crack has low severity if the width is less than .25 inch, a crack with a width between .25 inch to .75 inch is medium severity and a crack with a width of more than .75 inch is of high severity.

Figure 7 – Transverse Cracking

rePave:

rePave is a very useful tool where project managers can input their road's information within the website and it will calculate the necessary information to determine what type of pavement structure to use. rePave focuses on delivering long life options between 30 to 50 years of use. rePave is also a very useful tool to figuring out different options of how to repair a road and it contains the solution and recommendations of how that particular solution would be beneficial. It allows project managers a lot of insight into the type of road they would hope to design and the different options they could have for predesign work as well as trying to figure out possible repair options.

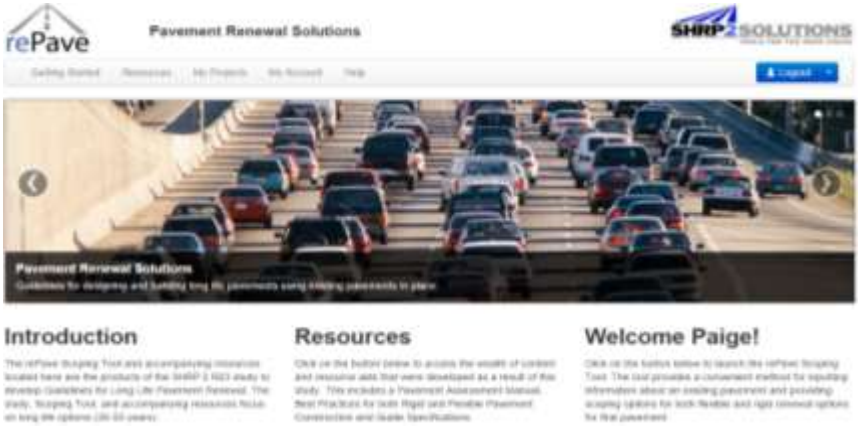

Figure 8 – rePave Home Page

For instance, in this paper rePave is used to determine the potential solutions to repair a road that I was experimenting with. The intersection is Peck Road and North Avenue and this road is near the northwest suburbs of Chicago. The road has low severity of fatigue cracking and is in its early stages of needing to be repaired. Three rePave projects were created to incorporate different sets of data within the severity level as well as the daily traffic count. The same asphalt design was used for each test which was a subgrade, 6-inch Granular Base, 10-inch stabilized base and then a top layer of 6-inch of Hot Mix Asphalt (HMA). In each project, there were different stress loads used for the roads. For example, for the first project contained a 30% severity level for fatigue cracking for the road as well as 5,000 cars being its Average Daily Traffic count (ADT). For the second project, the data changed to 40% severity for the road's fatigue cracking in addition to 6,000 cars as its ADT. For the last project, the severity for the road's fatigue cracking was 50% in addition to the 7,000 cars as its ADT. The solution that was created were the same for all three projects, which was to put a new overlaying level of HMA on the existing level of HMA after removing the HMA where needed. To be more specific the solution would cause the project to consist of removing and replacing the HMA layer and stripping the HMA from the top down cracking limiting the stripping to the top two inches of HMA and replacing that existing HMA between 9 to 10-inches of new HMA. This will cause a 7 to 8-inch elevation change within the road from additional HMA being laid. The estimated design thickness also increases to 13 to 14-inches.

Figure 9 – Existing Asphalt Pavement

Figure 10 – Severity Levels

Figure 11 –Renewal Options

If rePave offers multiple solutions due to a road having multiple destressers or the severity of the distresser being high, then the project manager should look at the different aspects of what the solution offers. Ideally a project manager would hope to achieve a road that encompasses the community's needs with having a project that is the most cost efficient, most timeliness as well as long lasting. rePave is an extremely useful tool for project managers along as others hoping to study pavement solutions.

Summary

This project has had an extremely beneficial impact on my education towards asphalt pavement because of all the research I have conducted. This project taught me much more about asphalt pavement distressers than just the different types of distressers there are, but how the particular distressers are formed and how their severity is classified. rePave was a very helpful tool that allowed me to form projects that corresponded to a road in my hometown which lead me into simulating a similar role that a project manager would partake in to search for solutions to repair a road's distressers. It allowed me to compare and contrast the projects by inputting different data into each project and seeing how the different severity levels differed from one another. I am very grateful to have been able to learn a great deal about a topic that is highly relevant within my daily life and to have found a new interest in a growing industry that I hope to enter soon after I graduate.

References

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