# PENNSYLVANIA DEPARTMENT OF TRANSPORTATION

## Bureau of Maintenance and Operations, Roadway Management Division

### Location Referencing System (LRS) – Definitions, Uses & Testing

The Department's LRS, implemented in 1987, is the mechanism to designate the State highway network, to define roadway lengths, locations, and route connectivity, and to serve as the basis for the collection, storage, and integration of roadway information.

An LRS key is a unique series of numbers that identifies the location of each point or feature along a State route. The fourteen digit number is an integral part of the Roadway Management System (RMS) where roadway data is stored. 07/4016/0100/0857 is an example of an LRS key, which identifies County (CO) = 07, State Route (SR) = 4016, Segment (SEG) = 0100, and Offset = 0857.

**County (CO)**

Each of Pennsylvania's sixty-seven counties is identified by a number.

| Name | # | Name | # | Name | # | Name | # |
|---|---|---|---|---|---|---|---|
| Adams | 1 | Clinton | 18 | Lackawanna | 35 | Potter | 52 |
| Allegheny | 2 | Columbia | 19 | Lancaster | 36 | Schuylkill | 53 |
| Armstrong | 3 | Crawford | 20 | Lawrence | 37 | Snyder | 54 |
| Beaver | 4 | Cumberland | 21 | Lebanon | 38 | Somerset | 55 |
| Bedford | 5 | Dauphin | 22 | Lehigh | 39 | Sullivan | 56 |
| Berks | 6 | Delaware | 23 | Luzerne | 40 | Susquehanna | 57 |
| Blair | 7 | Elk | 24 | Lycoming | 41 | Tioga | 58 |
| Bradford | 8 | Erie | 25 | McKean | 42 | Union | 59 |
| Bucks | 9 | Fayette | 26 | Mercer | 43 | Venango | 60 |
| Butler | 10 | Forest | 27 | Mifflin | 44 | Warren | 61 |
| Cambria | 11 | Franklin | 28 | Monroe | 45 | Washington | 62 |
| Cameron | 12 | Fulton | 29 | Montgomery | 46 | Wayne | 63 |
| Carbon | 13 | Greene | 30 | Montour | 47 | Westmoreland | 64 |
| Centre | 14 | Huntingdon | 31 | Northampton | 48 | Wyoming | 65 |
| Chester | 15 | Indiana | 32 | Northumberland | 49 | York | 66 |
| Clarion | 16 | Jefferson | 33 | Perry | 50 | Philadelphia | 67 |
| Clearfield | 17 | Juniata | 34 | Pike | 51 | | |

**State Route (SR)**

State Routes (SR's) are identified by four-digit numbers. SR numbers are assigned as follows:

| | |
|---|---|
| 1. Traffic Routes: Routes designated as Interstates, US or PA Routes | 0001-0999 |
| 2. Quadrant Routes (Non-Traffic Routes) | 1001-4999 |
| 3. Relocated Traffic Routes | 6000-6999 |
| 4. Turned Back, Abandoned, or Null Routes | 7000-7999 |
| 5. Interchanges | 8001-8999 |
| 6. WYE's | 9101-9199 |
| 7. Rest Areas | 9201-9299 |
| 8. Truck Escape Ramps | 9301-9399 |
| 9. Others | 9401-9499 |

Even/Odd Convention: Even numbers are typically given to SR's in the East/West direction, and odd numbers to SR's that run North/South. This convention applies to Interstate Routes (except those that are Beltways or Spurs), and Quadrant Routes. This convention may or may not apply to PA or US Traffic Routes.

Hierarchy: If two or more traffic routes occupy the same section of roadway, the SR number is based on the "higher" type route, according to the following hierarchy. If the traffic routes are the same hierarchy class, then the SR number is assigned the lower numbered traffic route (Figure 1).

1. Interstates
2. U.S. Routes
3. PA Routes
4. Quadrant Routes

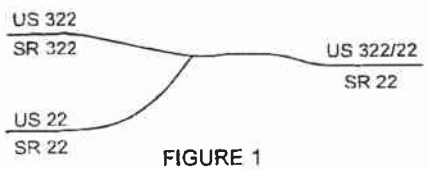



FIGURE 1

Other Numbering Conventions:

1. The first digit of a quadrant route is based on which quadrant of the county the route is located, as shown in the following diagram (Figure 2).
2. The last three digits of a Relocated Traffic Route are the same as the Traffic Route that was relocated.
3. Interchanges are numbered sequentially. Odd numbers are given to interchanges along SR's in the North/South direction; even numbers are given to interchanges along SR's in the East/West direction (Figure 3).
4. WYE's are given odd numbers if the connecting SR is odd numbered, and even numbers if the connecting SR is even numbered.
5. Rest Areas or Truck Escape Ramps are given odd numbers if they connect to the Southbound or Westbound side of an SR, and even numbers if they connect to the Northbound or Eastbound side.

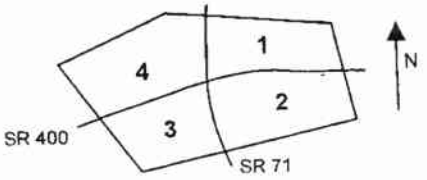



FIGURE 2

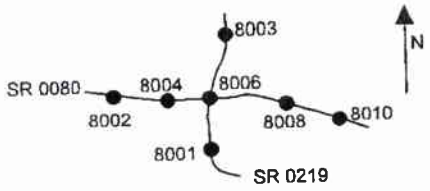



FIGURE 3

**Segment (SEG)**

State routes are divided into segments, which are approximately one-half mile long, and are identified by a four-digit number. Segment begin and end points are placed at physical features where possible. Segment numbers increase in the North or East direction, and typically by 10's (Figure 4). Segments are even numbered on undivided roadways, and in the Northbound or Eastbound direction of divided roadways. Segments are odd numbered in the Southbound or Westbound direction of divided roadways (Figure 5). Interstate segments are associated with the mile posts (Figure 6).

Undivided Roadways

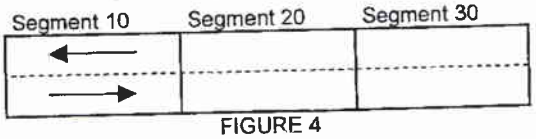



FIGURE 4

Divided Roadways

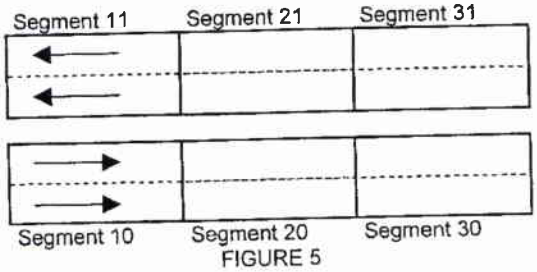



FIGURE 5

Interstate Roadways

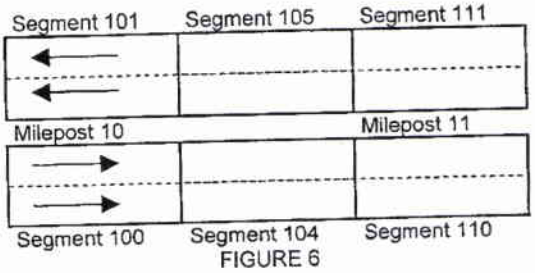



FIGURE 6

Turned Back, Abandoned, and Null Segments are given numbers in the range of 7000-7999. For two coincident State routes, the route with "lower" hierarchy is "nulled."

Segment numbering restarts on Traffic Routes at County boundaries, except Interstates (Figure 7).

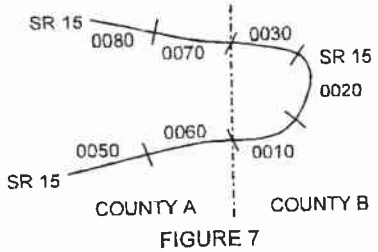


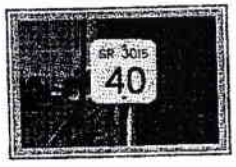

FIGURE 7

**Offset**

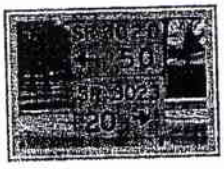
The offset, a subdivision of the segment, is the distance (in feet) from the beginning of the segment, expressed as a four-digit number. Offsets are measured in the increasing segment direction.

**Segment Markers**

Segment markers, which allow for easy identification of the LRS location on the State highway system, indicate the State route and segment number at the point that each segment is entered. If the beginning of a segment occurs at a physical feature, then the point of reference is at the physical feature and not the sign. At intersections, signs are used to identify beginning or ending State routes or segments.







**Users of the LRS**

Locations of all intersections, structures, and other points of interest are field verified and inventoried in the RMS. This information can be displayed on Straight Line Diagrams (SLD's) which can be viewed in the RMS, or hardcopy form. SLD books are refreshed and printed annually for distribution to the Department's District and County offices, as well as to many external entities.

A list of those within the Department that use the LRS to identify locations in the RMS and in the field includes personnel from the following organizations: Pavement Testing, County Maintenance, Traffic, Design, Surveys, Construction, Bridge, Permits, Crash Review, Planning and Programming, Posted & Bonded Roads, Tort Liability, and Emergency Management.

Users outside the Department include: County & Municipal governments, County 911, Planning Commissions, Federal Highway Administration, State & Local Police, Local Emergency Management, Delivery Services (UPS, Fed Ex, etc.), Fire Departments, Utility Companies, Contractors, and Consultants.

Without segment markers located in the field, all of these users would have to rely solely on the SLD, which would be extremely cumbersome at best, and impossible for some.

**Verification, QA & QC**

In order to assure that LRS information is indicated properly in the RMS, on SLD's, and in the field, LRS Quality Assurance (QA) and Quality Commitment (QC) programs are performed each year. The Bureau of Maintenance and Operations, Roadway Management Division, Roadway Inventory & Testing Section (RITS) performs all Statewide QC testing. Field verification and QA is also performed by RITS, except in Engineering Districts 2-0, 11-0, and 12-0, where it is done "in-house." Each Engineering District is responsible for its own LRS completeness and maintenance with respect to the RMS.

Twenty percent of each county is field tested annually as part of the QA program, and five percent of each county is tested for the annual QC program. The goal of the QC program is to maintain at least 90% accuracy between the RMS and the actual field locations of highway features. Annual QC ratings are developed and reported to the Engineering Districts.

Field testing is performed by two-person teams (a permanent employee that operates the test, and a temporary employee that drives the device) with the use of vans equipped with an on-board computer and a Data Measurement Subsystem. Testing is typically performed during the months of April through November.

Vehicle location and roadway features are displayed on the van's computer screen in SLD format, and the software accepts operator inputs verifying or modifying roadway feature locations, as well as comments. Though the system can function at greater speed, test speeds are typically less than 25 mph to ensure accuracy.

There are five categories of information that is verified and/or modified:

1. State Route Length
2. Segment Length
3. Roadway Geometry (lane count, pavement & shoulder types & widths)
4. Intersecting Feature Location (intersections & bridges)
5. Segment Marker Location

# STRAIGHT LINE DIAGRAM (SLD) ANNUAL REFRESH ATTRIBUTE KEY

| | | | |
|---|---|---|---|
| S SEGMENT MARKER | AHEAD LEFT INTER STATE OWNED | RAILROAD CROSSING | INTERSTATE MILEPOST |
| T TURNBACK | AHEAD LEFT INTER NON-STATE | RAILROAD OVER-PASS | MFC BEGIN |
| N NULL | AHEAD RIGHT INTE STATE OWNED | OVER-PASS | MUNICIPAL BOUNDARY |
| UNDIVIDED HIGHWAY | AHEAD RIGHT INTE NON-STATE | BRIDGE END | VILLAGE BEGIN |
| PHYSICALLY DIVIDED | BACK LEFT INTER STATE OWNED | BRIDGE BEGIN | AH - LENGTH FORWARD TO NEXT SEGMENT BEGIN<br>BK - LENGTH BACK WARD TO PREVIOUS SEGMENT BEGIN |
| PAINT DIVIDED | BACK LEFT INTER NON-STATE | TUNNEL | |
| INTERSECTION AHEAD | BACK RIGHT INTER STATE OWNED | SIGN STRUCTURE | MFC - MAINTENANCE FUNCTIONAL CLASS<br>A = INTERSTATE<br>B = EXPRESSWAY AND/OR PRINCIPLE ARTERIAL<br>C = MINOR ARTERIAL<br>D E = COLLECTOR LOCAL ACCESS<br>F = INTERCHANGE RAMP |
| INTERSECTION BACK | BACK RIGHT INTER NON-STATE | SIGN MOUNTED ON OVER-PASS | |
| REFERENCE AHEAD/BACK | T-LEFT INTERSEC STATE OWNED | RETAINING WALL | |
| DIVIDED CONNECTOR | T-LEFT INTERSEC NON-STATE | BRIDGE/CULVERT UNDER FILL | NULL AND TURNBACK SEGMENTS ARE DISPLAYED IN THE DEPARTMENT"S ROADWAY MANAGEMENT SYSTEM (RMS) AS 100 FEET IN LENGTH. ACTUAL SEGMENT AND SECTION LENGTHS MAY VARY SIGNIFICANTLY |
| CROSS INTERSEC STATE OWNED | T-RIGHT INTERSEC STATE OWNED | PIPE (STAMPP) | |
| CROSS INTERSEC NON-STATE | T-RIGHT INTERSEC NON-STATE | ROTARY INTERSEC | |

# STRAIGHT LINE DIAGRAM (SLD) ANNUAL REFRESH ATTRIBUTE KEY

| | | | |
|---|---|---|---|
| ROAD CLOSED | POI POINT OF INTEREST | C BRIDGE CLOSED | P BRIDGE POSTED |
| M MONITORING SITE | TRAFFIC SIGNAL | | |
| | | | |
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