

**CONDITION SURVEYING**  
**VideoLog & STAMPP**

## SYSTEMATIC TECHNIQUE TO ANALYZE & MANAGE PENNSYLVANIA'S PAVEMENTS (STAMPP)

In the early 1980's, the Department implemented the Systematic Technique to Analyze and Manage Pennsylvania's Pavements (STAMPP) program. STAMPP is a distress survey with the purpose of providing quantified location specific, condition data on the state highway system. The data is collected for all of the following purposes:

- To provide a uniform statewide condition evaluation which can improve decision making.
- To provide management with the information and tools to monitor condition of the network, assess future needs, establish county level condition rankings, and optimize investments.
- To provide condition information necessary to fulfill the requirements of the regulations regarding the allocation of Additional State funds from the Highway Maintenance Appropriation (ASHMA). These funds, which are in excess of all counties' base allocation funds, are distributed based in part on each county's condition rating relative to every other county. These ratings are based on dollar needs, which are the calculated costs of the required maintenance necessary to address the pavement, shoulder, guide rail, and drainage distresses.
- To provide information for monitoring the performance of various pavement designs, materials, rehabilitation, and maintenance techniques.
- To provide information for identifying candidate projects for maintenance and betterment programs.

Pavement and shoulder condition data are collected for the entire Interstate system, National Highway System (NHS) and one half of all other routes every year. Therefore, data for the entire system is collected every two years, and the annual survey totals are:

Interstate Routes	2,740 segment miles
Non-Interstate NHS Routes	7,187 segment miles
<u>½ other routes</u>	<u>16,690 segment miles</u>
TOTAL	26,617 segment miles

The state route guide rail system and drainage items are surveyed on a four year cycle.

## AUTOMATED PAVEMENT CONDITION SURVEYING (VIDEOLOGGING)



The Automated Pavement Distress Condition Surveying program, Videologging, replaced the manual pavement condition surveys for bituminous and cement concrete pavements in 1997. Data other than pavement condition has been, and can be, provided through Videologging: pavement roughness data, geometric information (horizontal and vertical curve data, grade, cross-slope, and superelevation), traffic signal type and location, rumble strip locations and other feature types and locations. Locations are provided by county/state route/segment/offset and latitude/longitude (determined by differential mode GPS). Information from Videologging is uploaded and stored in the Roadway Management System (RMS), and integrated with the Department's Geographic Information System (GIS).

Fugro Roadware Corporation, from Paris, Ontario, Canada, provides the Videologging service and product to the Department. Roadware has been under contract since April, 1997. Roadware's Videologging vans, known as Automated Road Analyzer (ARAN) vans, are equipped with 3 cameras: 1 mounted on top of the cab for panoramic view (images from the three cameras are "merged" to create the full panoramic view) and 2 pavement condition cameras (1 in each wheel path) mounted at the rear of the van.

The ARAN vans are also equipped with video storage units, and on-board computers. Similar to RITU' Road Profilers, the computer is also interfaced to sensors and accelerometers which are mounted along the front bumper which allow for pavement roughness data collection in accordance with ASTM E 950.

Roadware employs two-person teams for each ARAN van, a driver and an operator. Testing is

typically performed during the months of April through November, but can vary depending on weather conditions. The pavement must be dry and clear of leaves, snow, or other debris to obtain useful video images. The video images collected by the ARAN vans are delivered to Roadware's office facility for analysis and data reduction. Severity and extent data is derived, through a combination of automated distress programs and the visual rating of the pavement images, for the following pavement conditions:

Bituminous Pavements:

- Fatigue Cracking
- Transverse Cracking
- Miscellaneous Cracking
- Edge Deterioration
- Bituminous Patching
- Raveling/Weathering
- Rut Depth

Cement Concrete Pavements:

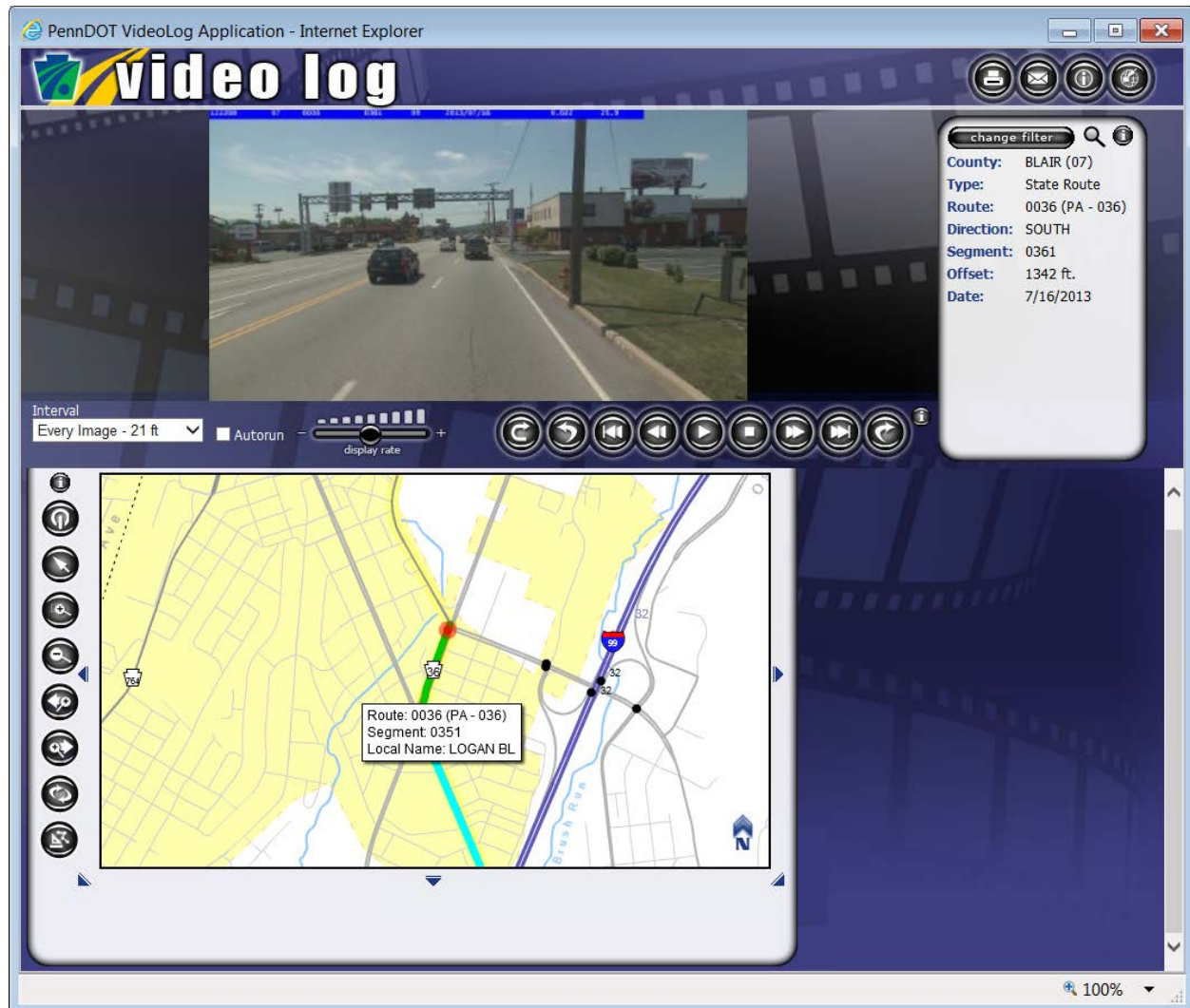
- Faulted Joints
- Broken Slab
- Transverse Joint Spalling
- Transverse Cracking
- Longitudinal Cracking
- Longitudinal Joint Spalling
- Bituminous Patching
- Cement Concrete Patching
- Rut Depth

Panoramic images are captured for all roadways according to the normal annual survey cycle (all NHS roadways and ½ of the others). Pavement condition data is reported only for bituminous and jointed concrete pavements. Condition surveys for continuously reinforced concrete (CRC) pavements, unpaved roads, shoulders, guide rail, and drainage items are still performed manually. Refer to the "Automated Pavement Condition Surveying Field Manual" (PennDOT Publication 336) for more information on automated pavement distress surveying.

Digital panoramic images are provided by Roadware to RITU on high capacity hard drives, which are then copied to servers in GIS. The images are used in different web based applications: iVidLog, VisiData and iVision.

## iVidLog

The GIS version (iVidLog), available through the Internet and Intranet, lets users choose a State Route through various means including Street Names, SR numbers, zip code, etc. The images are displayed in sequence and can be played like a video within the application. The speed at which the video is plays is controlled by bandwidth, but most broadband connections can handle viewing the images at acceptable speeds.



**Web based iVidLog Application**

## VisiData and iVision

VisiData and iVision are visual data presentation programs (developed by Roadware) that provides the ability to review ARAN processed data and synchronized video images. The programs allows the viewer to display multiple windows, each containing different combinations of data in graphical and tabular format. VisiData and iVision offer the following features:

- Location Based Image Playback
- Database Searching Capability
- Display Data in Graphical or Tabular Format
- Display Multiple Camera Images



## **AUTOMATED PAVEMENT CONDITION SURVEYING QUALITY ASSURANCE**



**PennDOT's VideoLog Van**

The Automated Pavement Distress Condition Surveying (Videologging) Quality Assurance (QA) program entails field testing of over 1,300 miles annually (5% of the annual survey mileage). The goal is to assure the quality of the service and product provided by the Videologging vendor.



**Rear View of Downward Camera & Lights**

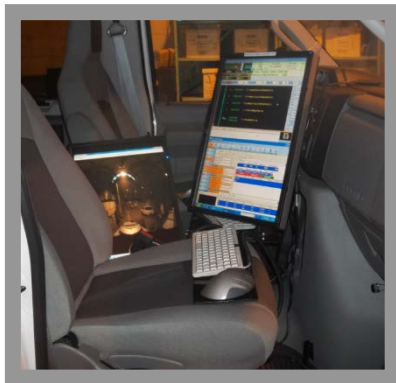
RITU currently owns one Videologging device, a Mobile Data Recorder (MDR) 4085-L3V2G model, manufactured by International Cybernetics Corporation, of Largo, Florida. The device is a van equipped with a 360 degree camera for panoramic views and 2 Laser pavement condition camera's mounted at the rear of the van (capable of capturing both wheelpaths simultaneously).



**Onboard Computers Systems**

The van is also equipped with 3 on-board IBM-PC compatible computers with associated compact keyboard, printer, and RS-232C Serial Interface. There are two LCD monitors, one for viewing 360 degree camera images and downward facing pavement images (the operator selects which camera to view), one for displaying vehicle location and roadway features in a Straight Line Diagram (SLD) format.

The systems have removable hard drives, that are used to store images and data; one of the computer systems is interfaced to sensors and accelerometers which are mounted along the front bumper and allow for pavement roughness data collection, similar to RITU' Road Profilers and in accordance with ASTM E 950.



**Operators Control Center**

A Data Measurement Subsystem installed in the System Unit provides interfaces to a wheel mounted distance encoder and a custom designed Event Keyboard. The system accepts a downloaded RMS file containing all roadway information as an input database for test data, and accepts operator inputs verifying segment locations, known as "events". Routes can be tested in increasing or decreasing segment order, and test sections may begin on a segment beginning, ending, or any permanent landmark feature. Two persons are needed to perform testing; a driver and an operator.

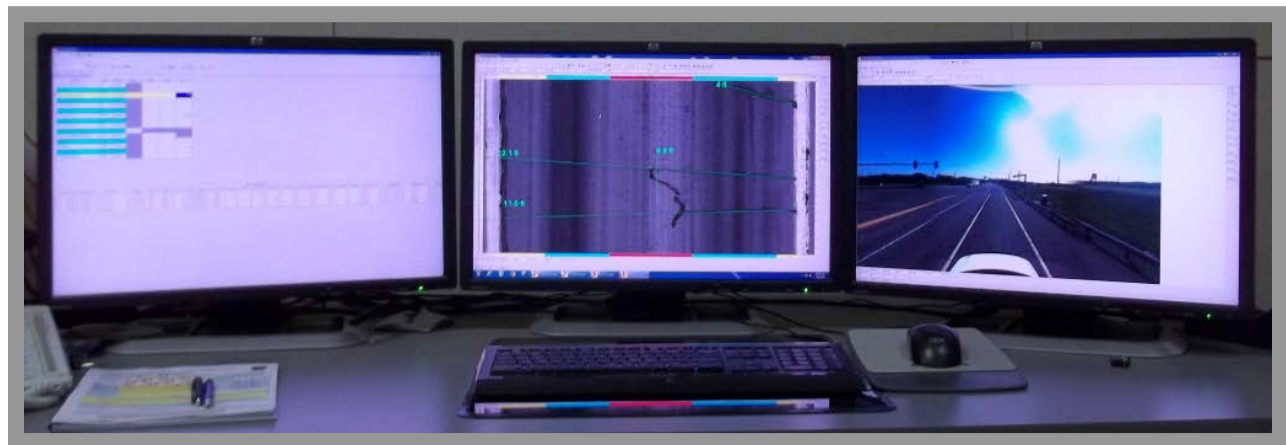


**Laser Crack Measurement System**

The pavement must be dry and clear of leaves, snow, or other debris to obtain useful video images. During the winter months, roughness test results may misleadingly indicate rougher roadways due to pavement surface characteristics caused by colder pavement temperatures. A Laser Crack Measurement System (LCMS) is used to record pavement deterioration conditions onto the onboard hard drives that are later processed and analyzed on a VideoLog workstation.



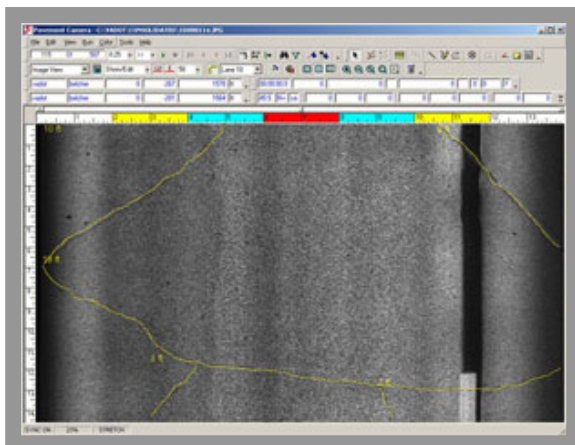
The video images collected by the Videolog van are stored directly on removable hard drives and brought into a Video work station to be processed for reviewing at the BOMO Annex facility.



**Video Workstation**

The pavement images are viewed through the use of a distress counting program (ICC Imaging Workstation Software), severity and extent data is derived for bituminous and jointed concrete pavement conditions.

The Imaging Workstation Software was designed for pavement surface analysis using digital image data collected by ICC Imaging Vehicles. The software was designed to expedite the distress rating process and to manage and maintain rating data. The Imaging Workstation allows users to synchronize images from multiple cameras. The application has tools to assist in distress analysis and measurement.



**Distress Manager Screen on Workstation**

Users can categorize, rate, measure and save all pavement distress information. Distress information can then be printed or exported in several formats. The Imaging Workstation is network compatible allowing multiple users to access data from a server and perform ratings.

## MANUAL CONDITION SURVEYING

Manual distress surveys are performed by two-person teams consisting of a driver and an evaluator, as they travel in a vehicle slowly along the shoulder. The type, severity, and extent of the conditions are noted on standardized survey forms, and then entered and stored in the Roadway Management System. While bituminous and jointed concrete pavement condition data is collected by Videologging, continuously reinforced concrete (CRC) pavements, unpaved roads, shoulder, guide rail, and drainage condition data is collected manually.



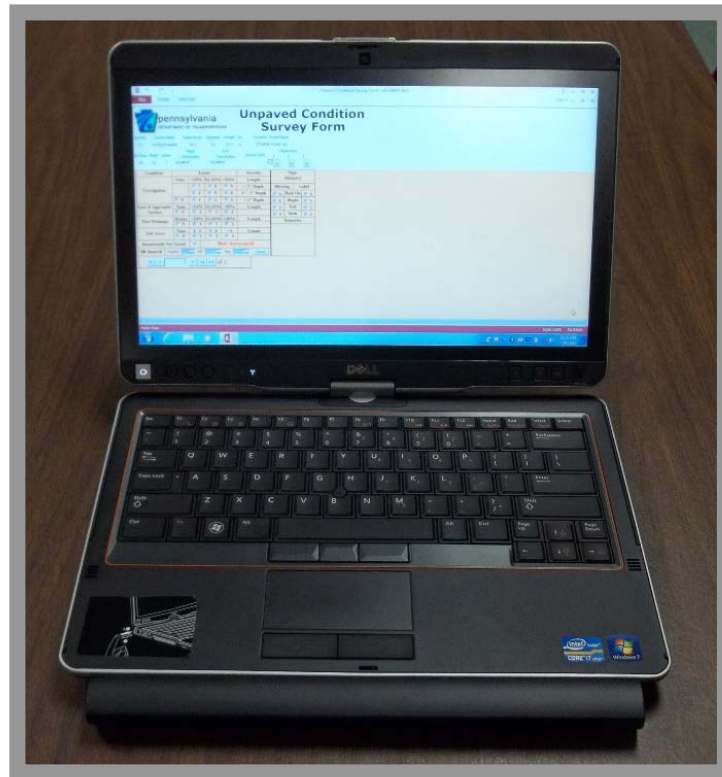
**STAMPP Car**

Manual surveys are typically performed by temporary Engineering, Scientific, and Technical Interns (ESTI) that are hired to perform the work during the summer months. RITU manages the entire STAMPP program, but Engineering Districts are responsible for performing the shoulder, guiderail and damage surveys. Starting in 2014 RITU's ESTI's started doing a STAMPP QA program on District STAMPP data to assure accuracy.

The following table lists the conditions that are surveyed, the organization(s) responsible for the survey, and the PennDOT Publication that should be referred to for more information.

Item	Responsible for Survey	Conditions Surveyed	Publication #
Continuously Reinforced Concrete Pavements (Currently inexistent)	RITU	Longitudinal Joint Spalling Transverse Cracking Punchouts Bridge Approaches Damaged Terminal Joints Rut Depth	343
Unpaved Roads	RITU	Corrugations Loss of Aggregate Surface Poor Drainage Soft Areas	343
Shoulder	Engineering Districts	Lane/Shoulder Separation Deterioration Deficient Slope Buildup Shoulder Dropoff Rut Depth	33
Guide Rail	Engineering Districts	Post Deflection Cable Sag Deterioration Hardware Height	33
Drainage	Engineering Districts	Physical Condition Structural Condition Flow Condition Roadway Deflection Ditch Erosion	73

Starting in 2008 the standardized paper STAMPP forms were replaced by a new electronic STAMPP form on a portable PC. The electronic STAMPP forms eliminated mass printing of scheduled survey forms each year and also eliminated the need for the STAMPP data to be manually entered into RMS. STAMPP data is saved on the electronic forms, transferred to a portable USB drive, uploaded to an FTP server and then automatically loads to RMS to update the RMS STAMPP database.



**Laptop PC used for STAMPP Data Collection**