The Virginia Department of Transportation (VDOT) Information Technology Division (ITD) is announcing the quarterly release of the Roadway Network System (RNS) Linear Referencing System (LRS). The LRS is used within a Geographic Information System (GIS) by internal and external customers from many different divisions, agencies, organizations and privately held corporations. This allows these entities to display VDOT maintained roadways in a cartographic fashion and more importantly locate business data (events) that occurs at specific locations along the road.

Highlights

A total of **3,337 miles** (3,261 routes) were processed for the 13.3 release. A *processed route* indicates that a route was added or geometry and/or attribution (measures, sequences, etc.) of an existing route have been modified. The modification to an existing route could be a minor change such as an intersection being added to provide access to a new subdivision or as major as the inclusion of a road that did not previously exist in the *network*. A complete list of processed routes is available upon request.

Update for ARS & PMS: The Maintenance Division's Pavement Management System and the Department of Motor Vehicles *Automated Routing Solution* will utilize this release as part of their annual update cycle.

[FIXED] Structure Locations: A bug was identified in RNS that was causing structures (i.e. bridge and culvert events) be to improperly located. The bug was resolved and as a result all structures were reprocessed statewide.

[RESOLVED] Physical Jurisdiction Issue: In some cases the physical jurisdiction location attributes that are in the edge based LRS types were incorrect. The RNS team was able to look back into history records to improve the jurisdiction attributes in the edge based LRS.

LRS Map Package mods: *Measure hatching* changes shown in red.

- Appear on Master (*SDE_VDOT_RTE_MASTER_LRS*) and Overlapping Routes (*SDE_VDOT_RTE_OVERLAP LRS*) LRS types.
- Display scales:
  - Below 1:10,000 - All routes with leader lines every 0.1 mile and measures every 0.5 mile
  - 1:10,000 to 1:50,000 - East and Northbound Primaries with measures every 1 mile
  - 1:10,000 to 1:100,000 - Interstates with measures every 1 mile
  - 1:100,000 to 1:1,000,00 – Interstates only with measures every 20 miles
  - 1:1,000,000 to 1:3,000,00 – Interstates only with measures every 25 miles
- Color coding for prime and non-prime directions:
  - Blue: Northbound prime
  - Red: Southbound non-prime
  - Green: Eastbound prime
  - Brown: Westbound non-prime

Known Issues

Geometric Discrepancies → Ongoing: Users will notice small feature malformations (e.g. disjointed endpoints, misaligned segmentation, etc.); particularly where old features that have not undergone conflation intersect conflated features. Editors are monitoring topology with enhanced QA processes to improve the *network*.

[UPDATED] Route Substitution Patch: The ~~16~~ 7 routes listed below (~~509~~ 144 coinciding problem *edges*), were exchanged with a manually edited version because the route requires edits and/or *reprocessing*. A few isolated incidents at locations where the primary road was not patched and a section of the primary was reprocessed precipitated further alignment issues. These routes will continue to be substituted in future releases until quality can be assured in the automated results.

1. US-1N
2. US-1S
3. US-17N
4. US-17S
5. US-58E
6. US-58W
7. SR-33W

BACKLOG:

The issues below still remain except where indicated as fixed. The unresolved issues need one or more of the following: RIMS edit jobs created, job prioritization by the business, route edits performed, enhancement to the *route build* process and/or the route (or portions of) need to be rebuilt.

[UPDATED] Edge Based Jurisdiction Measure LRS (*SDE_VDOT_EDGE_RTE_OL_JURIS_MSR*) **Errors**:
The bulk of these issues were known and/or identified by Divisions within VDOT that heavily use the LRS in day-to-day business activities. They expend a tremendous amount of effort ensuring the LRS type(s) they utilize will suit business needs. The result is the provision of valuable feedback to the RNS team.

1. **Edges with No Measure**: 363 secondary edges with shape length greater than a tenth mile and a measure sum of zero.

[UPDATED] Route Specific Errors:

2. **US-60WB**: Gaps and zero length measures.
3. **SR-7100** (Fairfax County Parkway): Gaps and zero length measures. ***Pending route processing.***
4. **[FIXED] US-221N/SB:** Master route flip-flop.
5. **[FIXED] US460E/WB:** Master route flip-flop.
6. **Flip Direction:** Segment flips are not being respected when a gap in the route occurs (e.g. US-60W after the P route for overlap on I-64W). ***Pending route processing.***

Looking Forward

Processing Queue: The queue has been enhanced to regenerate automatically as part of the nightly build. This includes the vast number of edits that are occurring across the commonwealth as every *edge* (i.e. record) is being conflated by the *UCP*.

Feedback

The RNS team wants to know how you utilize the LRS release products. We welcome suggestions and/or comments about data availability, usability, content, release notes subject matter, statistical analysis, quality control, issue resolution and ideas on how this data product could better suit your needs. Any input that is within our control to act upon will be considered, provided it maintains a uniform product that meets the needs of multiple customers and stays within budget constraints.

Send feedback to: *GIS@VDOT.Virginia.Gov*

Route Processing Statistics

The spatially enabled dual carriageway roadway network model that RNS uses allows for road centerlines to appropriately represent the real-world. An important aspect is that both prime (e.g. northbound/eastbound) and non-prime (e.g. southbound/westbound) directions for all route categories are maintained for this purpose.

Travel Miles

The statistics below represent comprehensive travel miles that are contained within the LRS. Distances where travel commences on multiple collocated routes (i.e. overlap one another as in the case of Interstate 95 southbound and Interstate 64 westbound) along the same roadway surface are accounted for in the summation of travel miles.

13.3 (current) Route Category	LRS Travel Miles	New Non-Prime LRS Travel Miles
Interstate	2,583.243	220.648
Primary	11,229.107	10,503.809
Secondary	49,699.333	49,592.129
City	2,334.916	2,332.001
County	319.145	319.310
Interstate Ramp	512.680	
Primary and Secondary Ramp	184.389	
Totals	**66,862.813**	**62,967.897**

13.2 (previous) Route Category	LRS Travel Miles	New Non-Prime LRS Travel Miles
Interstate	2,583.243	220.648
Primary	11,228.397	10,503.155
Secondary	49,610.433	49,496.898
City	2,334.916	2,332.001
County	319.145	319.310
Interstate Ramp	512.680	
Primary and Secondary Ramp	184.389	
Totals	**66,773.203**	**62,872.012**

Maintenance Miles

These figures portray the miles of road surface that VDOT maintains. Mileages only account for a single lane road surface.

13.3 (current) Route Category	LRS Maintenance Miles	New Non-Prime LRS Maintenance Miles
Interstate	2,499.733	0.147
Primary	9,816.660	2,925.687
Secondary	48,879.313	541.825
City	2,307.884	95.694
County	313.145	67.561
Interstate Ramp	511.289	
Primary and Secondary Ramp	182.399	
Totals	**64,510.423**	**3,630.914**

13.2 (previous) Route Category	LRS Maintenance Miles	New Non-Prime LRS Maintenance Miles
Interstate	2,499.733	0.147
Primary	9,810.825	2,929.479
Secondary	48,792.863	550.880
City	2,305.374	95.694
County	313.145	67.561
Interstate Ramp	507.874	
Primary and Secondary Ramp	182.399	
Totals	**64,412.213**	**3,643.761**

Appendix

Feature Class Application Matrices

Abbreviation Key:

JURIS - Jurisdiction	MPST - Milepost	OL - Overlap
LRS - Linear Referencing System	MSR - Measure	RTE - Route
MAINT - Maintenance	MSTR - Master	SDE - Spatial Database Engine
MIN - Minimum	MV - Materialized View (i.e. a table once in geodatabase format)	TBL - Table

Official State Measure Layers

Feature Class Name	Uses	ARS	VA Traffic	PMS	RNS
SDE_VDOT_EDGE_RTE_OL_JURIS_MSR • One feature per route centerline edge (segment between junctions or intersection nodes) • Contains State and Country measures • Includes overlap routes.	Dynamically segment event data that contains County and/or State Measures	✗	✗	✓	✗
SDE_VDOT_EDGE_RTE_OVERLAP_LRS • One feature per route centerline edge (segment between junctions or intersection nodes) • Includes overlap routes	Label overlapping route and/or street names	✗	✗	✗	✓
SDE_VDOT_RTE_MASTER_LRS • One feature per route • Only master routes are included	• Dynamically segment VDOT business data • Labels for Statewide maps	✗	✗	✗	✓
SDE_VDOT_RTE_OVERLAP_LRS • One feature record per route • Includes overlap routes	• Used directly within RNS • Dynamic segmentation • Local maps to show overlapping route name labels	✗	✗	✗	✓
SDE_VDOT_LANE_COUNT_MSTR_RTE • Number of lanes on master routes • Calculated lanes prime and non-prime • Derived from the source system of record	Can be used to determine if LRS is divided	✗	✗	✗	✗

Milepost Measure Layers

Feature Class Name	Uses	ARS	VA Traffic	PMS	RNS
SDE_VDOT_EDGE_RTE_OL_MPST_LRS • One feature per route centerline edge (segment between junctions or intersection nodes) • Includes overlap routes • Milepost measure provided for Interstates in the attributes and embedded M-values	• Street Maps to show overlapping route labels and/or street names • All key network information about route such as intersection measures, id's, jurisdictions, etc. • Dynseg public facing data	✓	✓	✗	✗
SDE_VDOT_RTE_OL_MPST_LRS • One feature record per route • Includes overlap routes • Milepost measures for Interstates embedded in M-values	• Dynamically segment shared data between VDOT and public facing systems when VDOT does not maintain the asset • Local area maps to show overlapping routes	✓	✓	✗	✗
SDE_VDOT_LANE_COUNT_MPST_RTE • Number of lanes • Calculated lanes prime and non-prime • Derived from the source system of record • Milepost measure provided for Interstates in the attributes and embedded M-values	Can be used to determine if centerline is divided	✗	✓	✗	✗

Other Layers

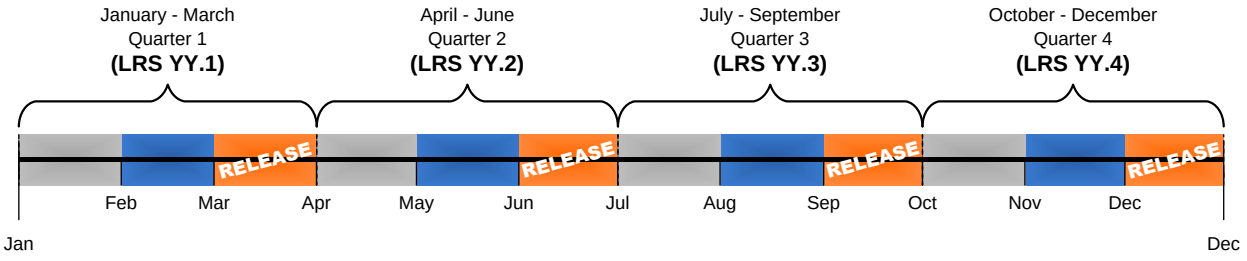
Feature Class Name	Uses	ARS	VA Traffic	PMS	RNS
MV_STRUCTURE_CAPACITY_PONTIS	Clearance Data for Structures	✓	✗	✗	✓
SDE_VDOT_INTERSECTION_W_XY • LRS Junction locations with latitudinal and longitudinal coordinates provided in the attribution.	Generalized placement of event data	✗	✓	✗	✓
SDE_VDOT_STRUCTURE_PT_MSTR _RTE • Point features representing the beginning location of each structure along the master route. • A replica of the spatial data view that is maintained in RNS by the Structures and Bridge Division.	Display bridge and culvert events.	✓	✗	✗	✓
TBL_VDOT_MIN_MAINT_JURIS_MSR	Cross reference to convert business data between county and state measures	✗	✗	✓	✓

Release Version Naming Convention Explained

In an effort to differentiate between the RNS application and RNS data, a new version naming convention has been adopted. All RNS data, "LRS Quarterly Releases" will be represented in this fashion: [Year].[Quarter Number] (i.e. quarter 4 in the year 2012 will be 12.4). The quarter numbering is based on calendar (not Fiscal) quarters, and represents the quarter for which the data is released (i.e. 12.4 will be released toward the end of 2012 in early October. This change became necessary to facilitate application and data releases that do not coincide. The new convention also aids the end-users in quickly identifying the time-period of the LRS data.

LRS Release Schedule
(Calendar Quarters)

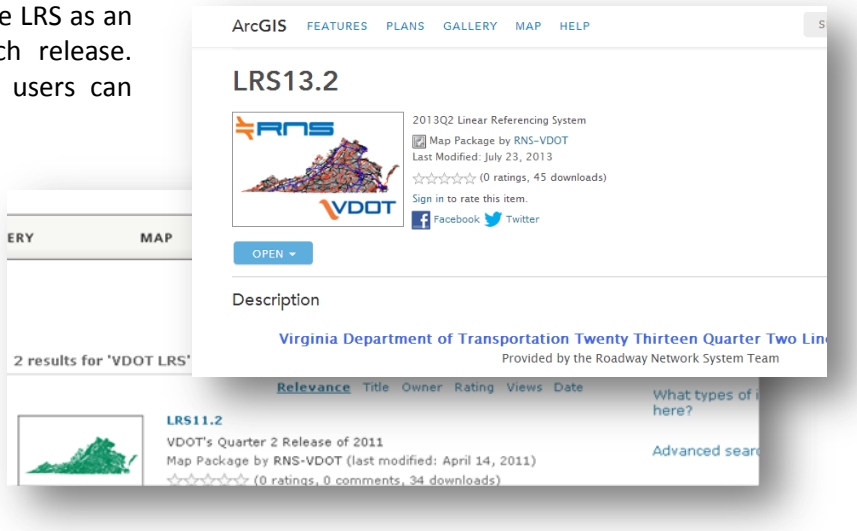
NOTICE:
Data releases are targeted for the fifteenth day of the third month (orange) of each quarter. YY indicates two digit year (e.g. the year 2012 equals 12). This schedule does not guarantee the release will be available at the times indicated.



Data Retrieval and Formats

LRS Map Packages @ *ArcGIS.com*

The RNS Team publishes the LRS as an Esri map package for each release. When visiting *ArcGIS.com*, users can search for "VDOT LRS".



Secure FTP (SFTP) @ *ftp.VDOT.Virginia.Gov*

Please contact the Helpdesk at 804-786-1280 or *caddsupport@VDOT.Virginia.Gov* and request access to the "VDOT-GIS" folder.

Host: *ftp.VDOT.Virginia.Gov*
User: [obtain from *helpdesk*]
Pass: [obtain from *helpdesk*]

VDOT-GIS FTP LRS Tips and Tricks:

- READ the release notes: Feature Class Application Matrices
- (page 5) section to determine which files will best suit your needs.
- VDOT-GIS FTP does not support browser connections. Please use an SFTP client such as Filezilla, WS-FTP, etc.
- Clients external to the Commonwealth domain should set the ACTIVE transfer mode option.

SDE Connection @ VDOT's GIS Enterprise

(Internal Use Only)

Contact *GIS@VDOT.Virginia.Gov* if you require assistance configuring an SDE connection, are having issues connecting to the GIS Enterprise or FTP.

LRS Delivery Format Comparison

Format	Uncompressed	Zip compression (Level 9 "Ultra" deflate)	Esri Map Package		Esri Spatial Database Engine (SDE)**
			Transfer (compressed)	Storage (Uncompressed)	
Content	11 Personal Geodatabases (.mdb)	11 .zip files (Compressed .mdb)	1 Map Package (.mpk)	1 File Geodatabase and map document (.gdb containing ~180 related files + .mxd)	10 feature classes and 1 table (other related tables exist)
Size*	4GB	2GB	700MB	1.5GB	unavailable

MB = megabyte (1,024 kilobytes)
GB = gigabyte (1,024 megabytes)
*Data storage sizes are approximate
**Internal agency use only

File geodatabases offer many improvements over personal geodatabases. A few to mention that are specific to the LRS:

- Far more proficient at storing and displaying data, especially when speaking in terms of size and speed. This directly affects data consumers because less time will be spent downloading releases and release packages will take up significantly less disk space on workstation hard drives. Please see the *LRS Delivery Format Comparison* above.
- A particular enhancement that the RNS team often leverages is that the display of measure hatching is considerably faster.

Consumers must also be warned that file geodatabases also have caveats. Non-Esri users cannot directly access the tabular data within a file geodatabase, which is possible with personal geodatabases because a personal geodatabase is simply a Microsoft Access™ file. The RNS team recognizes that many data consumers may not use Esri products and also that users may not want the release as a comprehensive package, therefore the LRS will continue to be provided in the traditional personal geodatabase format downloadable through the FTP. More information on Esri Map Packages and file geodatabase format can be obtained by visiting the links listed below.

- *ArcGIS.com - What's new for sharing maps and data in ArcGIS 10*
- *ArcGIS.com - Types of geodatabases*
- *Esri.com - The Top Nine Reasons to Use a File Geodatabase*

Glossary