AUTOMATED PAVEMENT DISTRESS SURVEYS

John Hunt

Since the early 1980s, there has been a growing national interest in pavement management systems. The 1989 Federal Highway Administration’s pavement policy has significantly increased this interest by requiring state and local governments to have some form of pavement management system approved and in-place by 1993.

The single most important element of any pavement management system is the collection of timely and accurate data on the pavement’s condition. The types of pavement condition data collected includes: surface distress, transverse profile, roughness, friction, and deflections. It is standard practice to collect all of these items, except surface distress and transverse profile, using automated survey methods. Today, I will be dealing with the collection of surface distress and transverse profile data. This data can be collected in any number of ways ranging from manual windshield surveys to state-of-the-art automated surveys.

Manual surveys are slow and dangerous, typically record distress in very broad ranges or groups, and may require traffic control. An example of this is the Pennsylvania Department of Transportation’s annual STAMPP condition surveys. PennDOT summer interns typically survey approximately 16 survey miles of highway a day while driving along the shoulder. The information collected is recorded into two or three very broad extent ranges, depending upon the particular distress type observed. Between 1983 and 1989 these surveyors were involved in two injury accidents and a number of “fender benders” while surveying. One of the injury accidents was fatal. In some areas of the state crash trucks follow the surveyors.

On the other hand, automated survey systems are fast, safe, accurate, and require no traffic control. These systems include such systems as the PASCO RoadRecon systems, ARAN, PAVETECH, and Laser RST. These systems range in capabilities from the PASCO RoadRecon system, which records over 15 types of surface distress and transverse profile, to the Laser RST, which collects longitudinal and transverse profiles, pavement cacro texture, and some measure of cracking.

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**John E. Hunt** is Chief Engineer for PASCO USA Inc. and is involved in Automated Pavement Condition Surveys as well as other areas of pavement management. Previously, he worked as a pavement engineer for the Pennsylvania Department of Transportation and as a consultant inspector for the Maryland State Highway Administration.

Mr. Hunt earned his BS in Civil Engineering Technology at the University of Pittsburgh at Johnstown.
When conducting condition surveys of pavements, whether manual or automated surveys, the position of the sun is very important. Depending upon the angle of the sun, distresses can be hidden from the observer, or survey system. This is particularly true with manual surveys, and automated systems like ARAN and PAVETECH that use video logging techniques to collect condition data. Sunlight affects systems like the Laser RST to a somewhat lesser degree. The PASCO system has eliminated the effects of the sunlight by surveying only at night. This allows us to control the amount and angle of the light on the pavement's surface, thereby permitting us to consistently provide high quality images. In addition, PASCO USA's night-time operations increase safety and minimize interference with the traveling public.

In 1987, the FHWA published Report No. FHWA-TS-87-213 entitled "Improved Methods and Equipment to Conduct Pavement Distress Surveys." This report evaluated several ways of conducting pavement distress surveys for use with the Strategic Highway Research Program's (SHRP) Long-Term Pavement Performance Studies program. The methods/equipment recommended as best suiting the requirements of SHRP were the PASCO RoadRecon systems or the GERPHO device. SHRP chose the PASCO RoadRecon systems. The RoadRecon systems chosen by SHRP were the RoadRecon-70 system for surface distress and RoadRecon-75 system for transverse profile. These systems use 35-mm film techniques and photogrammetry principles to record their data.

The PASCO RoadRecon systems have a number of advantages over the other automated systems. PASCO provides the highest quality image available, with resolution on the surface distress film able to record cracks 1 mm wide and the transverse profile able to record rut depths to ±1 mm. They provide a permanent record of the pavement on the night surveyed. They require minimum collection time by being able to operate at speeds up to 60 mph. They use nighttime operations for increased safety and quality. And they record the highest number of surface distress types of any automated system.

The PASCO RoadRecon systems are mounted in custom-built vehicles that resemble fire/rescue trucks. Both systems are mounted in each vehicle, one on the front and one on the rear.

The RoadRecon-70 (RR-70) system is mounted on the front of the vehicle and uses 12 halogen spotlights and a 35-mm slit camera to obtain a continuous-strip film of the pavement's surface. The film speed in this system is synchronized with the speed of the vehicle in such a manner as to produce a 1:200 scale photograph of the pavement. The RR-70 system records conditions on a 16-foot width of pavement and is capable of recording a wide range of pavement conditions including: all types of cracking, patching, raveling/weathering, potholes, and various other distresses. These distresses can be recorded while traveling at speeds up to 60 mph.

The pavement condition information is obtained from the film through the use of PASCO USA's PAvement DIstress Analysis System (PADIAS). This system is a highly flexible, semi-automated system, which uses a modified VIP-6000 Film to Video Processor coupled with a specially equipped IBM-compatible 386SX PC to display pavement images on a computer screen. The PADIAS software is then used to overlay the images to examine the pavement conditions.
these images with grids and pop-up menus for analysis of the pavement conditions.

The operator views a 16- by 12-foot area of pavement and uses pop-up menus to select the distress type and severity observed. The operator then uses a "mouse" to tell the computer where the distresses occur on that screen. The computer automatically stores the distress type, severity, and extent in a binary data file. The software can either generate some standard reports, including a distress map, or convert the data file to standard ASCII format for uploading into the agency's existing pavement system's data base.

The RoadRecon-75 (RR-75) system is mounted on the rear of the vehicle and uses a strobe projector synchronized with a 35-mm pulse camera to obtain transverse profiles by photographing a hairline that is projected onto the pavement's surface. The analysis of this hairline produces a transverse profile that is repeatable and accurate to within \( \pm 1 \) mm. These transverse profiles can be recorded at any desired interval; however, the interval required will affect the speed of the survey. For example, SHRP requires transverse profiles at 50-foot intervals, thus reducing survey speed to 30 mph.

The transverse profile data is obtained from the films through use of PASCO USA's PAvement Rut Depth Analysis System (PARDAS). PARDAS is an interactive, semi-automated, data reduction system, which uses a film motion analyzer coupled with an IBM-compatible 386 PC. The PARDAS software records the digitized data from the FMA and analyzes it to determine the location and magnitude of maximum rutting, as well as the shape of the transverse profile. With further analysis, it is possible to determine the existence and magnitude of lane-lane differential and lane-shoulder dropoff. All data analysis of the transverse profile is performed using the wire method.

There are a number of automated systems available to collect surface distress and transverse profile data. The survey method that provides the highest degree of flexibility and accuracy is the PASCO RoadRecon systems. These units have the highest quality image, provide permanent records of the pavement condition, record the widest variety of distress types, and have been operating safely across the US and Canada as part of the SHRP LTPP studies for the past 1-1/2 years. In addition, PASCO uses semi-automated data reduction systems that are readily and easily modified to be compatible with any existing pavement management system an agency may have.

In closing, I just want to leave you with one thought: Automated Distress Surveys are the wave of the future... catch the wave!