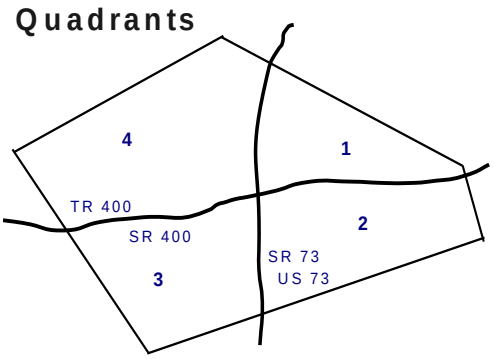
LOCATION REFERENCING SYSTEM (LRS)

LOCATION REFERENCING SYSTEM - BACKGROUND

In 1987, the Department implemented the Location Reference System (LRS), which was designed to bring Pennsylvania's roadway designations into a verifiable, flexible, and constant Engineering standard. LRS is the key to the collection, storage, and integration of roadway information. Locations are identified along State highways by a unique county/state route/segment key (CO/SR/SEG).

There are sixty-seven counties in Pennsylvania, and each is designated by a number, as is every route on the State highway system. Interstates, US Routes, and PA Routes are given numbers from 0001 to 0999. These routes, referred to as Traffic Routes, have the same SR number in each county they pass through.



County Map with SR Quadrants

Other roadways, called Quadrant Routes, are numbered from 1000 to 4999, according to the "quadrant" in the county that they are located. (For example, Quadrant Routes in the Northeastern quadrant of a county are numbered from 1000 to 1999.) Relocated Traffic Routes are numbered from 6000 to 6999; Interchanges are numbered from 8000 to 8999; Wyes from 9100 to 9199; Rest Areas from 9200 to 9299; Truck Escape Ramps from 9300 to 9399; and other miscellaneous items are numbered from 9400 to 9499.

A segment is a section of roadway approximately one-half mile in length. Each segment along a route within a county is given a unique number; segment numbers increase in the north or east direction. Undivided roadways and Northbound/Eastbound sides of divided roadways are designated with even segment numbers. The Southbound/Westbound sides of divided roadways are designated with odd segment numbers. State Route and Segment numbers are identified along highways with signs, called Segment Markers. Additionally, segment markers are placed at intersections that denote segments in either direction.

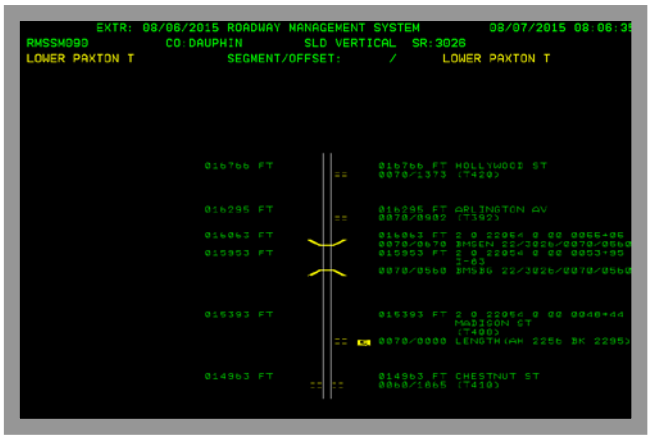
Stand Alone Segment Sign

Intersection Segment Sign

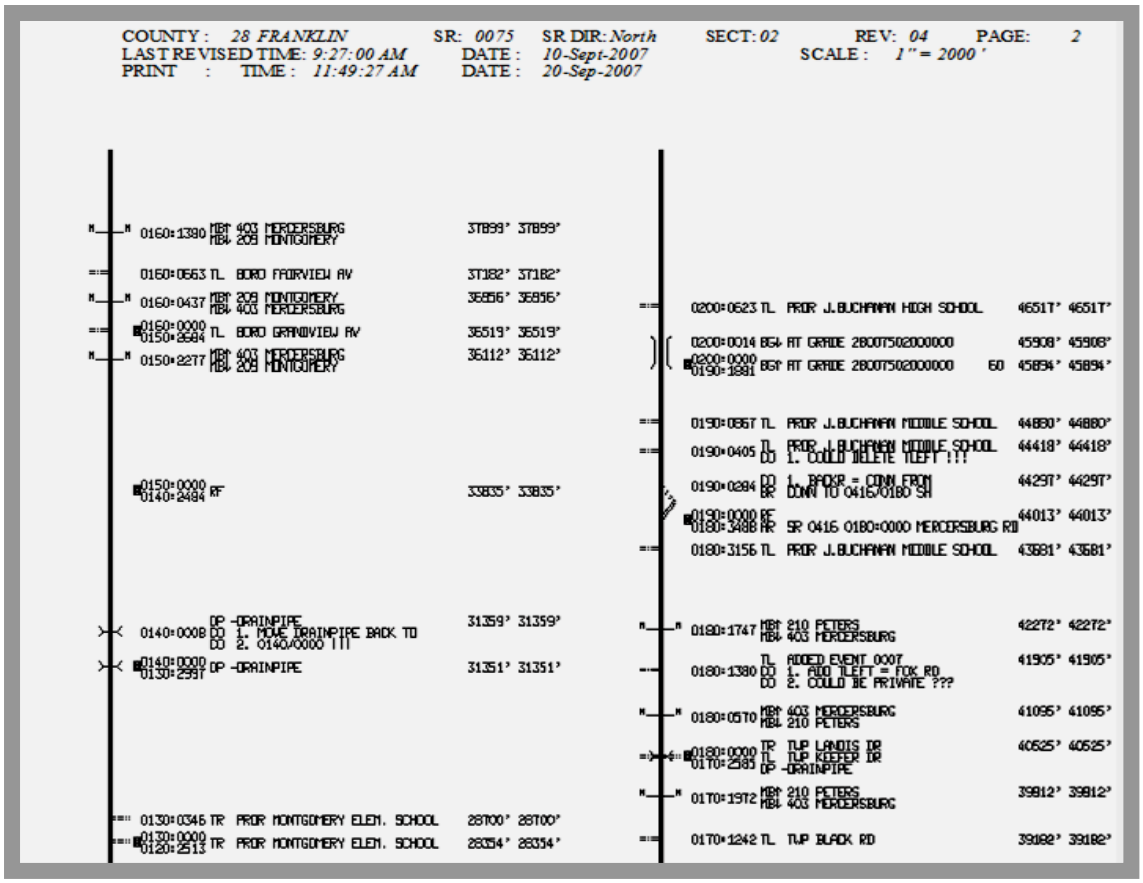
All roadway connectivity and inventory data, including pavement testing results, are stored in the Roadway Management System (RMS) according to the CO/SR/SEG key. Locations within a segment are identified by their "offset," which is the distance from the beginning of the segment. Roadway intersection, bridge, boundary, and drainage features are examples of items that are inventoried and stored in RMS based on their CO/SR/SEG/OFFSET.

These items are also displayed on Straight Line Diagrams (SLD's) which can be viewed in RMS, or obtained in hardcopy form. SLD books are refreshed and printed annually by RITU for distribution to the Department's District and County offices, as well as to county and municipal governments, and planning commissions.

Vehicle location and roadway features are displayed on the computer screen in a Straight Line Diagram (SLD) format in RITU' pavement testing vehicles so that test locations can be accurately attributed to a CO/SR/SEG key.

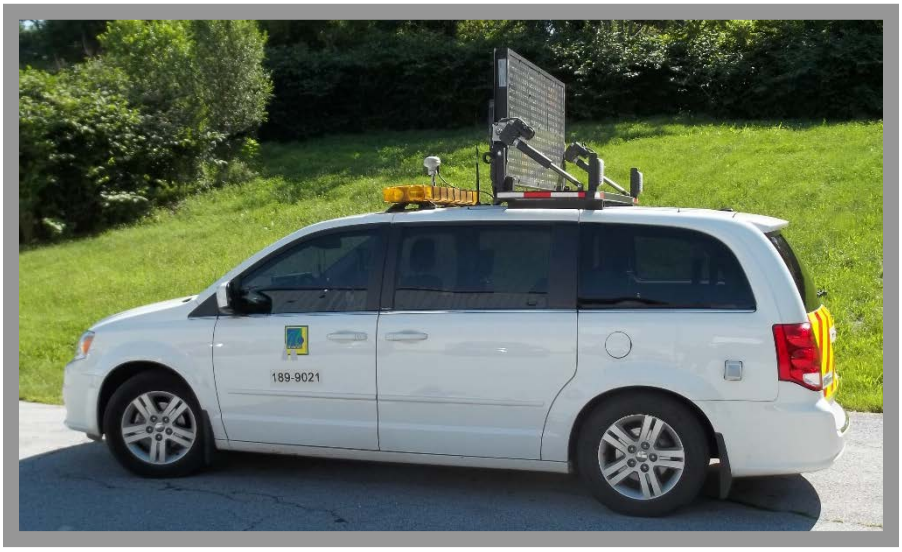


RMS Straight Line Diagram



LRS SLD Used in Testing Vehicles

Location Referencing System (LRS) and LRS QC and QA Programs



LRS Testing Vehicle

The Location Reference System (LRS) is divided into 2 different types of operational programs, the programs are as follows:

- The Location Referencing System Quality Commitment (QC) program, which entails field testing of approximately 2,200 miles annually (5%) of each county's state highway system). The QC program has been in place since 1990. The goal is to maintain at least 95% accuracy between the Department's Roadway Management System (RMS) and the actual field locations of highway features recorded in the system.

- The LRS Quality Assurance (QA) program entails field testing of all state owned roads within a 5 year cycle. The current goal is to test and process 20% of all state roads per year. After the SR's are tested and processed the results are sent to each engineering district where the location referencing data is updated in RMS as required.

PennDOT's LRS vehicles are manufactured by International Cybernetics Corporation, of Largo, Florida. RITU maintains 4 LRS testing vehicles. These devices are vans equipped with an on-board computer that consists of an IBM-PC compatible computer System Unit with associated LED monitor, compact keyboard, printer, customized event boards and RS-232C Serial Interface. A data measurement subsystem installed in the system unit provides interfaces to a wheel mounted distance transducer.

LRS Computer and Printer

LRS Monitor in Vehicle

The system unit accepts a downloaded RMS file containing all roadway information as an input database for verification and outputs an RMS file containing all feature information, segment and offset values, as well as any comments made during verification. Vehicle location and roadway features are displayed on the computer screen in a Straight Line Diagram (SLD) format, and the software accepts operator inputs verifying or modifying roadway feature locations. Collection and display is in real time including on-board analysis and instant recall of previously verified features.

LRS Van Screen SLD Display

The system is capable of performing verification at highway speeds, but usually test speeds are less than 25 mph to ensure accuracy. State 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. Typically, the operator is a permanent Roadway Programs Specialist or Technician 2, and the driver is a temporary Roadway Programs Technician 1. The QC program field testing is typically performed during the months of March through October, and the QA program is performed year round.

LRS QC DATA

The information that is verified and/or modified as part of the LRS QC program is broken down into four categories:

- **SR LENGTH:** The total length of a State Route measured in feet by summing the segment lengths of all undivided highways and the longest side of divided highways.

- **SEGMENT LENGTH:** The total length of a segment in feet from the beginning offset to the ending offset.

- **INTERSECTING FEATURE:** The County, SR, Segment, and Offset value of the intersection, or the BMS structure key for bridges, and the intersection type code.

- **SEGMENT MARKER:** The SR/Segment sign marking the beginning of a segment. For undivided roads this includes both the ahead and back signs.

Accurate segment markers are of obvious significance. Signing is important to many people within the Department (including Pavement Testing and Distress Surveys, Design, Construction, Maintenance, Highway Occupancy Permits, Roadway Posting and Bonding, Tort Liability, Turnbacks, Planning and Programming, Traffic, Municipal Services, Utilities, Right of Way, Crash review and Analysis, and Emergency Management) and customers outside the Department (including the Federal Highway Administration, County 911 programs, State & Local Police, Townships, Local Emergency Management, Consultants, Delivery Services (UPS, Fed Ex, etc.), Fire Departments, and Utility Companies). When segment marker signs are missing or improperly placed, the information reported may not be tied to the proper location.