COMMONWEALTH OF VIRGINIA

Information Technology Resource Management (ITRM)

VIRGINIA INFORMATION TECHNOLOGIES AGENCY (VITA)

VIRGINIA GEOGRAPHIC INFORMATION NETWORK (VGIN)

ROAD CENTERLINE

GEOSPATIAL DATA STANDARD

Reviews

- This publication was reviewed and approved by the Manager of the Enterprise Architecture Division.
- Online review was provided for agencies and other interested parties via the VITA Online Review and Comment Application (ORCA).

Publication Version Control

Questions related to this publication should be directed to the Manager of VITA's Enterprise Architecture (EA) Division. EA notifies Agency Information Technology Resources (AITRs) at all state agencies, institutions and other interested parties of -proposed revisions to this document.

This following table contains a history of revisions to this publication.

Version	Date	Revision Description
1.0	03/22/2016	Original document

Identifying Changes in This Document

- See the latest entry in the revision table above.
- Vertical lines in the left margin indicate the paragraph has changes or additions. Specific changes in wording are noted using italics and underlines; with italics only indicating new/added language and italics that are underlined indicating language that has changed.

The following examples demonstrate how the reader may identify requirement and recommend practice updates and changes:

EXA-R-01 **Example with No Change –** The text is the same. The text is the same. The text is the same.

EXA-R-02 **Example with Revision –** The text is the same. *A wording change, update or clarification is made in this text.*

EXA-R-03 ***Example of New Text –*** *This language is new.*

EX~~A-R-03~~ **~~Technology Standard Example of Deleted Standard –~~** ~~This standard was rescinded on mm/dd/yyyy.~~

Preface

Publication Designation

ITRM VGIN Road Centerline Geospatial Data Standard (OTH 703-00)

Subject

Road Centerline Geospatial Data Standard

Effective Date

March 22, 2015

Supersedes

Nothing; this is the first version of the standard.

Scheduled Review:

This standard shall be reviewed on an annual basis.

Authority

Code of Virginia, §2.2-225 (Powers and duties of the Secretary of Technology (SoTech)

Code of Virginia, §2.2-2007 (Powers of the CIO)

Code of Virginia §2.2-2008 (Additional duties of the CIO relating to project management)

Code of Virginia, § 2.2-2010 (Additional powers of VITA)

Scope

This standard is applicable to all Executive Branch state agencies and institutions of higher education (hereinafter collectively referred to as "agencies") that are responsible for the management, development, purchase and use of information technology resources in the Commonwealth of Virginia. This standard does not apply to research projects, research initiatives or instructional programs at public institutions of higher education.

Purpose

This standard establishes direction and technical requirements which govern the acquisition, use and management of information technology resources by executive branch agencies.

General Responsibilities

Chief Information Officer of the Commonwealth (CIO)

Develop, review and approve statewide technical and data policies, standards and guidelines for information technology and related systems.

Virginia Information Technologies Agency (VITA)

At the direction of the CIO, VITA leads efforts that draft, review and update technical and data policies, standards, and guidelines for information technology and related systems. VITA uses requirements in IT technical and data related policies and standards when establishing contracts; reviewing procurement requests, agency IT projects, budget requests and strategic plans; and when developing and managing IT related services

Information Technology Advisory Council (ITAC)

Advise the CIO on the development, adoption and update of statewide technical and data policies, standards and guidelines for information technology and related systems.

Executive Branch Agencies

Provide input and review during the development, adoption and update of statewide technical and data policies, standards and guidelines for information technology and related systems.

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Overview

1) Publishing and Developing Road Centerlines

The Road Centerline Geospatial Data Standard implements, as a Commonwealth ITRM Standard, the data file naming conventions, coordinate systems, geometry, attributes, dataset type and specifications for the Virginia Road Centerline Dataset. The standard shall be applicable to Commonwealth local governments and state agencies and serve as the data source of record at the state level for road centerline spatial features within the Commonwealth of Virginia.

Road Centerlines shall be defined as a digitally rendered linear geometric representation of a geographical center of a true to ground navigational carriageway. Road centerline features are topologically connected in a joined network of road segments. They are used for geo-locating features and residences along the linear segmented paths and provide the ability to route vehicles and resources throughout the road centerline network.

The Road Centerline Geospatial Data Standard shall consist of the following standard database elements and entry methodologies.

1.1 Road Centerline Publication Format

File and Feature Naming Conventions

Dataset Published Title (Release in YYYY Format)	"Virginia_RCL_Dataset_Q***"
Dataset Type	ESRI-compatible File Geodatabase
Feature Geodatabase File Name	"VA_RCL"
Geodatabase Feature Classes	"VA_CENTERLINE" – Contains Road Centerline feature class as provided by the Virginia Geographic Information Network (VGIN) "VA_SNAP_POINT" – Contains point geometry at jurisdiction boundaries which represents extent of local government geospatial Road Centerline data maintenance

Coordinate Systems and Geometry

Projected Coordinate System	Lambert Conformal Conic Virginia
Geographic Coordinate System	GCS North American 1983
Geometry Type	ESRI True Curves

1.2 Road Centerline Schema

Feature Class: VA_CENTERLINE				
Field Name	**Data Type**	**Length / Precision**	**Description**	**LOV / Domain**
OBJECTID	Object ID	Default	ESRI geodatabase feature ID	None
Shape	Geometry	Default	Feature geometry. Coordinates defining the features.	None
Shape_Length	Double	Default	Length of feature in internal units.	None
RCL_ID	Double	16	Unique statewide VGIN Road Centerline ID	None
LOCAL_ID	Double	16	Unique Road Centerline ID from Locality	None
VDOT_EDGE_ID	Double	16	Unique Road Centerline ID from VDOT	None
MFIPS	Text	7	Maintenance FIPS code of locality	FIPS
GEOMETRY_EDIT_TYPE	Short	Default	Type of edit made to geometry	EDIT_TYPE
GEOMETRY_EFFECTIVE_DATE	Date	Default	Date of segment entry	None
GEOMETRY_SOURCE	Text	4	Source of centerline geometry	SOURCE
GEOMETRY_EDIT_DATE	Date	Default	Date of segment edit	None
LEFT_FROM_ADDRESS	Long	Default	Address range from, left side	None
LEFT_TO_ADDRESS	Long	Default	Address range to, left side	None
RIGHT_FROM_ADDRESS	Long	Default	Address range from, right side	None
RIGHT_TO_ADDRESS	Long	Default	Address range to, right side	None
ADDRESS_RANGE_FORMAT	Text	1	Address Range Format Type	RANGE_TYPE
ADDRESS_RANGE_SOURCE	Text	4	Source of address range	SOURCE
ADDRESS_RANGE_EDIT_DATE	Date	Default	Date of address range edit	None
STREET_ALIAS_ID	Double	16	Street Alias ID to Alias table	None
STREET_PREMODIFIER	Text	10	USPS Street Modifier - PRE	MODIFER
STREET_PREFIX_DIRECTION	Text	2	USPS / NENA Standard Street Prefix	DIRECTION
STREET_NAME	Text	75	Standardized Street Name	None
STREET_SUFFIX	Text	4	USPS/NENA Street Suffix Type	SUFFIX
STREET_SUFFIX_DIRECTION	Text	2	USPS/NENA Street Suffix Direction	DIRECTION
STREET_POSTMODIFIER	Text	10	USPS Street Modifier - Post	MODIFIER
STREET_NAME_FULL	Text	100	Full title concatenated street name	None
STREET_NAME_SOURCE	Text	4	Source of street name	SOURCE
STREET_NAME_EDIT_DATE	Date	Default	Date of street name edit	None
MTFCC	Text	10	Modified Census feature class code	MTFCC
SEGMENT_TYPE	Short	Default	Modified NVRRCL segment type code	SEGMENT_TYPE
LOCAL_SPEED_MPH	Short	Default	Speed provided by locality and VGIN	None
DUAL_CARRIAGEWAY	Text	1	Indicator field for dual carriageway	YES_NO
ONE_WAY	Text	2	One Way directionality indicator	ONE_WAY
REVERSIBLE	Text	1	Reversible for traffic management	YES_NO
SEGMENT_EXISTS	Text	1	Availability for routing	YES_NO

Feature Class: VA_CENTERLINE_SNAP_POINT				
Field Name	**Data Type**	**Length / Precision**	**Description**	**LOV / Domain**
OBJECTID	Object ID	Default	ESRI geodatabase feature ID	None
Shape	Geometry	Default	Feature geometry. Coordinates defining the features.	None
SNAP_POINT_ID	Double	8	Unique Snap Point ID	None
X_COORD	Double	8	X Coordinate	None
Y_COORD	Double	8	Y Coordinate	None
LAST_UPDATE	Date	Default	Date of last geometry edit	None
NAME_CHANGE	Text	1	Street name changes at junction	YES_NO
FIPS_01	Text	7	Locality code for segment A	FIPS
FIPS_02	Text	7	Locality code for segment B	FIPS
FIPS_03	Text	7	Locality code for possible segment C	FIPS
GEOMETRY_SOURCE	Text	4	Source of point geometry	SOURCE

Object Table: ZONE				
Field Name	**Data Type**	**Length / Precision**	**Description**	**LOV / Domain**
OBJECTID	Object ID	Default	ESRI geodatabase feature ID	None
RCL_ID	Double	16	Unique centerline ID	None
COMMUNITY_LEFT	Text	50	MSAG Community Left	None
COMMUNITY_LEFT	Text	50	MSAG Community Left	None
COMMUNITY_RIGHT	Text	50	MSAG Community Right	None
ESN_LEFT	Text	5	ESN on segment, left side	None
ESN_RIGHT	Text	5	ESN on segment, right side	None
FIPS_LEFT	Text	7	PSAP on segment, left side	FIPS
FIPS_RIGHT	Text	7	PSAP on segment, right side	FIPS
ZIP_LEFT	Long	Default	Zip Code on segment, left side	None
ZIP_RIGHT	Long	Default	Zip Code on segment, right side	None

Object Table: STREET_ALIAS				
Field Name	**Data Type**	**Length / Precision**	**Description**	**LOV / Domain**
OBJECTID	Object ID	Default	ESRI geodatabase feature ID	None
STREET_ALIAS_ID	Double	16	Street Alias table ID	None
STREET_PREMODIFIER	Text	10	USPS Street Modifier - PRE	MODIFER
STREET_PREFIX_DIRECTION	Text	2	USPS / NENA Standard Street Prefix	DIRECTION
STREET_NAME	Text	75		None
STREET_SUFFIX	Text	4	USPS/NENA Street Suffix Type	SUFFIX
STREET_SUFFIX_DIRECTION	Text	2	USPS/NENA Street Suffix Direction	DIRECTION
STREET_POSTMODIFIER	Text	10	USPS Street Modifier - Post	MODIFIER
STREET_NAME_FULL	Text	100	Full title concatenated street name	None
STREET_NAME_SOURCE	Text	4	Source of street name	SOURCE
STREET_NAME_EDIT_DATE	Date	Default	Date of street name edit	None

Object Table: ADDRESS_ALTERNATE				
Field Name	**Data Type**	**Length / Precision**	**Description**	**LOV / Domain**
OBJECTID	Object ID	Default	ESRI geodatabase feature ID	None
RCL_ID	Double	16	Road Centerline	None
LEFT_FROM_ADDRESS	Long	Default	Address range from, left side	None
LEFT_TO_ADDRESS	Long	Default	Address range to, left side	None
RIGHT_FROM_ADDRESS	Long	Default	Address range from, right side	None
RIGHT_TO_ADDRESS	Long	Default	Address range to, right side	None
ADDRESS_RANGE_FORMAT	Text	1	Address Range Format Type	RANGE_TYPE
ADDRESS_RANGE_SOURCE	Text	4	Source of address range	SOURCE

Object Table: VDOT_ATTRIBUTE				
Field Name	**Data Type**	**Length / Precision**	**Description**	**LOV / Domain**
OBJECTID	Object ID	Default	ESRI geodatabase feature ID	None
VDOT_EDGE_ID	Double	16	Unique centerline ID from VDOT	None
VDOT_RTE_NM	Text	60	Full Segment Route Name	None
VDOT_RTE_NUMBER	Long	10	Segment Route Number	None
VDOT_RTE_TYPE_CD	Text	3	Segment Route Type Code	None
VDOT_RTE_CATEGORY_CD	Text	6	Segment Route Category Code	None
VDOT_FUNCTIONAL_CLASS_CD	Text	3	Functional Class Code	None
VDOT_PAVEMENT_TYPE_CD	Text	6	Pavement Type Code	None
VDOT_SPEED_LIMIT_NBR	Short	5	Posted Speed Limit	None
VDOT_RESTRICTION_CD	Text	2000	Restriction descriptor field	None
VDOT_LANE_COUNT_NBR	Short	5	Lane Count	None
VDOT_PAVEMENT_WIDTH_MSR	Long	10	Pavement Width	None
VDOT_SURFACE_WIDTH_MSR	Long	10	Surface Width	None
VDOT_TRAFFIC_AADT_NBR	Long	10	Average Annual Daily Traffic Count	None

1.3 Road Centerline Attributes

Domain: SOURCE		
Code	**Description**	**Source**
L	Local Government	VGIN
VGIN	Virginia Geographic Information Network	VGIN
VDOT	Virginia Department of Transportation	VGIN
USCB	U.S. Census Bureau	VGIN
O	Commercial / Other	VGIN

Domain: EDIT_TYPE		
Code	**Description**	**Source**
1	Segment Addition	VGIN
2	Cartographic Location Change	VGIN
3	Segment Split	VGIN
4	Length Location Change	VGIN
5	Segment Merge	VGIN
6	Functional Location Change	VGIN
8	QC Segment Split	VGIN
9	QC Segment Merge	VGIN

Domain: FIPS

Code	Description	Source
51001	Accomack County	Census
51003	Albemarle County	Census
51510	Alexandria city	Census
51005	Alleghany County	Census
51007	Amelia County	Census
51009	Amherst County	Census
51011	Appomattox County	Census
51013	Arlington County	Census
51015	Augusta County	Census
51017	Bath County	Census
51019	Bedford County	Census
51021	Bland County	Census
51023	Botetourt County	Census
51520	Bristol city	Census
51025	Brunswick County	Census
51027	Buchanan County	Census
51029	Buckingham County	Census
51530	Buena Vista city	Census
51031	Campbell County	Census
51033	Caroline County	Census
51035	Carroll County	Census
51036	Charles City County	Census
51037	Charlotte County	Census
51540	Charlottesville city	Census
51550	Chesapeake city	Census
51041	Chesterfield County	Census
51043	Clarke County	Census
51570	Colonial Heights city	Census
51580	Covington city	Census
51045	Craig County	Census
51047	Culpeper County	Census
51049	Cumberland County	Census
51590	Danville city	Census
51051	Dickenson County	Census
51053	Dinwiddie County	Census
51595	Emporia city	Census
51057	Essex County	Census
51600	Fairfax city	Census
51059	Fairfax County	Census
51610	Falls Church city	Census
5127440	Farmville Town	Census
51061	Fauquier County	Census
51063	Floyd County	Census
51065	Fluvanna County	Census
51620	Franklin city	Census
51067	Franklin County	Census
51069	Frederick County	Census
51630	Fredericksburg city	Census

Code	Description	Source
51640	Galax city	Census
51071	Giles County	Census
51073	Gloucester County	Census
51075	Goochland County	Census
51077	Grayson County	Census
51079	Greene County	Census
51081	Greensville County	Census
51083	Halifax County	Census
51650	Hampton city	Census
51085	Hanover County	Census
51660	Harrisonburg city	Census
51087	Henrico County	Census
51089	Henry County	Census
51091	Highland County	Census
51670	Hopewell city	Census
51093	Isle of Wight County	Census
51095	James City County	Census
51097	King and Queen County	Census
51099	King George County	Census
51101	King William County	Census
51103	Lancaster County	Census
51105	Lee County	Census
51678	Lexington city	Census
51107	Loudoun County	Census
51109	Louisa County	Census
51111	Lunenburg County	Census
51680	Lynchburg city	Census
51113	Madison County	Census
51683	Manassas city	Census
51685	Manassas Park city	Census
51690	Martinsville city	Census
51115	Mathews County	Census
51117	Mecklenburg County	Census
51119	Middlesex County	Census
51121	Montgomery County	Census
51125	Nelson County	Census
51127	New Kent County	Census
51700	Newport News city	Census
51710	Norfolk city	Census
51131	Northampton County	Census
51133	Northumberland County	Census
51720	Norton city	Census
51135	Nottoway County	Census
51137	Orange County	Census
51139	Page County	Census
51141	Patrick County	Census
51730	Petersburg city	Census
51143	Pittsylvania County	Census

Code	Description	Source
51735	Poquoson city	Census
51740	Portsmouth city	Census
51145	Powhatan County	Census
51147	Prince Edward County	Census
51149	Prince George County	Census
51153	Prince William County	Census
51155	Pulaski County	Census
51750	Radford city	Census
51157	Rappahannock County	Census
51760	Richmond city	Census
51159	Richmond County	Census
51770	Roanoke city	Census
51161	Roanoke County	Census
51163	Rockbridge County	Census
51165	Rockingham County	Census
51167	Russell County	Census
51775	Salem City	Census
51169	Scott County	Census
51171	Shenandoah County	Census
51173	Smyth County	Census
51175	Southampton County	Census
51177	Spotsylvania County	Census
51179	Stafford County	Census
51790	Staunton City	Census
51800	Suffolk City	Census
51181	Surry County	Census
51183	Sussex County	Census
51185	Tazewell County	Census
51810	Virginia Beach City	Census
51187	Warren County	Census
51191	Washington County	Census
51820	Waynesboro City	Census
5184960	West Point Town	Census
51193	Westmoreland County	Census
51830	Williamsburg City	Census
51840	Winchester City	Census
51195	Wise County	Census
51197	Wythe County	Census
51199	York County	Census
11001	District of Columbia (DC)	Census
21013	Bell County (KY)	Census
21095	Harlan County (KY)	Census
21133	Letcher County (KY)	Census
21195	Pike County (KY)	Census
24017	Charles County (MD)	Census
24021	Frederick County (MD)	Census
24047	Worcester County (MD)	Census
24043	Washington County (MD)	Census
24033	Prince George's County (MD)	Census
24031	Montgomery County (MD)	Census
24037	St. Mary's County (MD)	Census

Code	Description	Source
24039	Somerset County (MD)	Census
37171	Surry County (NC)	Census
37005	Alleghany County (NC)	Census
37169	Stokes County (NC)	Census
37009	Ashe County (NC)	Census
37157	Rockingham County (NC)	Census
37185	Warren County (NC)	Census
37181	Vance County (NC)	Census
37131	Northampton County (NC)	Census
37145	Person County (NC)	Census
37033	Caswell County (NC)	Census
37077	Granville County (NC)	Census
37053	Currituck County (NC)	Census
37091	Hertford County (NC)	Census
37073	Gates County (NC)	Census
37029	Camden County (NC)	Census
47091	Johnson County (TN)	Census
47067	Hancock County (TN)	Census
47163	Sullivan County (TN)	Census
47025	Claiborne County (TN)	Census
47073	Hawkins County (TN)	Census
54031	Hardy County (WV)	Census
54037	Jefferson County (WV)	Census
54065	Morgan County (WV)	Census
54027	Hampshire County (WV)	Census
54003	Berkeley County (WV)	Census
54063	Monroe County (WV)	Census
54075	Pocahontas County (WV)	Census
54059	Mingo County (WV)	Census
54055	Mercer County (WV)	Census
54025	Greenbrier County (WV)	Census
54071	Pendleton County (WV)	Census
54047	McDowell County (WV)	Census
54089	Summers County (WV)	Census

Domain: RANGE_FORMAT		
Code	**Description**	**Source**
A	Actual Address Range	VGIN
T	Theoretical Address Range	VGIN

Domain: MODIFIER		
Code	**Description**	**Source**
ACCESS	Access	USPS
ALTERNATE	Alternate	USPS
BUSINESS	Business	USPS
BYPASS	Bypass	USPS
CONNECTOR	Connector	USPS
EXTENDED	Extended	USPS
EXTENSION	Extension	USPS
LOOP	Loop	USPS
OLD	Old	USPS
OVERPASS	Overpass	USPS
PRIVATE	Private	USPS
PUBLIC	Public	USPS
RAMP	Ramp	USPS
SCENIC	Scenic	USPS
SPUR	Spur	USPS
UNDERPASS	Underpass	USPS

Domain: DIRECTION		
Code	**Description**	**Source**
N	North	USPS
S	South	USPS
E	East	USPS
W	West	USPS
NE	Northeast	USPS
NW	Northwest	USPS
SE	Southeast	USPS
SW	Southwest	USPS

Domain: SUFFIX		
Code	**Description**	**Source**
ALY	ALLEY	USPS
ANX	ANEX	USPS
ARC	ARCADE	USPS
AVE	AVENUE	USPS
BYU	BAYOU	USPS
BCH	BEACH	USPS

Code	**Description**	**Source**
BND	BEND	USPS
BLF	BLUFF	USPS
BLFS	BLUFFS	USPS
BTM	BOTTOM	USPS
BLVD	BOULEVARD	USPS
BR	BRANCH	USPS

Code	Description	Source
BRG	BRIDGE	USPS
BRK	BROOK	USPS
BRKS	BROOKS	USPS
BG	BURG	USPS
BGS	BURGS	USPS
BYP	BYPASS	USPS
CP	CAMP	USPS
CYN	CANYON	USPS
CPE	CAPE	USPS
CSWY	CAUSEWAY	USPS
CTR	CENTER	USPS
CTRS	CENTERS	USPS
CIR	CIRCLE	USPS
CIRS	CIRCLES	USPS
CLF	CLIFF	USPS
CLFS	CLIFFS	USPS
CLB	CLUB	USPS
CMN	COMMON	USPS
CMNS	COMMONS	USPS
COR	CORNER	USPS
CORS	CORNERS	USPS
CRSE	COURSE	USPS
CT	COURT	USPS
CTS	COURTS	USPS
CV	COVE	USPS
CVS	COVES	USPS
CRK	CREEK	USPS
CRES	CRESCENT	USPS
CRST	CREST	USPS
XING	CROSSING	USPS
XRD	CROSSROAD	USPS
XRDS	CROSSROADS	USPS
CURV	CURVE	USPS
DL	DALE	USPS
DM	DAM	USPS
DV	DIVIDE	USPS
DR	DRIVE	USPS
DRS	DRIVES	USPS
EST	ESTATE	USPS
ESTS	ESTATES	USPS
EXPY	EXPRESSWAY	USPS
EXT	EXTENSION	USPS
EXTS	EXTENSIONS	USPS
FALL	FALL	USPS
FLS	FALLS	USPS
FRY	FERRY	USPS
FLD	FIELD	USPS
FLDS	FIELDS	USPS
FLT	FLAT	USPS
FLTS	FLATS	USPS

Code	Description	Source
FRD	FORD	USPS
FRDS	FORDS	USPS
FRST	FOREST	USPS
FRG	FORGE	USPS
FRGS	FORGES	USPS
FRK	FORK	USPS
FRKS	FORKS	USPS
FT	FORT	USPS
FWY	FREEWAY	USPS
GDN	GARDEN	USPS
GDNS	GARDENS	USPS
GTWY	GATEWAY	USPS
GLN	GLEN	USPS
GLNS	GLENS	USPS
GRN	GREEN	USPS
GRNS	GREENS	USPS
GRV	GROVE	USPS
GRVS	GROVES	USPS
HBR	HARBOR	USPS
HBRS	HARBORS	USPS
HVN	HAVEN	USPS
HTS	HEIGHTS	USPS
HWY	HIGHWAY	USPS
HL	HILL	USPS
HLS	HILLS	USPS
HOLW	HOLLOW	USPS
INLT	INLET	USPS
IS	ISLAND	USPS
ISS	ISLANDS	USPS
ISLE	ISLE	USPS
JCT	JUNCTION	USPS
JCTS	JUNCTIONS	USPS
KY	KEY	USPS
KYS	KEYS	USPS
KNL	KNOLL	USPS
KNLS	KNOLLS	USPS
LK	LAKE	USPS
LKS	LAKES	USPS
LAND	LAND	USPS
LNDG	LANDING	USPS
LN	LANE	USPS
LGT	LIGHT	USPS
LGTS	LIGHTS	USPS
LF	LOAF	USPS
LCK	LOCK	USPS
LCKS	LOCKS	USPS
LDG	LODGE	USPS
LOOP	LOOP	USPS
MALL	MALL	USPS
MNR	MANOR	USPS

Code	Description	Source
MNRS	MANORS	USPS
MDW	MEADOW	USPS
MDWS	MEADOWS	USPS
MEWS	MEWS	USPS
ML	MILL	USPS
MLS	MILLS	USPS
MSN	MISSION	USPS
MTWY	MOTORWAY	USPS
MT	MOUNT	USPS
MTN	MOUNTAIN	USPS
MTNS	MOUNTAINS	USPS
NCK	NECK	USPS
ORCH	ORCHARD	USPS
OVAL	OVAL	USPS
OPAS	OVERPASS	USPS
PARK	PARK	USPS
PARK	PARKS	USPS
PKWY	PARKWAY	USPS
PKWY	PARKWAYS	USPS
PASS	PASS	USPS
PSGE	PASSAGE	USPS
PATH	PATH	USPS
PIKE	PIKE	USPS
PNE	PINE	USPS
PNES	PINES	USPS
PL	PLACE	USPS
PLN	PLAIN	USPS
PLNS	PLAINS	USPS
PLZ	PLAZA	USPS
PT	POINT	USPS
PTS	POINTS	USPS
PRT	PORT	USPS
PRTS	PORTS	USPS
PR	PRAIRIE	USPS
RADL	RADIAL	USPS
RAMP	RAMP	USPS
RNCH	RANCH	USPS
RPD	RAPID	USPS
RPDS	RAPIDS	USPS
RST	REST	USPS
RDG	RIDGE	USPS
RDGS	RIDGES	USPS
RIV	RIVER	USPS
RD	ROAD	USPS
RDS	ROADS	USPS
RTE	ROUTE	USPS
ROW	ROW	USPS
RUE	RUE	USPS

Code	Description	Source
SHLS	SHOALS	USPS
SHR	SHORE	USPS
SHRS	SHORES	USPS
SKWY	SKYWAY	USPS
SPG	SPRING	USPS
SPGS	SPRINGS	USPS
SPUR	SPUR	USPS
SPUR	SPURS	USPS
SQ	SQUARE	USPS
SQS	SQUARES	USPS
STA	STATION	USPS
STRA	STRAVENUE	USPS
STRM	STREAM	USPS
ST	STREET	USPS
STS	STREETS	USPS
SMT	SUMMIT	USPS
TER	TERRACE	USPS
TRWY	THROUGHWAY	USPS
TRCE	TRACE	USPS
TRAK	TRACK	USPS
TRFY	TRAFFICWAY	USPS
TRL	TRAIL	USPS
TRLR	TRAILER	USPS
TUNL	TUNNEL	USPS
TPKE	TURNPIKE	USPS
UPAS	UNDERPASS	USPS
UN	UNION	USPS
UNS	UNIONS	USPS
VLY	VALLEY	USPS
VLYS	VALLEYS	USPS
VIA	VIADUCT	USPS
VW	VIEW	USPS
VWS	VIEWS	USPS
VLG	VILLAGE	USPS
VLGS	VILLAGES	USPS
VL	VILLE	USPS
VIS	VISTA	USPS
WALK	WALK	USPS
WALK	WALKS	USPS
WALL	WALL	USPS
WAY	WAY	USPS
WAYS	WAYS	USPS
WL	WELL	USPS
WLS	WELLS	USPS

RUN	RUN	USPS
SHL	SHOAL	USPS

Domain: ONE_WAY

Code	Description	Source
B	Bi-Directional	USPS
FT	With Segment Arc Directionality	USPS
TF	Against Segment Arc Directionality	USPS
N	Not Traversable	USPS

Domain: YES_NO

Code	Description	Source
Y	YES	VGIN
N	NO	VGIN

Domain: MTFCC

Code	Description	Source
S1100	Limited Access Highways	Census
S1100HOV	High Occupancy Vehicle (HOV) Lanes	VGIN
S1200PRI	US and VA Primary Highways	VGIN
S1200LOC	Local Main Arteries	VGIN
S1640	Limited Access Highway Frontage	Census
S1400	Local Secondaries	Census
S1630	Ramps	Census
S1730	Alleys	Census
S1780	Parking Lot Roads	Census
S9999	Driveways	VGIN
S2000	Road Medians	Census
S1710	Walkways/Pedestrian Trails	Census
S1720	Stairways	Census
S1740	Service Vehicle Private Drives	Census
S1820	Bike Paths or Trails	Census
S1830	Bridle Paths	Census
S1500	4WD Vehicular Trails	Census

Domain: SEGMENT_TYPE

Code	Description	Source
1	Airport Road	NOVA
2	Bridge/Overpass	NOVA
5	Gate	NOVA
8	Merge	NOVA
9	Separated Turn Lane	NOVA
10	Tunnel/Underpass	NOVA
20	Traffic Circle	VGIN
30	Cul-de-sac	VGIN
40	Toll Booth	VGIN
50	Ferry Crossing	VGIN
99	Other Centerline	NOVA

2 Road Centerline Geometry Standardization

2.1 Road Centerline Geometry Representation

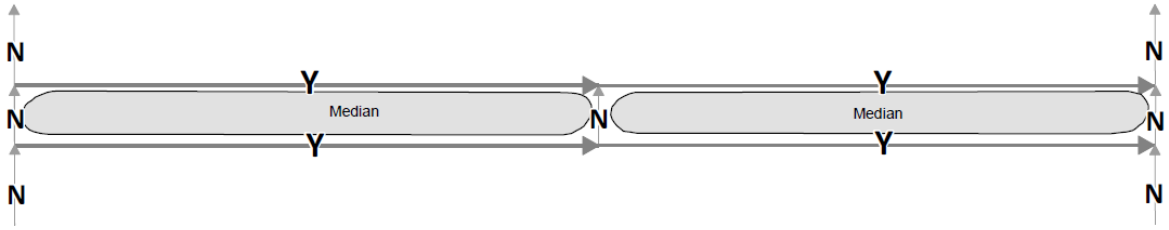
The National Emergency Number Association (NENA) specializes in standardizing data to be used in public safety systems for the purpose of emergency response. This includes geometry standard and best practice components of Road Centerline geometry modeling. In most cases of geospatial data the geometry and attributes work together to form the basis of centerline data development and maintenance. The Federal Highway Administration (FHWA) as well as individual state departments of transportation also provide valuable insight on modeling centerline data and have specific guidebooks for maintaining consistency in Road Centerline data development. The following components of geometric characteristics will determine consistency within the Virginia Road Centerline data.

Carriageways

Virginia Road Centerline segment geometry shall be represented as a single centerline where no physical barrier is present and dual centerline where physical barriers are present with opposing lanes of traffic. When roads are represented by undivided pavement with no barriers present between the traffic lanes, the Road Centerline should be represented as a single piece of geometry no matter how wide the pavement of the road is.

These carriageway type divisions can be located with field verification or VBMP imagery and commercial mapping sites by looking specifically for concrete/grass medians, raised barriers, and other pavement types which physically separate traffic lanes. There may be other factors or barrier types which warrant a divided centerline. While VDOT centerline modeling may include specific limitations on primary highways for minimum length of pavement divisions/barriers for a dual centerline to be modeled, it is best advised to digitize with the most amount of granularity based on ground condition regardless of length.

Figure 2a: Dual carriageway segments = Y, single carriageway segments = N.



The VGIN RCL data model contains an indicator field for segments that are considered dual carriageway. This field makes analysis of road network ideal and also provides a good resource when performing QC to one way attribution within the data model along with address low and high fields.

Directionality

Virginia Road Centerline segment geometry directionality shall be oriented in the direction of

increasing address ranges. NENA states, "*Centerline segments should be drawn in the direction of increasing addresses, which is not necessarily the same as the direction of travel*". Road centerlines should be digitized from the lowest address point on the ground and traverse intersections and segments as ranges increase.

It is understood that by following this standard, some inconsistencies may be present in address point location when applying the centerline due to legacy entry where data is out of linear synch. While local jurisdiction workflows and constraints may be in place to model reality, human errors related to desynchronization can arise when placing new address points on the map. Inconsistencies related to existing ground condition that cause model issues are to be flagged as exceptions while actual errors within the data should be corrected within the jurisdiction centerline or address point followed by the state Road Centerline.

Interstate highways shall maintain prime directionality on both dual carriageway lanes within the centerline. Addressing will be based off mile marker locations established by VDOT.

Figure 2b: Single Carriageway: centerline arcs flow against increasing address ranges on Segment A and Segment B and do not meet the state standard

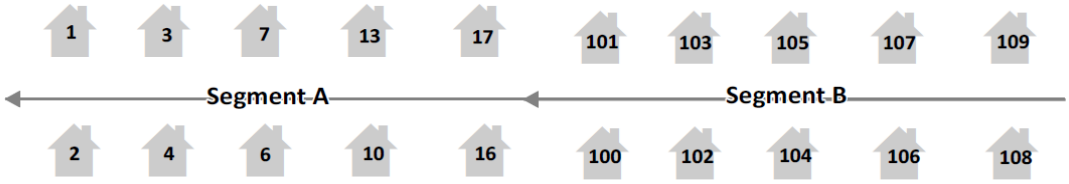
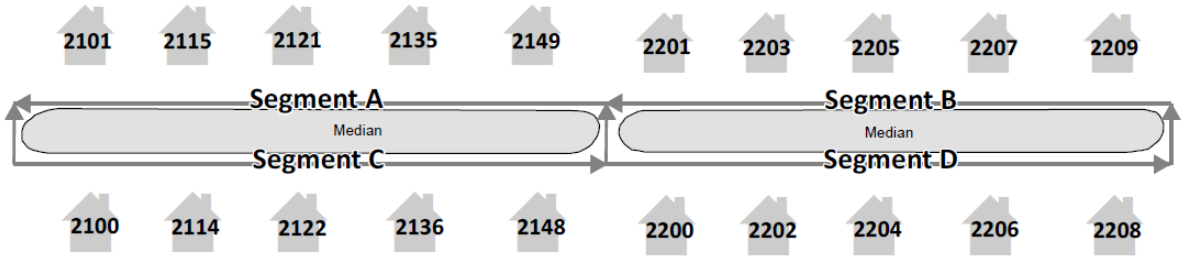


Figure 2c: Dual Carriageway: centerline arcs flow with increasing address ranges on Segment C and Segment D and meet the state standard, Centerline arcs flow against increasing address ranges on Segment A and Segment B and do not meet the state standard



Where dual carriageways exist and using the RCL directionality standard, both sides of the median or barrier should be travelling in the same direction and addresses ranges should be zeroed out on the interior segment sides. Dual carriageway segments should be travelling with traffic flow on one side of the street and against traffic flow on the other while each segment should be attributed accordingly with the one way indicator field.

<u>Intersection Modeling</u>

The NENA standard for grade level intersections states "*Centerline segments must be split (broken) at all true (grade-level) intersections. Line (road) segments shall be split at intersections and ESZ boundaries. Road segments can be split at city and country boundaries as well*." The Virginia Road Centerline segment geometry intersections shall meet the NENA standard for grade level intersections and segmentation locations and maintenance process should be implemented to make sure linear features are:

a) Segmented at intersections that are not elevated crossings
b) Snapped at segmented intersections

Quality control processes should be implemented to make sure segmentation maintenance adheres to the standard.

The NENA standard for grade separated intersections (elevated crossings) states "*If segments intersect without begin or end nodes*/points*, (i.e. overpasses or underpasses) a street intersection is not established*." Therefore, Virginia Road Centerline segment geometry shall be split at grade level intersections and not split at grade separations (elevated crossings) within the physical road network to maintain this standard.

Figure 2d: Meets NENA and Virginia standard for elevated crossings. Arrows indicate endpoints; Centerlines not segmented at overpass and underpass.

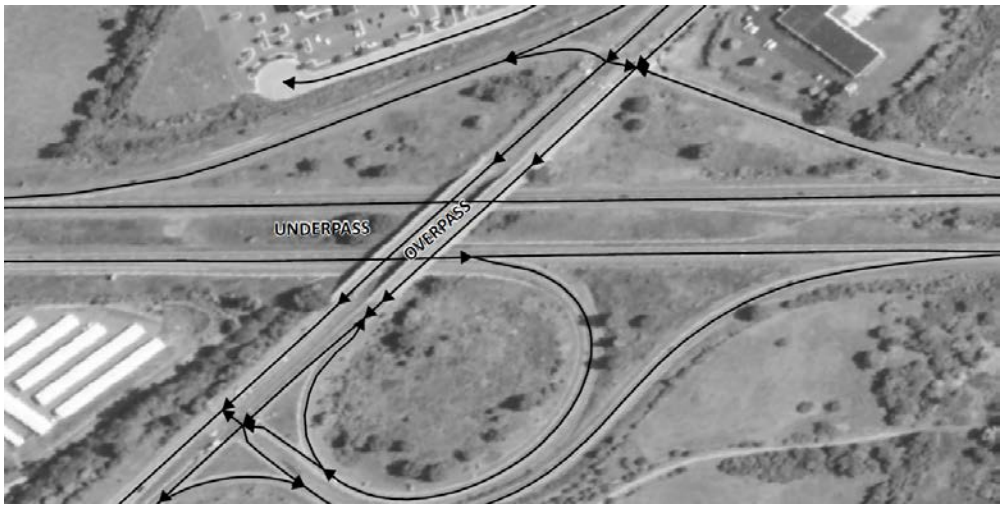
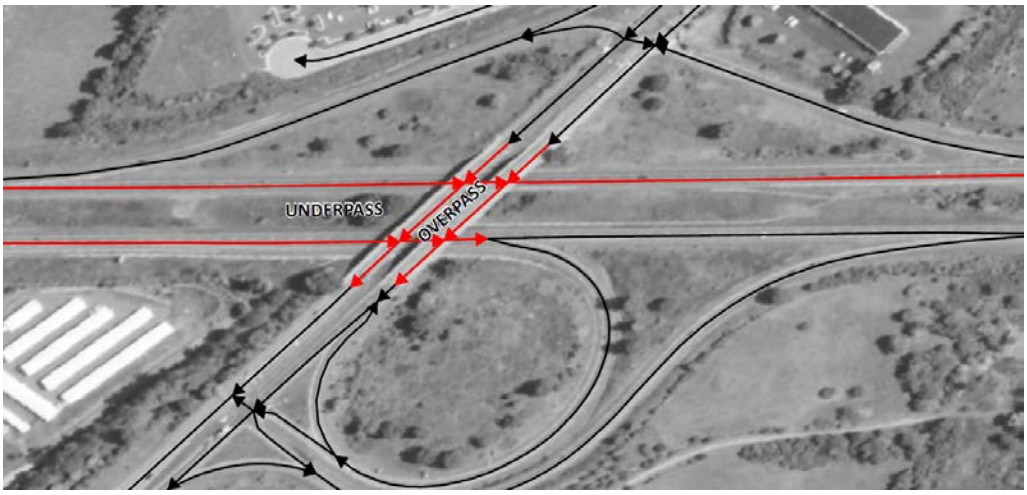


Figure 2e: Does not meet NENA and Virginia standard for elevated crossings. Arrows indicate endpoints; centerlines segmented at overpass and underpass



Storing attributes as overpass/underpass segments within the data model is ideal for quickly querying a database to obtain reference location of elevated crossings throughout a locality and throughout the state. A benefit of the reference is knowing where bridges reside so heights can be evaluated and subsequently placed on a route model if desired. In some cases impedances need to be placed on an elevated crossing to restrict certain vehicle passage so the modeling of these intersection types from a geometry and attribute standpoint are critical.

Also consider splitting centerlines at bridge decking for elevation crossing Z value management where existing. NENA recommends each road centerline editing authority consider splitting at railroad tracks and streams for intersection lookups and searches.

Planned & Existing

It is critical for 9-1-1 dispatch mapping to be aware of ground condition by the knowledge of existing roadways or roadways that are in the process of being built. Roadway alterations in progress and planned subdivisions are both areas that need to be appropriately modeled in order to make better routing decisions.

Determining planned or paper roads and life cycle status of a Road Centerline can be modeled and maintained several ways in a GIS but the most basic way to handle these roadway types is by using a single field in the data model and store existing segments as a Y or N character via Geodatabase domain values. This allows decisions to be made for routes that draw through non-existent areas of the map based on the code. Should additional information be needed by the locality, such as planned, proposed, built, or removed, local data model additions can and should be created as needed by the locality.

VGIN has included a field in the state data model and recommends the inclusion of a field locally which provides quick reference to the ground condition of the data. By incorporating a single field (VGIN model designates the field named SEGMENT_EXIST) and providing feedback to VGIN of the status of the development through this field type, locality and state data models will benefit from an information perspective. The field allows the centerline to be distinguished for routing and planning; for CAD & GIS.

2.2 Digitizing Road Centerlines

A benefit to consistently digitizing the centerline between all jurisdictions throughout the Commonwealth will allow the data to be used without modification at both the jurisdiction and State levels. The processes involve implementing the data standards mentioned above through some of the items listed below.

The recommended geometry representation standards should be applied to current data management practices. Implementation of some of these standards may require changes to practices used today, however, there is recognition that not all of the identified standards can be accommodated or incorporated immediately. A direct result of the standards included in this documentation will be adopted over time while Virginia localities and VGIN develop and maintain datasets and modify data management practices. When developing a Road Centerline, the beginning stages use digitization methods. The following should be considered when digitizing a Road Centerline geometry feature in a database.

<u>VGIN general practices for digitizing Road Centerlines to meet geometry standards:</u>

- Digitize the centerline geography to the center of the thru-lanes of the roadway. Use necessary additional base mapping resources (imagery, GPS, etc.) where available.
- Digitize segments so that they do not overlap.
- Digitize segments so that they are not self-overlapping.
- Digitize segments so that they are single part.
- Digitize the centerline from low to high address range to maintain consistent segment directionality and meet the NENA standard.
- Digitize the dual carriageway centerline with a median section where present on imagery or under construction. Code values with the DUAL_CARRIAGEWAY field as “Y”, Code ONE_WAY field with attributes for with segment directionality or against segment directionality based on arc direction, digitize median segments where present and code with MTFCC value for median type.
- Digitize dual carriageway segments using the following recommended complex intersection modeling to include median/cross over segments:

Figure 2f: 2-1-6 intersection, dual carriageway meets single carriageway; six total segments in intersection

Figure 2g: 2-2-9 intersection, dual carriageway meets dual carriageway, nine total segments in intersection

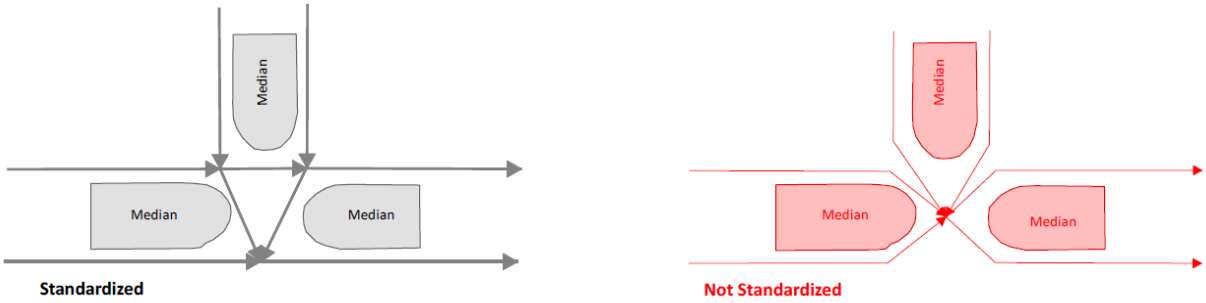


Figure 2h: 2-2-1-10 intersection, dual carriageway meets dual carriageway meets single carriageway, ten total segments in intersection

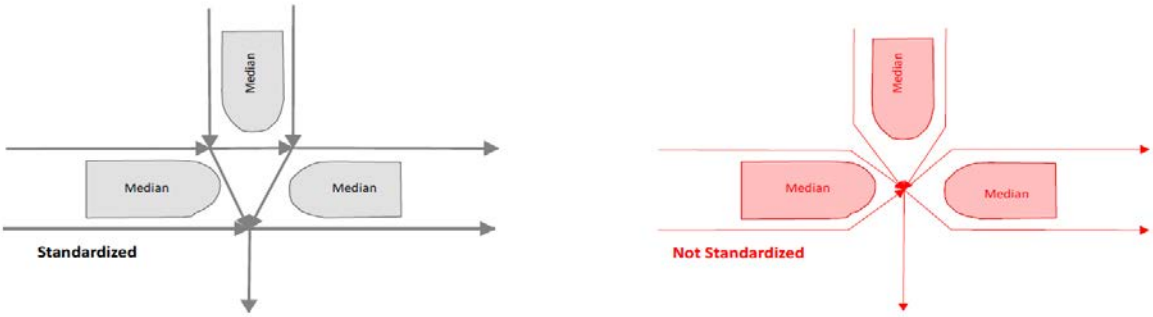
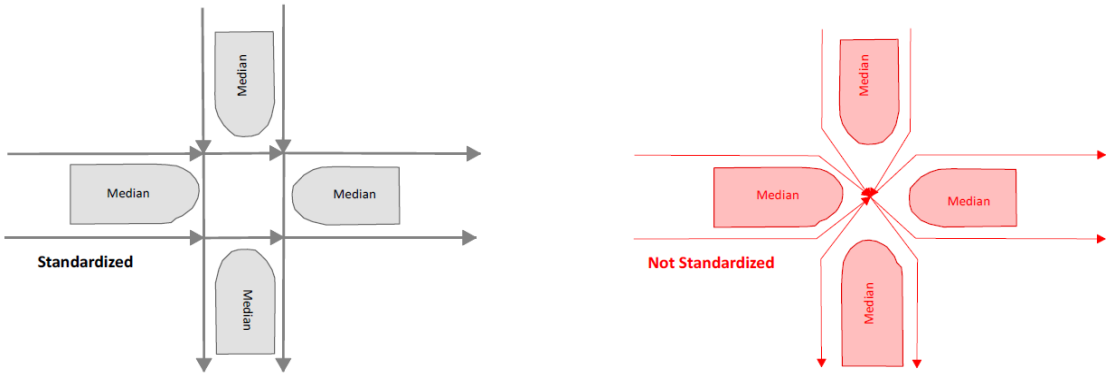


Figure 2i: 2-2-12 intersection, dual carriageway meets dual carriageway, twelve total segments in intersection



There are other combinations that can be made when working with dual carriageways and median segments as they meet other potential carriageway patterns. The included graphics are the most basic way to view the complexities and should be used when digitizing specific centerline intersection types.

- Digitize segments so that they are not zero length.
- Segment and snap centerline features at grade level intersections to meet the NENA standard, merge segments together for grade separated intersections (elevated crossings) so that they do not break at an over/under pass. Code Segment with SEGMENT_TYPE value for specific elevated crossing type.
- Digitize planned road segments based on locality data distinction, code segments with the SEGMENT_EXISTS field.

VGIN and VDOT Recommendations for Data Consistency:

- Digitize the centerline to the center of the circle for Cul-De-Sacs. For cul-de-sac segments that have barriers, either digitize through the pavement to the centerline in the back of the circle or segment at the entry point of the circle and create two additional segments to meet at the back of the circle using direction of increasing address ranges on opposing sides. Address interior segments with 0 if no addresses are on the barrier, code segments with SEGMENT_TYPE.
- Digitize the centerline to the end of the pavement for dead ends.
- Digitize segments around traffic circles using multiple segmentation. Code traffic circle segments with SEGMENT_TYPE value for traffic circle. Name segments consistently with the roads that feed into the intersection. If traffic circles contain addresses, use directionality and addressing guidelines. Code traffic circles with ONE_WAY direction indicator.
- Digitize the centerline in the turn lane separated by an island if the edges facing onto the main roadway are > 0.005 mile in length. Digitize separated Turn lanes and code segments with SEGMENT_TYPE and ONE_WAY direction indicators.
- Digitize interchanges to reflect the FHWA manual for ground safety
- Digitize ramps as close as possible to the location of physical separation of the ramp from the centerline (gore point). Code segments with MTFCC ramps. Use ONE_WAY direction indicator where applicable.
- Digitize HOV lanes as separate segments from the centerline when the lanes are separated by a barrier. Code segments with MTFCC HOV lane.
- Digitize a dual centerline when opposing traffic on a road is separated by an obvious barrier, such as a raised median or jersey wall. Digitize a dual centerline when opposing traffic is separated by a grass median. Digitize dual centerlines when a combined turn lane is present for the entire length of the roadway. Code dual carriageway centerlines with ONE_WAY indicator field.
- Digitize a median where there is roadway access between the dual centerlines.
- Designate the additional MTFCC value within the digitized centerline to assist with road classification and routing

3 Road Centerline Field Standardization

NENA specializes in standardizing data to be used in public safety systems for the purpose of emergency response. The United States Postal Service (USPS) also specializes in standardizing road name and address information so that databases accurately reflect ground condition for mail delivery.

A geospatial database of Road Centerline features enables geocoding and routing functionality to the geographic shapes by using shape length and direction along with the non-spatial attribute information that can be stored alongside or specifically within the features themselves. The quality of an interpolated point upon a line and the route generated by parameters placed on the feature work directly with non-spatial attribution on the feature or within a related table and the geographic shape. While shapes provide a spatial basis for location, the attributes dictate the degree of usage for the shape in the location and route. Placing standards on the input attribution will cause the output attribution and derivative products to also be standardized.

By using existing NENA and USPS standards for address and street name location, it is the goal of VGIN to be able to highlight the Road Centerline data model schema outlined in section one with a proper data entry methodology. Using specific parameters on the data model by utilizing Geodatabase domain values as well as using data entry standards for

fields which are open will ensure that Road Centerline data is properly enabled for output publications to check against provider databases (MSAG/ALI). Implementing field standardization by standardized attributes will also ensure that data is compatible with a Next Generation 9-1-1 system.

3.1 Address Range Standardization

NENA and industry standards state that geospatial Road Centerline arc directionality shall travel from the lowest address in a range to the highest based on ground condition of address points. Segment arc direction will not necessarily reflect the direction of traffic flow. In GIS software, arc directionality of linear spatial data can be easily distinguished by symbolizing an arrow at the end of the line segment. The directionality of the Road Centerline is thus synchronized with address range fields on the left and right hand side of the street segment.

A Fishbone line segment is external to the Road Centerline feature class and represents a straight line comparison of two points; address point locations and their subsequent interpolated match representation using input centerline address ranges. Geocoding geospatial address point attributes to their corresponding centerlines and visually checking the linear connectivity of source point to destination point in an address range provides an ideal snapshot of address range format differences as well as possible inconsistencies in the data. Actual and Theoretical address range formats can be easily visualized with a fishbone map to show point address point and Road Centerline synchronization.

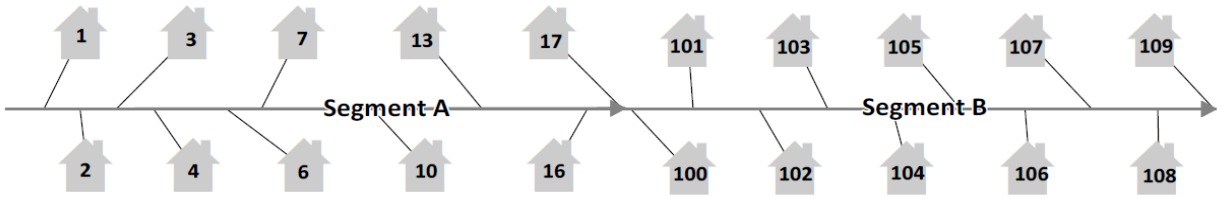
Figure 3a: Neighborhood scenario, single carriageway with address numbers

NENA recommends actual address ranges be used on the segment to create a more accurate geocoding representation of the segment. In Figure 3a, addresses on "Segment A" and "Segment B" show odd address numbers on left hand side of the street centerline and even numbers on the right hand side of the street based on the flow of low to high addresses. Actual address ranges should capture the lowest address point in the two "_FROM_ADDRESS" fields and the highest address point number based on points in the "_TO_ADDRESS" fields:

Segment A	
LEFT_FROM_ADDRESS	1
LEFT_TO_ADDRESS	17
RIGHT_FROM_ADDRESS	2
RIGHT_TO_ADDRESS	16

Segment B	
LEFT_FROM_ADDRESS	101
LEFT_TO_ADDRESS	109
RIGHT_FROM_ADDRESS	100
RIGHT_TO_ADDRESS	108

Figure 3a with Actual address ranges, showing fishbone connectivity



If address points do not exist in reality due to life cycle of a planned community or the centerline is a throughway and may never contain addresses, or to capture entire potential addresses within a block, a theoretical or potential range should be assigned which is in conjunction with existing address values and centerline segment directionality should continue through the area with no address data. This can use existing county standards or NENA standards. In Figure 3a, Theoretical address ranges should capture the lowest address point in the two "_FROM_ADDRESS" fields and the highest potential address number based on block or centerline length for each address ceiling in the "_TO_ADDRESS" fields:

Segment A	
LEFT_FROM_ADDRESS	1
LEFT_TO_ADDRESS	99
RIGHT_FROM_ADDRESS	2
RIGHT_TO_ADDRESS	98

Segment B	
LEFT_FROM_ADDRESS	101
LEFT_TO_ADDRESS	199
RIGHT_FROM_ADDRESS	100
RIGHT_TO_ADDRESS	198

Figure 3a with Theoretical address ranges, showing fishbone connectivity

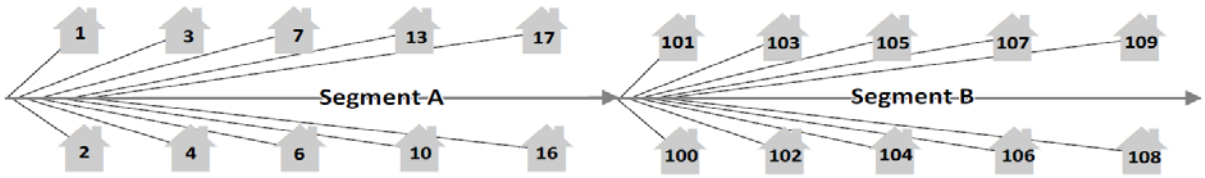
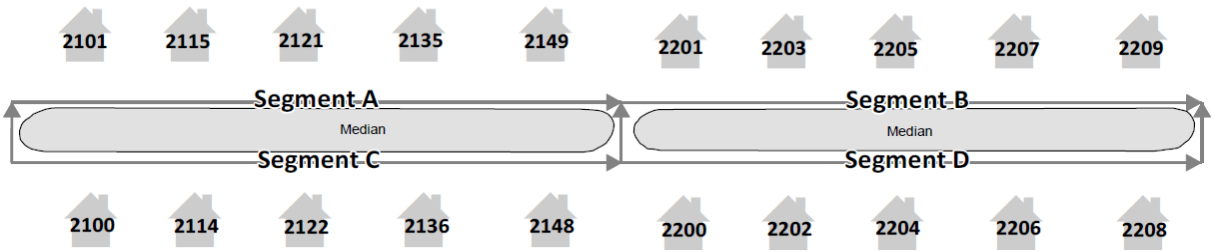


Figure 3b: Neighborhood scenario, dual carriageway with address numbers



For dual carriageway centerlines, interior addresses are zeroed out on the left and right hand street side within the centerline depending on location because generally speaking, there are no physical addresses than can be located due to a physical barrier. Where barriers reside and dual carriageways are created within the centerline, interior address ranges are represented with a 0 range number from and to:

Figure 3b, Actual address ranges

Segment A	
LEFT_FROM_ADDRESS	2101
LEFT_TO_ADDRESS	2149
RIGHT_FROM_ADDRESS	0
RIGHT_TO_ADDRESS	0

Segment B	
LEFT_FROM_ADDRESS	2201
LEFT_TO_ADDRESS	2209
RIGHT_FROM_ADDRESS	0
RIGHT_TO_ADDRESS	0

Segment C	
LEFT_FROM_ADDRESS	0
LEFT_TO_ADDRESS	0
RIGHT_FROM_ADDRESS	2100
RIGHT_TO_ADDRESS	2148

Segment D	
LEFT_FROM_ADDRESS	0
LEFT_TO_ADDRESS	0
RIGHT_FROM_ADDRESS	2200
RIGHT_TO_ADDRESS	2208

Figure 3b, Theoretical address ranges

Segment A	
LEFT_FROM_ADDRESS	2101
LEFT_TO_ADDRESS	2199
RIGHT_FROM_ADDRESS	0
RIGHT_TO_ADDRESS	0

Segment B	
LEFT_FROM_ADDRESS	2201
LEFT_TO_ADDRESS	2299
RIGHT_FROM_ADDRESS	0
RIGHT_TO_ADDRESS	0

Segment C	
LEFT_FROM_ADDRESS	0
LEFT_TO_ADDRESS	0
RIGHT_FROM_ADDRESS	2100
RIGHT_TO_ADDRESS	2198

Segment D	
LEFT_FROM_ADDRESS	0
LEFT_TO_ADDRESS	0
RIGHT_FROM_ADDRESS	2200
RIGHT_TO_ADDRESS	2298

The VGIN Road Centerline Data model allows both Actual address ranges and Theoretical ranges to be stored in different locations, whether on the centerline or in the ADDRESS_ALTERNATE table so geocoding results can be customized ad hoc. An indicator field for range type is present within the model to distinguish the two types.

Interstate addressing should be based off mile marker locations established by VDOT. Each lane should follow the geometry directionality standard and both flow from low to high mile markers. Addresses should be odd on the left from and to fields and even on the right from and to fields. Street naming should distinguish northbound/southbound or eastbound/westbound directionality so duplicate address information is prevented. Since there can possibly be one thousand addresses every mile, or one address every 5.28 feet, interstate addresses should increase by one thousand every mile marker.

Figure 3c: Interstate addressing scenario. Interstate prime directionality example based on the mile markers in this graphic is West to East.

Segments B & D	
STREET_PREMODIFIER	
STREET_PREFIX_DIRECTION	
STREET_NAME	INTERSTATE 38 EB
STREET_SUFFIX	
STREET_SUFFIX_DIRECTION	
STREET_POSTMODIFIER	

Segments A & C	
STREET_PREMODIFIER	
STREET_PREFIX_DIRECTION	
STREET_NAME	INTERSTATE 38 WB
STREET_SUFFIX	

STREET_SUFFIX_DIRECTION	
STREET_POSTMODIFIER	

Segment A	
LEFT_FROM_ADDRESS	145001
LEFT_TO_ADDRESS	145999
RIGHT_FROM_ADDRESS	145000
RIGHT_TO_ADDRESS	145998

Segment B	
LEFT_FROM_ADDRESS	145001
LEFT_TO_ADDRESS	145999
RIGHT_FROM_ADDRESS	145000
RIGHT_TO_ADDRESS	145998

Segment C	
LEFT_FROM_ADDRESS	146001
LEFT_TO_ADDRESS	146999
RIGHT_FROM_ADDRESS	146000
RIGHT_TO_ADDRESS	146998

Segment D	
LEFT_FROM_ADDRESS	146001
LEFT_TO_ADDRESS	146999
RIGHT_FROM_ADDRESS	146000
RIGHT_TO_ADDRESS	146998

3.2 Road Name Standardization

The following recommendations are based on NENA standards and should be implemented in the local Road Centerline database. Processes can be easily implemented to check for each of these items which could allow potential inconsistencies in the centerline database:

- Use uppercase characters for fields that do not contain a GDB Domain. Domains by default enter upper case characters.
- All punctuation should be avoided in fields that allow text entry
- Remove special characters such as dashes, underscores, apostrophes, quotes, or any other special characters that could cause problems in any software or database
- Use complete spelling of the legal street name assigned by the addressing authority
    - “MOUNTAIN VIEW RD” versus “MTN VIEW RD”
    - “SAINT PAULS AVE” versus “ST PAULS AVE”
- Spell out the complete MSAG and Postal Community name where Right and Left values differ. Fill in bulk of community values via spatial location where right and left are identical.
- Street Prefix Directional and Suffix Directional are only abbreviated when not part of the actual street name. In these instances, use domain value.
    - “EAST DR” would not be abbreviated “E DR”
    - “SOUTHEAST SIDE HIGHWAY” would be abbreviated “SE SIDE HWY”
    - “S EAST SIDE HIGHWAY” would be abbreviated “S EAST SIDE HWY”
    - “21ST STREET SOUTH” would be abbreviated “21ST ST S”
- Street Suffix standardized according to most recent USPS publication. Options not listed in the domain should be included in the Street Name field.
    - “SOUTH LAWN” would be entered into street name field since there is no USPS Suffix / Domain value
    - “DOGWOOD DRIVE” would use domain value “DR”
    - “WASHINGTON ST EXTENDED” would use “WASHINGTON ST” as the street name and “EXT” as the Street Suffix using the valid USPS domain

Figure 3d: Street Standardization shown by concatenation and parsed via RCL standard model

Not Standardized	Standardization with RCL					
Original	**Premod**	**Predir**	**Name**	**Suffix**	**SufDir**	**Postmod**
MTN VIEW ROAD			MOUNTAIN VIEW	RD		
ST. PAUL'S AVENUE			SAINT PAULS	AVE		
N BENJAMIN R. LEE ST.		N	BENJAMIN R LEE	ST		
C-B LN			C B	LN		
EAST DR			EAST	DR		
E ST			E	ST		
N WAYNE AVE		N	WAYNE	AVE		
NORTH WAYNE AVE			NORTH WAYNE	AVE		
S EAST SIDE HWY		S	EAST SIDE	HWY		
21ST ST SOUTH			21ST	ST	S	
S ARC NE		S	ARC		NE	
SOUTH LAWN			SOUTH LAWN			
US ROUTE 29 BYPASS			US ROUTE 29			BYPASS
ALTERNATE ROUTE 28 N	ALTERNATE		ROUTE 28		N	
I-64 WEST			INTERSTATE 64 W			
N.E. CHARLES DR		NE	CHARLES	DR		
WASHINGTON ST EXT			WASHINGTON ST	EXT		

For Street Standardization best practices, see the USPS URL in the resource section below.

4 Road Centerline Data Quality

NENA standards recommend specific quality control and geometric topology elements reside within the Road Centerline data workflow and VGIN has extended the recommendations and additional data checks to a series of data quality rules. By using additional industry standards provided by ESRI software topology functionality, desktop extensions, and out of the box modeling and/or scripting, it is relatively easy to achieve a methodology for isolating inconsistencies. VGIN will utilize an out of the box solution to check for and ensure that quality resides within the data based on a specific rule set of rules to identify inconsistencies.

A topologically correct street centerline allows the systems to verify addresses and assign those addresses to specific agencies, cities, ESZ areas, districts, beats, units, etc. It is also vital for defining intersections, common place names, and vehicle routing, premise and hazard data.

VGIN's topology requirements enforce Address and Geometry quality standards and isolate areas that are not synchronized within the GIS data. The following rules are broken down by Attribute and Geometry. Each violation example shows in

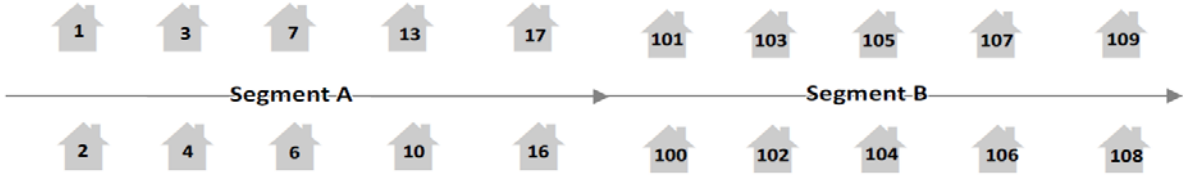
To maintain proper topology the addressed centerline data and related area boundary layers must adhere to the following minimum address and geometry topology requirements:

4.1 Attribute Data Rules Using Field Standardization

- *Road Centerline ID Must Be Unique And Persistent*

Violations of this rule are systematic in nature. They prevent relational database management which allows proper feature connectivity and correct data normalization in a GIS data model. VGIN currently implements this on the VBMP RCL unique and persistent Road Centerline ID. In past experience with populating the VBMP RCL database, not all local governments within Virginia maintain a unique ID on the GIS centerline. It is recommended that localities implement this and as a preprocess QC measure VGIN will check for duplicates or zeroes in the data. This check will not be performed on local data by default until the majority of centerline databases presented to VGIN contain a managed Unique ID. The localities who have notified VGIN of the presence of a unique ID available in the centerline data will have the check performed.

Violation Example:



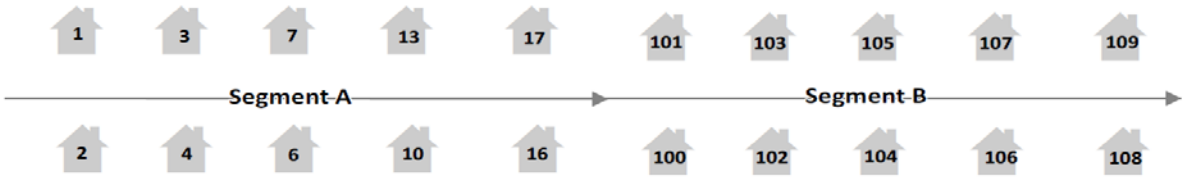
Segment A	
LOCAL_ID	1951

Segment B	
LOCAL_ID	1951

- *Road Centerline Must Not Have Duplicate Address Ranges For Attributes <> 0*

Violations of this rule affect Geocoding. With duplicate segments that contain the same address range, geocoding engines may erroneously place the input address result on the wrong section of road affecting routing destination. Addresses that have “0” values for the from/to left and from/to right will be skipped.

Violation Example:



Segment A	
LEFT_FROM_ADDRESS	1
LEFT_TO_ADDRESS	17

Segment B	
LEFT_FROM_ADDRESS	1
LEFT_TO_ADDRESS	17

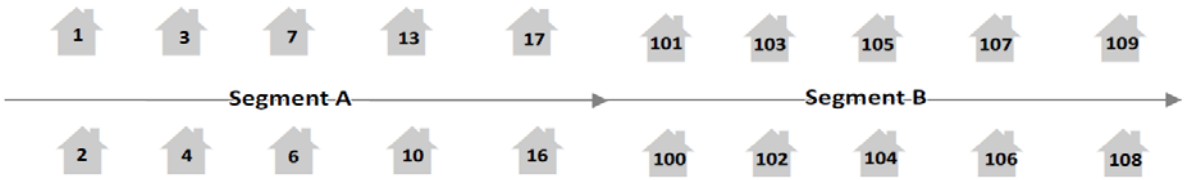
RIGHT_FROM_ADDRESS	2
RIGHT_TO_ADDRESS	16

RIGHT_FROM_ADDRESS	2
RIGHT_TO_ADDRESS	16

- *Road Centerline Numerical Address Ranges Must Not Begin Or End With 0*

In some cases, even and odd street side range numbers within a centerline will start at 0 instead of 2. This check locates 0 values at start or end for data standardization.

Violation Example:

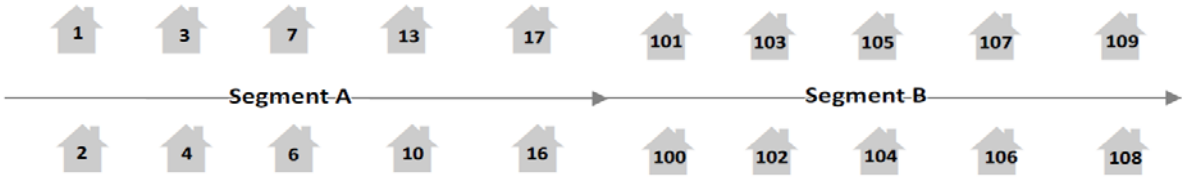


Segment A	
LEFT_FROM_ADDRESS	1
LEFT_TO_ADDRESS	17
RIGHT_FROM_ADDRESS	0
RIGHT_TO_ADDRESS	16

Segment B	
LEFT_FROM_ADDRESS	101
LEFT_TO_ADDRESS	109
RIGHT_FROM_ADDRESS	100
RIGHT_TO_ADDRESS	108

- *Road Centerline Must Not have From Left Value Greater Than To Left value*
- *Road Centerline Must Not Have From Right Value Greater Than To Right value*

Occurs in areas where address ranges have been input erroneously or where routing attribution has taken precedent over geocoding attributes. In some cases a street side is addressed in reverse from its opposite side based on site address points and the usage of transposition of these attributes is legitimate. In general, however, if these values are found in the data they do go against NENA centerline recommendations for directionality.



Violation Example (Left From / Left To):

Segment A	
LEFT_FROM_ADDRESS	17
LEFT_TO_ADDRESS	1
RIGHT_FROM_ADDRESS	2

Segment B	
LEFT_FROM_ADDRESS	109
LEFT_TO_ADDRESS	101
RIGHT_FROM_ADDRESS	100

RIGHT_TO_ADDRESS	16

RIGHT_TO_ADDRESS	108

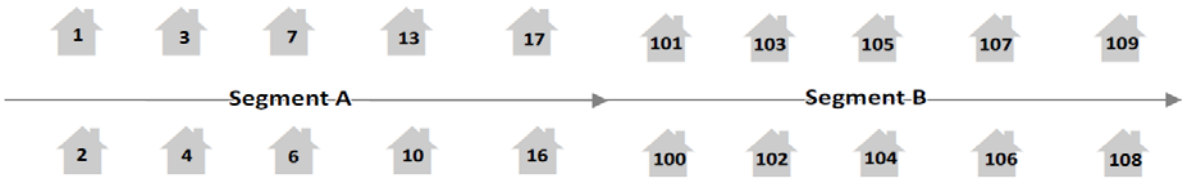
Violation Example (Right From/Right To):

Segment A	
LEFT_FROM_ADDRESS	1
LEFT_TO_ADDRESS	17
RIGHT_FROM_ADDRESS	16
RIGHT_TO_ADDRESS	2

Segment B	
LEFT_FROM_ADDRESS	101
LEFT_TO_ADDRESS	109
RIGHT_FROM_ADDRESS	108
RIGHT_TO_ADDRESS	100

- *Road Centerline Must Not Have Left Side Overlapping Address Range*
- *Road Centerline Must Not Have Right Side Overlapping Address Range*

In a consecutive network of street centerline data, addresses are to be synchronized by beginning and ending from segment to segment. Overlapping address ranges because duplicate match results for houses within a range.



Violation Example (Left side):

Segment A	
LEFT_FROM_ADDRESS	1
LEFT_TO_ADDRESS	105
RIGHT_FROM_ADDRESS	2
RIGHT_TO_ADDRESS	98

Segment B	
LEFT_FROM_ADDRESS	101
LEFT_TO_ADDRESS	109
RIGHT_FROM_ADDRESS	100
RIGHT_TO_ADDRESS	108

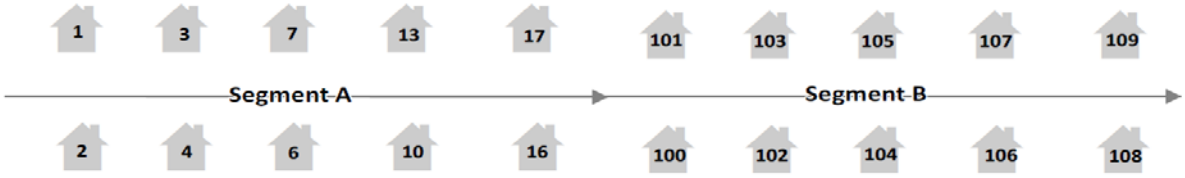
Violation Example (Right side):

Segment A	
LEFT_FROM_ADDRESS	1
LEFT_TO_ADDRESS	99
RIGHT_FROM_ADDRESS	2
RIGHT_TO_ADDRESS	1098

Segment B	
LEFT_FROM_ADDRESS	101
LEFT_TO_ADDRESS	199
RIGHT_FROM_ADDRESS	100
RIGHT_TO_ADDRESS	198

- *Road Centerline Must Not Have Odd/Even Left Side Address Parity*
- *Road Centerline Must Not Have Odd/Even Right Side Address Parity*

Occurs in areas where address ranges have been input erroneously odd/even on the same side of the street in the right side address range fields or attempt to address mixed odd/even address points on street side.



Violation Example (Left side):

Segment A	
LEFT_FROM_ADDRESS	2
LEFT_TO_ADDRESS	17
RIGHT_FROM_ADDRESS	2
RIGHT_TO_ADDRESS	16

Segment B	
LEFT_FROM_ADDRESS	101
LEFT_TO_ADDRESS	134
RIGHT_FROM_ADDRESS	100
RIGHT_TO_ADDRESS	108

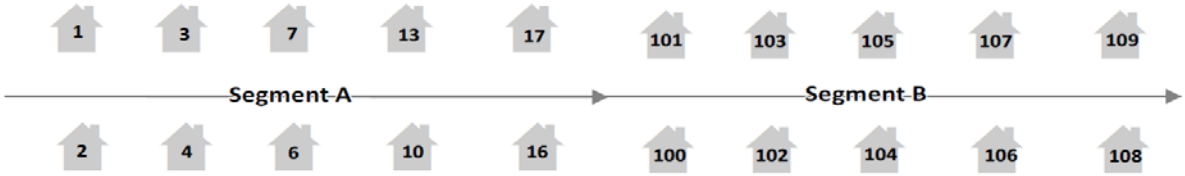
Violation Example (Right side):

Segment A	
LEFT_FROM_ADDRESS	1
LEFT_TO_ADDRESS	17
RIGHT_FROM_ADDRESS	2
RIGHT_TO_ADDRESS	39

Segment B	
LEFT_FROM_ADDRESS	101
LEFT_TO_ADDRESS	109
RIGHT_FROM_ADDRESS	101
RIGHT_TO_ADDRESS	108

- *Address Ranges will reflect odd and even address points by using correct street side*

Odd values are entered on side of street in centerline where even values exist in address points or even values are entered on side of street in centerline where odd values exist. In some instances, even and odd ranges are placed on the wrong side of the street within the centerline from and to ranges. This affects travel destination side in a navigation system.



Violation Example:

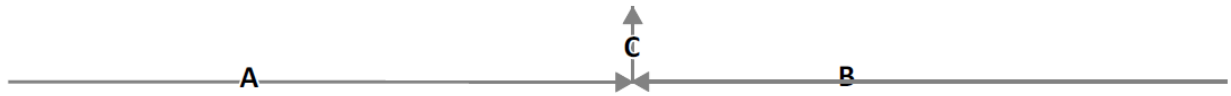
Segment A	
LEFT_FROM_ADDRESS	2
LEFT_TO_ADDRESS	16
RIGHT_FROM_ADDRESS	1
RIGHT_TO_ADDRESS	17

Segment B	
LEFT_FROM_ADDRESS	100
LEFT_TO_ADDRESS	108
RIGHT_FROM_ADDRESS	101
RIGHT_TO_ADDRESS	108

- *Street Modifiers, Directionals, and Suffixes will follow the Virginia/ USPS_standard*

In cases where domain values are not present locally, inconsistencies are entered into the street suffix field. Those include additional spaces, incorrect suffix, or non-alpha characters. This check will isolate those values not in synch with the USPS standard through the Virginia standard.

Violation Example:



Assumed Official Street Names
A: West Main Street
B: East Walnut Avenue
C: Cherrywood Parkway North

Segment A	
STREET_PREMODIFIER	
STREET_PREFIX_DIRECTION	W
STREET_NAME	MAIN
STREET_SUFFIX	STR*
STREET_SUFFIX_DIRECTION	
STREET_POSTMODIFIER	

Segment B	
STREET_PREMODIFIER	
STREET_PREFIX_DIRECTION	E
STREET_NAME	WALNUT
STREET_SUFFIX	AV
STREET_SUFFIX_DIRECTION	
STREET_POSTMODIFIER	

Segment C	
STREET_PREMODIFIER	
STREET_PREFIX_DIRECTION	
STREET_NAME	CHERRYWOOD
STREET_SUFFIX	PKY
STREET_SUFFIX_DIRECTION	NO
STREET_POSTMODIFIER	

4.2 Geometry Data Rules Using Geometry Standardization

- Road Centerline Must Not Have Invalid Geometry

This inconsistency type is normally where ESRI geodatabases have empty geometry (rows in feature class with no associated spatial data). It can be problematic when comparing shapes to table records or performing database queries. The evaluation reveals specific geometry data errors, many caused by editing tools and data environment.

- Road Centerline Must Not Have Multipart Features

Multipart lines can affect routing if endpoint is part of the edges in a gap. This can also affect incorrect positional location of geocode result. The source of these inconsistencies can be merging two segments together that are not snapped at endpoints or other data management related types. The evaluations will reveal lines that are multipart in nature.

- Road Centerline Must Not Have Duplicate Geometry

Duplicate geometry can occur where a segment is copied and pasted into a feature class multiple times or data has been loaded into a schema twice instead of once. The evaluation will locates areas where local data or state data is completely on top of another segment of the same shape and contains all attributes that are identical.

- Road Centerline Must Be Segmented And Snapped At Road Intersections

Grade Separated Intersections (overpasses/underpasses) are to be kept as individual segments and not segmented at intersections so these types are carried as exceptions. All other segments should be correctly segmented and snapped. The evaluation of this inconsistency type reveals rule violations which critically affect routing and data connectivity.

- Road Centerline Must Not Have Dangles Within 30 Feet of Another Centerline

This type of inconsistency is an extension of the previous data rule and the purpose is to locate gaps between centerline endpoints that are not snapped at all to neighboring segments within a 30 feet tolerance of a centerline. VGIN will flag and exclude segments shorter than 30 feet because they naturally cause the inconsistency to occur due to an endpoint being less than 30 feet from another centerline that it is not snapped to. Localities should provide VGIN with additional flags if necessary.

- Road Centerline Must Connect to Other Centerlines in Road network

Segments within a RCL data set where both endpoints are not connected to any other centerline are a critical to be isolated because of their impact in routing. “Island” segments do not have any connector roads and thus cannot be routed to within a physical network of centerlines. These inconsistencies can be located and feeder roads should be constructed (or mutual data management agreements with adjacent localities should be established) to provide service to the addressed segment.

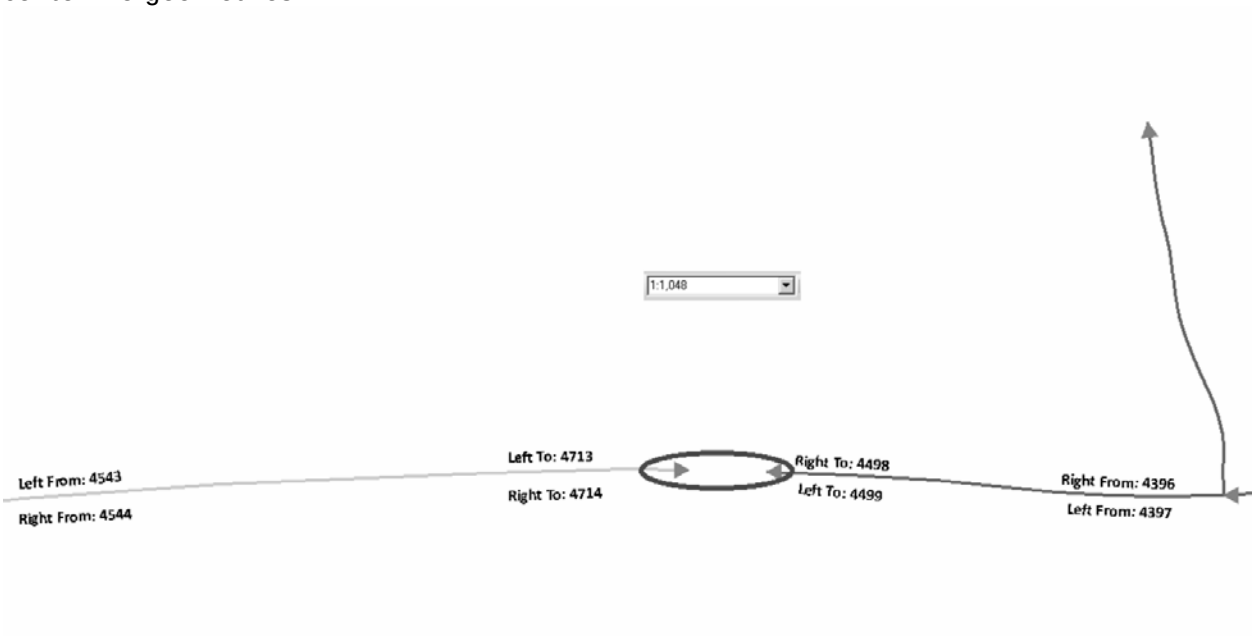
Arc Directionality Will Travel From Low to High Based on Address Ranges and Address Points

Arc directionality in some cases is incorrectly modeled based on existing address points and violates the directionality standard. Results by the check include segment arcs that are traveling the incorrect direction based on fishbone intersections to the centerline OR segments that specifically yield extra intersections and have increased points where odd and even values are mismatched when compared to centerlines. This provides Geocoding results at the incorrect part of the segment based on ground condition.

4.3 Edge Matching

The process of Edge Matching Road Centerline geospatial data at borders between local government entities or maintenance zones takes into account the beginning and end point locations of specific linear features. It is an important practice for maintaining data which is able to route across jurisdictions and for the assurance of clean topology for data interoperability. Along with the centerline geometry component of the data, it is important to ensure that specific attributes such as road names, address ranges, DOT business data, and routing codes remain consistent from one locality to the next within the road network. A Snap To Point data management methodology is the best method to maintain regularity and data quality between segmentation by the authoritative editing entity.

Figure 4a: Locality 1- left side, light grey and Locality 2- right side, dark grey contain geometry not edge matched or address matched around jurisdictional border. Address gap and 70 foot geometry gap (within ellipsis) is created when working with jurisdictional centerline geometries.



Identification of partners

The first step in successfully edge matching the Road Centerline data across jurisdictions and states is to identify all parties who have road centerline data maintenance responsibilities for the jurisdictions in question. This can vary from the simple model of 2 partners to the more complex. Examples of typical partners:

- Local GIS coordinator
- Local 9-1-1/PSAP Director
- Local addressing authority
- State Department of Transportation
- Third party (private) data maintenance firm
- State GIS coordination office

Starting point for dialog – snap point creation

To begin a dialog about who maintains data where, it is best to create a set of GIS "snap points" as close to the dividing border as possible. It is important to note that these do not represent a legal boundary. Rather, they simple identify a point of demarcation for data maintenance responsibility. In the review, include road centerlines and orthophotography that is sufficiently deep enough on both sides the boundary to provide a perspective view.

An easy way to share these points with participants is through an ArcGIS Online map. This provides a visual way of showing a proposed dividing point for each road along with supporting orthophotography or other ancillary data.

A process of agreements

The first agreement to consider should be with the location of the snap points. Move them if necessary and within a reasonable distance of the border. These can be auto-generated within GIS software to be placed on the end of the centerlines. They define the point of demarcation for maintenance of centerline geometry and addressing attribution.

The second agreement to consider is to adjust centerline geometry to snap point. Once the location of the snap points is agreed upon, then the centerline geometry can be adjusted to these points. This provides important connectivity and topology. Obtain commitment from centerline data maintenance authority to continue maintaining to this location. In some cases there may need to be an adjustment to/from dual and single carriageways. Overall the objective is that the geometry have topological alignment (no overshoots or undershoots).

The third agreement to consider involves attribution fields of street name, address range, and route number. It may be acceptable to have abrupt name and address changes at a snap point between two jurisdictions. Overall the objective is for attribute consistency such as logical progression of address ranges, similar street names and route numbers where appropriate.

In the establishment of procedures for determining and maintaining the common set of XY coordinates through a snap point feature class between adjacent jurisdictions and states, the following should be considered:

- Utilize most recent locality, adjacent locality, and VGIN Road Centerline, Administrative Boundary, Address Points, and Orthophotography products as source base map data starting points.
- Identify the location of the coordinates where centerlines are coincident between jurisdictions in the local Road Centerline and the VGIN Road Centerline.
- Identify the address range information at the geometry point locations.
- Determine discrepancies between jurisdictional data, centerline placement, address point data, address ranges, and street names.
- Meet with adjacent local governments and states to review Snap Point locations and data inconsistencies.
- Modify centerline and address data to meet the agreed upon Snap Point locations, including centerline placement and address range distribution.
- Establish procedures for future updates of data at boundary locations.
- Modify Snap Point locations when a new street is added to the database that affects multiple jurisdictions by being coincident to an existing or proposed snap point.
- Modify Snap Point locations when a street is deleted from the database that affects multiple jurisdictions by being coincident to a snap point.
- Modify Snap Point locations when an existing street coincident to a snap point is realigned or spatially adjusted.
- Modify Snap Point locations when there is a direct impact between the existing coordinates and the updated information within the centerline.
- Report local Snap Point deltas to VGIN
- Reconcile locality snap point with quarterly VGIN snap point product

Figure 4b: Locality centerline geometry is Edge Matched, Street Name matched, and Address Range matched using Snap To Point as data management boundary

5 Metadata

VA_CENTERLINE

File Geodatabase Feature Class

Summary

The ongoing goal of the VBMP is to establish a consistent, seamless base and foundation for local and state government mapping systems (GIS) that will help all increase efficiency and reduce redundant efforts in developing these systems. The seamless Road Centerline base layer is critical to the effective and efficient delivery of wireless E-911 and many other government services and is a critical component in the development of spatial data guidelines and standards, supporting the cost-effective sharing of GIS data and expertise across the Commonwealth.

Description

The Virginia Geographic Information Network (VGIN) coordinates and manages the development of a consistent, seamless, statewide digital road centerline file with address range, road name, state route number, and many other components as part of the Virginia Base Mapping Program (VBMP). The Road Centerline Program (RCL) leverages the Commonwealth's investment in the VBMP digital orthophotography and is focused on creating a single statewide, consistent digital road file. The RCL data layer is a dynamic dataset supported and maintained by Virginia's Local Governments, VDOT, and VGIN. VBMP RCL is extracted and provided back to local governments and state agencies in many geographic data sets every quarter.

Credits

VITA, VGIN

Use limitations

As of January 1, 2012, RCL geometry and attributes are public domain.

Virginia Geographic Information Network (VGIN)

Virginia Base Mapping Program (VBMP)

Geospatial Data Sharing

VGIN was established in 1997 in Virginia Code to "foster the creative utilization of geographic information and oversee the development of a catalog of GIS data available in the Commonwealth". One of the main core functions of VGIN according to the code is:

* Provide services, geographic data products, and access to the repository

Source: Virginia Code § 2.2-2026 and § 2.2-2027

Commonwealth wide GIS data initiatives require the active participation by local government entities. Many services and data products are readily available through the Virginia GIS clearinghouse and could not function without local government geospatial data input. These data

sets are the source for data sharing between Local, State, Federal, and commercial geospatial entities through VGIN. The following programs or initiatives require the active participation by Virginia Local governments.

VA_CENTELRINE:

The Road Centerline (RCL) dataset provides a consistent and seamless statewide digital dataset of all roads in the Commonwealth of Virginia. The purpose for the continued development of this dataset is to support the base mapping needs of state, regional, and local governments as well as to provide the most accurate representation of centerlines within the Commonwealth to as commercial entities and the general public. The purpose is to achieve a singular, consistent and maintainable base map dataset usable by all entities. The high quality of this product is available for use within a geographic information system (GIS) or a computer aided dispatch (CAD) / 911 system, however all warranties regarding the accuracy of the map data and any representation or inferences derived there from are hereby expressly disclaimed.

i Executive Order 12906, published in the April 13, 1994, edition of the Federal Register, Volume 59, Number 71, pp. 17671-17674; and amended by Executive Order 13286, published in the March 5, 2003, edition of the Federal Register, Volume 68, Number 43, pp. 10619-10633. Framework layers are detailed in OMB Circular A-16.
http://www.whitehouse.gov/omb/circulars/a016/a016_rev.html#4#4

Extent

West	-77.256731	**East**	-77.253991
North	37.559125	**South**	37.557961

Scale Range

Maximum (zoomed in)	1:5,000
Minimum (zoomed out)	1:150,000,000

VA_CENTERLINE_SNAP_POINT

File Geodatabase Feature Class

Summary

The ongoing goal of the VBMP is to establish a consistent, seamless base and foundation for local and state government mapping systems (GIS) that will help all increase efficiency and reduce redundant efforts in developing these systems. The seamless VBMP base is critical to the effective and efficient delivery of wireless E-911 and many other government services and is a critical component in the development of spatial data guidelines and standards, supporting the cost-effective sharing of GIS data and expertise across the Commonwealth.

Description

The Virginia Geographic Information Network (VGIN) has coordinated and manages the development of a consistent, seamless, statewide digital road centerline file with address, road name, and state route number attribution, as part of the Virginia Base Mapping Program (VBMP).

The Road Centerline Program (RCL) leverages the Commonwealth's investment in the VBMP digital orthophotography and is focused on creating a single statewide, consistent digital road file. The VA_CENTERLINE_SNAP_POINT represents an XY point feature that participants of the RCL program will agree to maintain and snap their centerline data to. This will provide seamless data exchange via the RCL data set.

Credits

VITA, VGIN

Use limitations

Virginia Geographic Information Network (VGIN)

Virginia Base Mapping Program (VBMP)

Geospatial Data Sharing

VGIN was established in 1997 in Virginia Code to "foster the creative utilization of geographic information and oversee the development of a catalog of GIS data available in the Commonwealth". One of the main core functions of VGIN according to the code is:

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Source: Virginia Code § 2.2-2026 and § 2.2-2027

Commonwealth wide GIS data initiatives require the active participation by local government entities. Many services and data products are readily available through the Virginia GIS clearinghouse and could not function without local government geospatial data input. These data sets are the source for data sharing between Local, State, Federal, and commercial geospatial entities through VGIN. The following programs or initiatives require the active participation by Virginia Local governments.

VA_CENTERLINE_SNAP_POINT:

The VA_CENTERLINE_SNAP_POINT is a XY point boundary which represents maintenance agreement nodes for localities and state agencies to use in edge matching data. THE VA_CENTERLINE_SNAP_POINT IS NOT AN OFFICIAL BOUNDARY AND SHOULD NOT BE USED AS AN OFFICIAL BOUNDARY OF ANY SORTS. All warranties regarding the accuracy of the map data and any representation or inferences derived there from are hereby expressly disclaimed.

i Executive Order 12906, published in the April 13, 1994, edition of the Federal Register, Volume 59, Number 71, pp. 17671-17674; and amended by Executive Order 13286, published in the March 5, 2003, edition of the Federal Register, Volume 68, Number 43, pp. 10619-10633. Framework layers are detailed in OMB Circular A-16.
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Minimum (zoomed out)	1:150,000,000

6 References

The following are references used with constructing this document

1) NENA GIS Data Collection and Maintenance Standards

   http://c.ymcdn.com/sites/www.nena.org/resource/collection/C74A8084-E3BD-405D-93C2-48AFCFA5B490/NENA_02-014-v1_GIS_Data_Collection_and_Maintenance.pdf

2) NENA Standard Data Formats for 9-1-1 Data Exchange & GIS Mapping

   http://c.ymcdn.com/sites/www.nena.org/resource/collection/C74A8084-E3BD-405D-93C2-48AFCFA5B490/NENA_02-010-v9_Data_Formats_for_ALI_MSAG_GIS.pdf

3) NENA Information For Synchronizing MSAG/ALI Databases with GIS data

   https://c.ymcdn.com/sites/www.nena.org/resource/collection/F2E0D66A-4824-418C-8670-3238D262B84A/NENA_71-501-v1_Synchronizing_GIS_Databases_with_MSAG_and_ALI.pdf

4) USPS Postal Addressing Standards

   http://pe.usps.gov/text/pub28/welcome.htm

5) VDOT Roadway Centerline Editing Style Guide (11/24/2009)

6) FHWA intersection and interchange safety treatments

   http://safety.fhwa.dot.gov/hsip/hrrr/manual/sec42.cfm

7) FGDC Content standard for digital geospatial metadata

   http://www.fgdc.gov/standards/projects/FGDC-standards-projects/metadata/base-metadata/v2_0698.pdf3

8) US Census Bureau FIPS Codes
   https://www.census.gov/geo/reference/codes/cou.html