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16. Abstract The artificial lighting system called a light bar is a specially designed lighting device for the automated pavement distress measurement system (VCrack) developed in a previous TxDOT project. The basic function of this device is to provide intense, uniform, and linear illumination for the VCrack's line-scan camera and helps it provide high quality pavement images under any exterior lighting conditions. It consists of three major units: one 6-foot long central unit and two one-foot long wing units (see Figure 1). Each unit utilizes three rows of red LED's, a cylindrical lens and two mirrors, forming a one-inch wide beam at a distance 16-inch (see Figure 2). The energy consumption of the light bar is <250 watts, eliminating the need for a special generator. Along with a matching band pass filter, the light bar enables the camera to avoid the variations of the ambient light. The lighting intensity is sufficient enough for nighttime surveys. The light bar has been merged with the existing rut bar that is installed on the front bumper, and its wing assemblies break-away should they collide with a foreign object. The light bar is eye-safe, durable, and easy to maintain. Figure 3 shows the light bar that is mounted on a survey vehicle and provides beam illumination.					
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# **SUMMARY OF IMPLEMENTATION OF AN ARTIFICIAL LIGHTING SYSTEM FOR AUTOMATED VISUAL DISTRESS RATING SYSTEM**

Bugao Xu

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Project performed in cooperation with the Texas Department of Transportation and the Federal Highway Administration.



## **Disclaimers**

**Author's Disclaimer:** The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official view or policies of the Federal Highway Administration or the Texas Department of Transportation (TxDOT). This report does not constitute a standard, specification, or regulation.

**Patent Disclaimer:** The University of Texas at Austin filed patent “**Real-Time, High-Speed Pavement Cracking Distress Inspection System**” on May 23, 2006. It is pending.

Notice: The United States Government and the State of Texas do not endorse products or manufacturers. If trade or manufacturers' names appear herein, it is solely because they are considered essential to the object of this report.

## **Engineering Disclaimer**

NOT INTENDED FOR CONSTRUCTION, BIDDING, OR PERMIT PURPOSES.

Research Supervisor: Dr. Bugao Xu

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## **Final Report 5-4958-01-1**

### *Project 0-4958: Development of an Artificial Lighting System to Enhance the Automated Pavement Distress Measurement System*

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The artificial lighting system called a light bar is a specially designed lighting device for the automated pavement distress measurement system (VCrack) developed in a previous TxDOT project. The basic function of this device is to provide intense, uniform, and linear illumination for the VCrack's line-scan camera and helps it provide high quality pavement images under any exterior lighting conditions. It consists of three major units: one 6-foot long central unit and two one-foot long wing units (see Figure 1). Each unit utilizes three rows of red LED's, a cylindrical lens and two mirrors, forming a one-inch wide beam at a distance 16-inch (see Figure 2). The energy consumption of the light bar is <250 watts, eliminating the need for a special generator. Along with a matching band pass filter, the light bar enables the camera to avoid the variations of the ambient light. The lighting intensity is sufficient enough for nighttime surveys. The light bar has been merged with the existing rut bar that is installed on the front bumper, and its wing assemblies break-away should they collide with a foreign object. The light bar is eye-safe, durable, and easy to maintain. Figure 3 shows the light bar that is mounted on a survey vehicle and provides beam illumination.

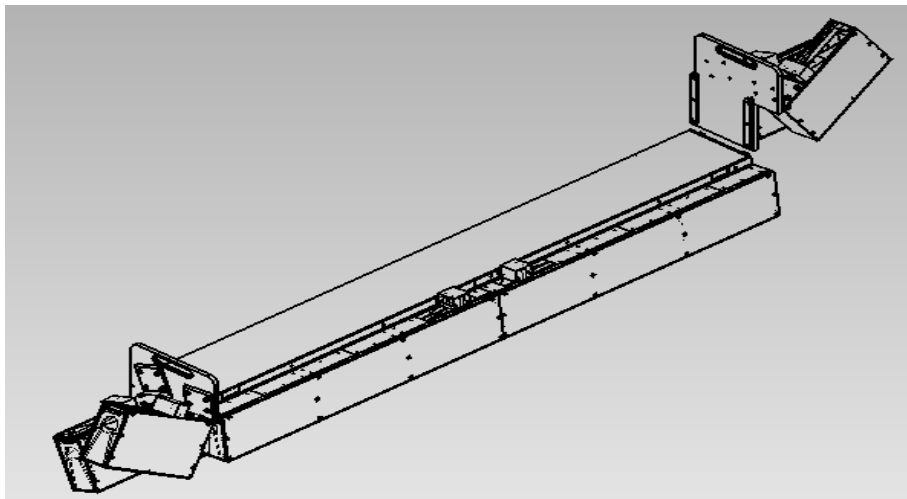


Figure 1 Light Bar Assembly

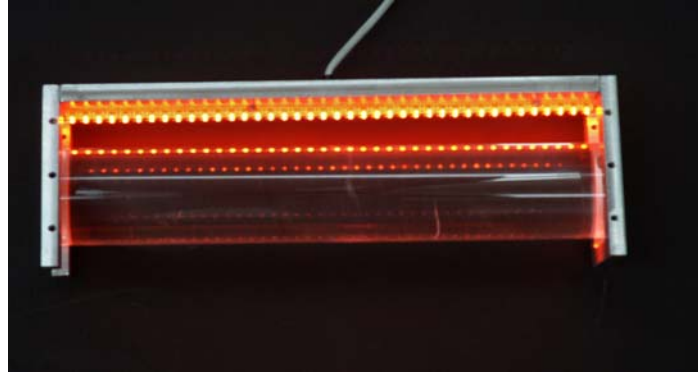


Figure 2 Single Unit



Figure 3 Light Bar in Operation

### **Benefits**

The light bar provides a consistent lighting condition to the camera so that the VCrack system can

- Minimize the effects of change in cloudiness, vehicle driving direction, survey time, etc.
- Eliminate shadows of vehicles and roadside objects.
- Detect alligator cracks on dark pavements more reliably.
- Enable the vehicle to maintain more constant speeds.
- Reduce adjustments of camera scanning rates needed to accommodate changes in pavement condition.
- Perform the survey in nighttime.

Ultimately, the light bar greatly improves the repeatability and accuracy of the measurement data. Figure 4 shows the alligator cracking data of an FM pavement in six repeated surveys conducted from morning to midnight. A project level test proved that the use of the light bar can increase the correlations of the cracking data of multiple runs from under 0.8 to above 0.9. The light bar enables TxDOT to collect time-independent and weather-invariant cracking data.



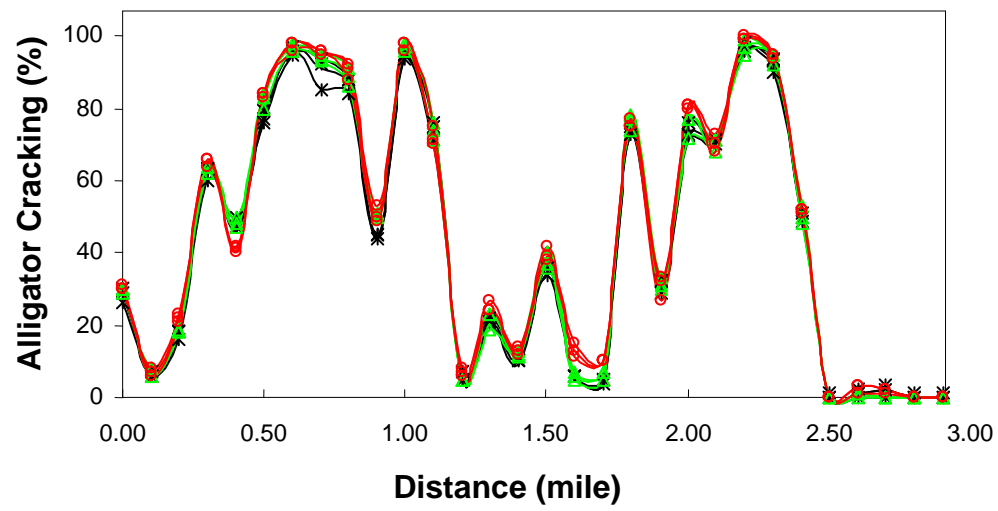


Figure 4 Cracking Data of Multiple Surveys