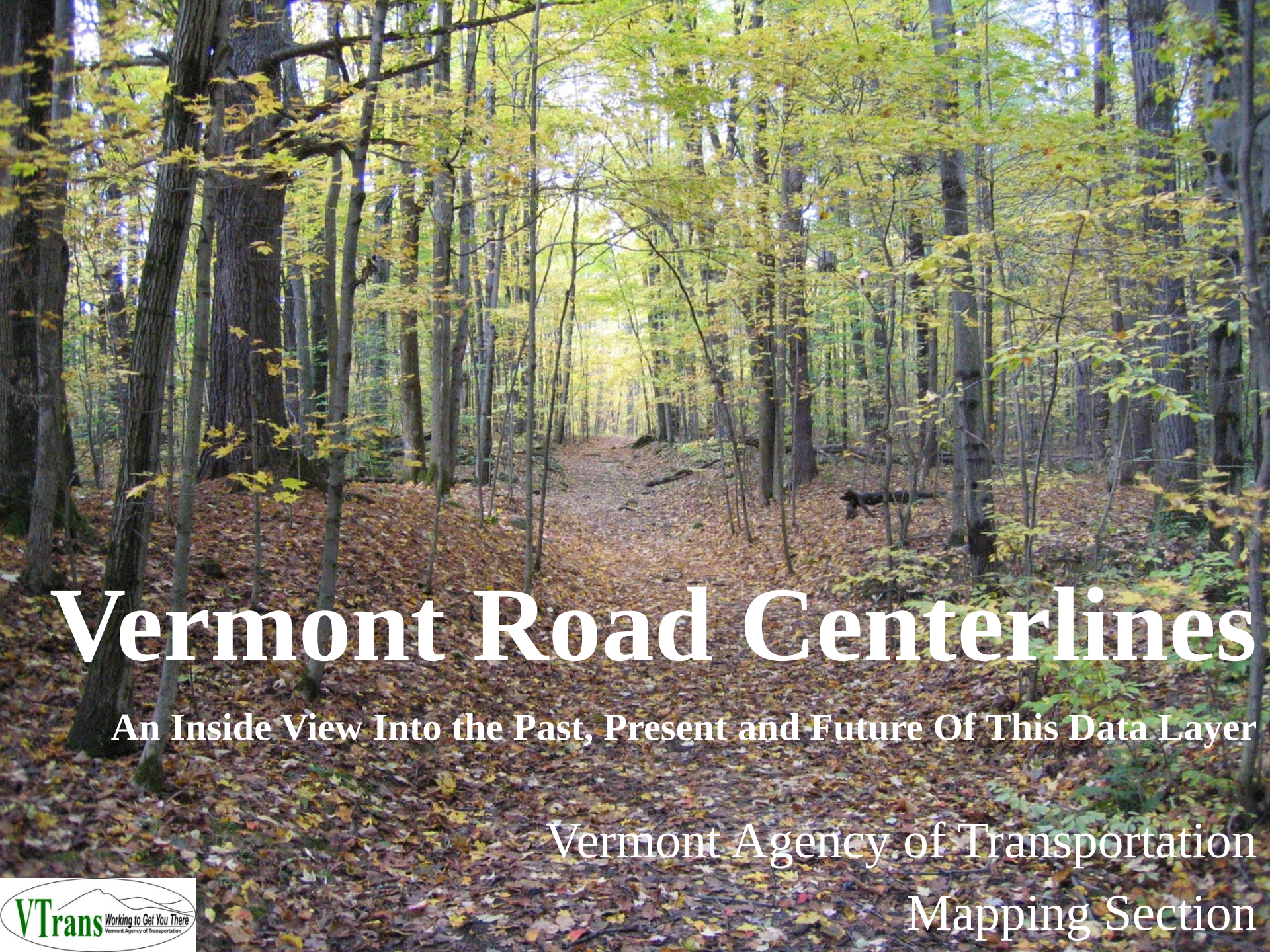


Vermont Road Centerlines

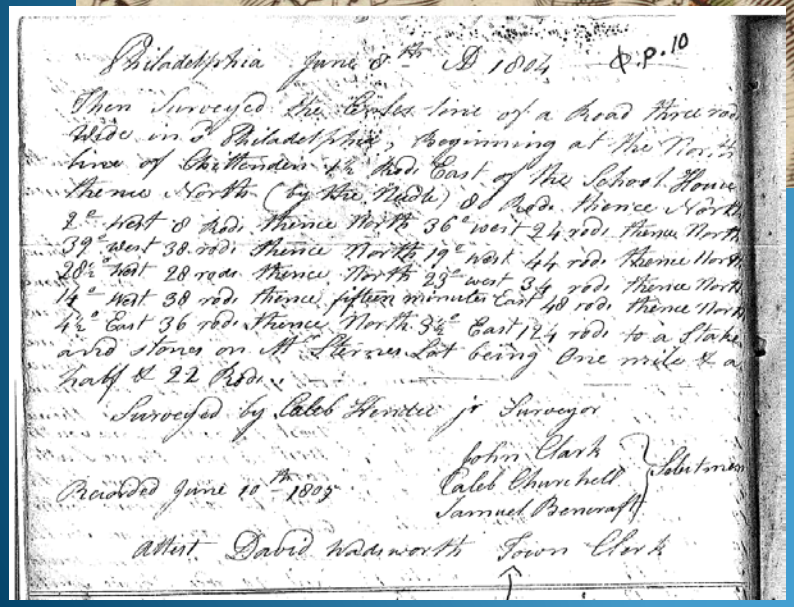
An Inside View Into the Past, Present and Future Of This Data Layer

Vermont Agency of Transportation

Mapping Section

VTrans Working to Get You There
Vermont Agency of Transportation

Abbreviated History of Highways


Philadelphia June 8th A 1804 Q.P.10
Then Surveyed the Center line of a Road three rods
Wide in S Philadelphia, Beginning at the North
line of Chittenden 1½ Rods East of the School House
thence North (by the Needle) 80 Rods thence North
2° West 8 Rods thence North 36° west 24 rods thence North
39° west 38 rods thence North 19° west 44 rods thence North
28½ west 28 rods thence North 23° west 34 rods thence North
14° West 38 rods thence fifteen minutes East 48 rods thence North
4½° East 36 rods thence North 3½° East 124 rods to a Stake
and stones on Mr Sternes Lot being One mile & a
half & 22 Rods
Surveyed by Caleb Hendee jr Surveyor
John Clark
Caleb Churchill } Selectmen
Samuel Bencraft
Recorded June 10th 1805
Attest David Wadsworth Town Clerk

For the past 266 years, starting with the chartering of Bennington in 1749, Towns have been establishing highways. This prompted the need for surveys and highway maps. Survey descriptions, generated by compass and chain from intrepid surveyors in the wilderness of Vermont provide the backbone for the highway network.

http://vtransplanning.vermont.gov/maps/historic

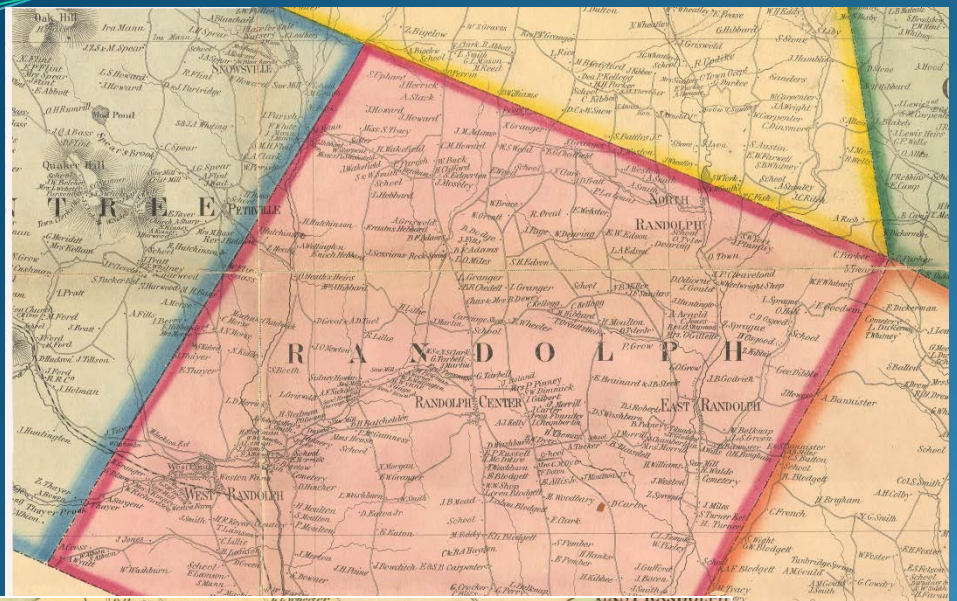
Abbreviated History of Highways

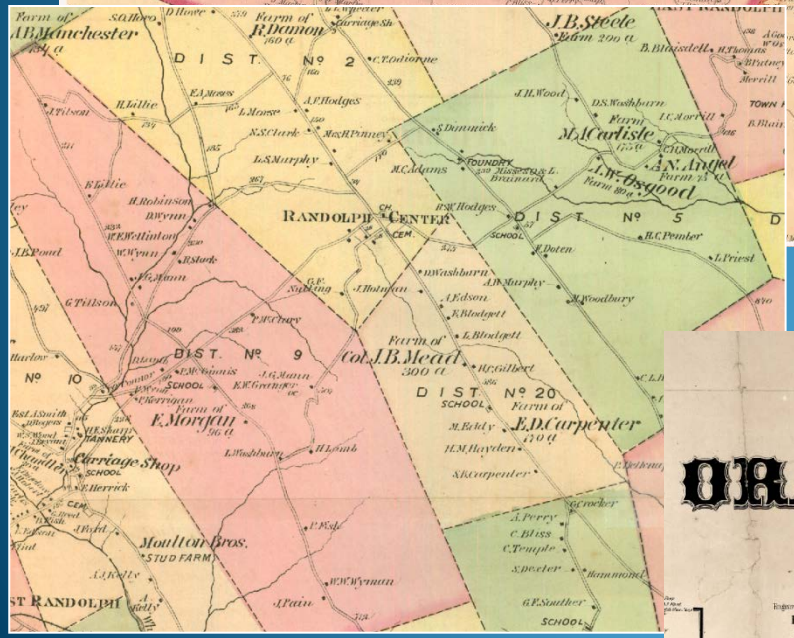
The history of Vermont and it's highways span the days under the reign of George II and George III, the Republic of Vermont, and from 1791 the State of Vermont.

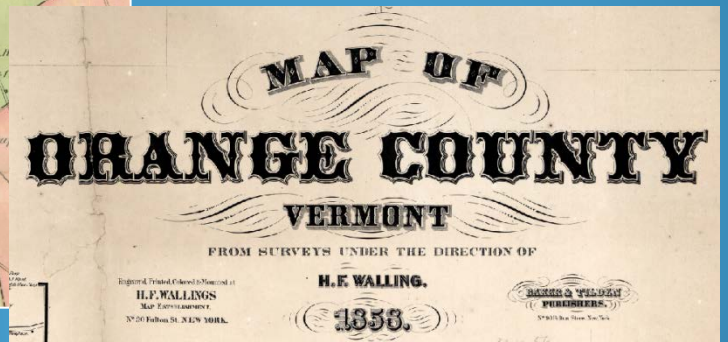
Ira Allen becomes the first Surveyor General, followed by James Whitelaw who produces statewide maps with highways.

http://vtransplanning.vermont.gov/maps/historic

19th Century Maps & Atlases

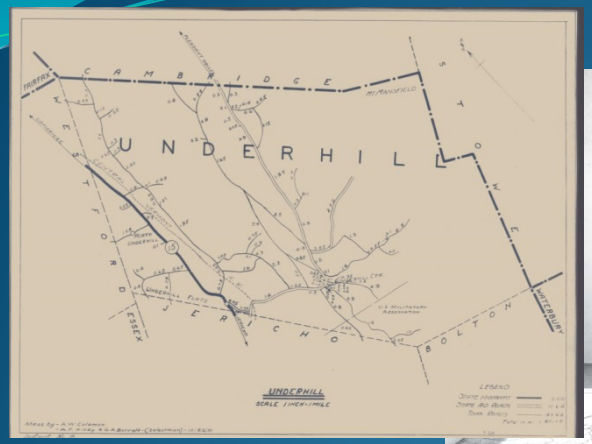


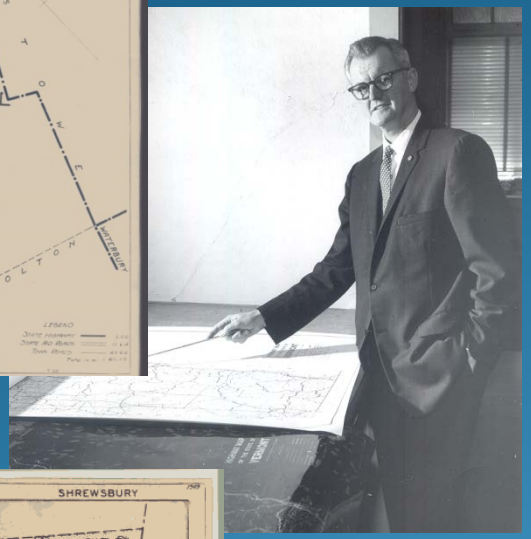


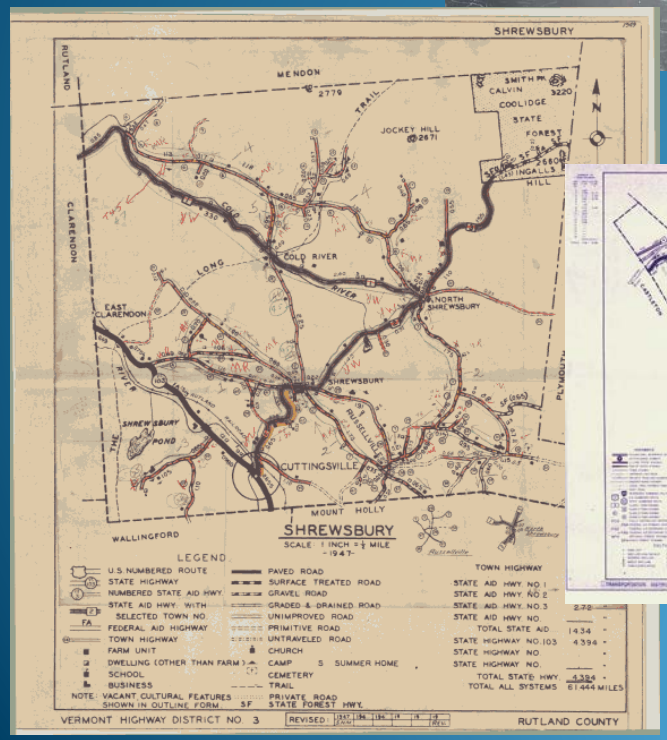


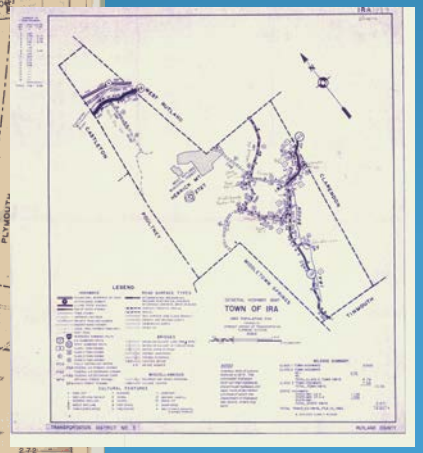
During the 19th Century, several commercial ventures publish maps and atlases that show roads and highways in detail, including the Walling, Doton and Scott County Maps, and the F. W. Beers County Atlases.

Town Highway Maps – Pen & Ink







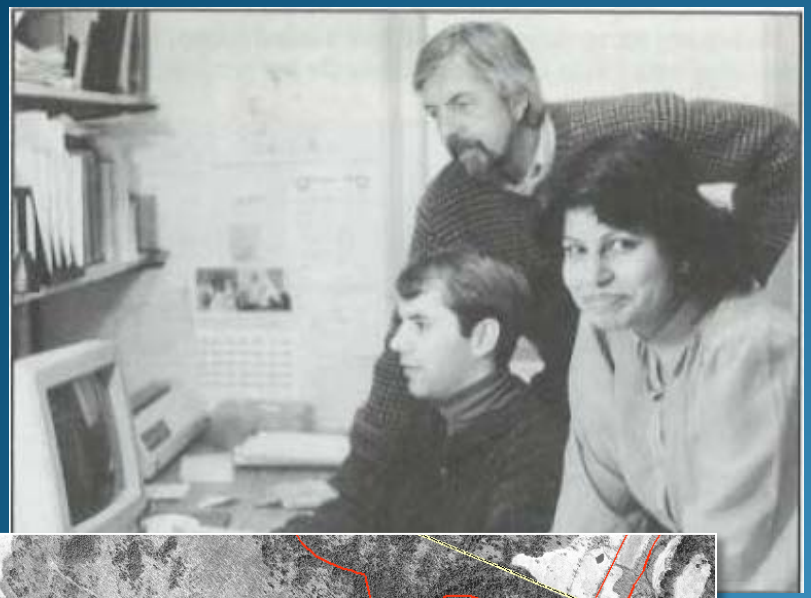


The Mapping Section of the Vermont Agency of Transportation has produced Town Highway Maps since 1931, based on a statutory requirement.

The main purpose of these maps is to document highway classification and mileage of town highways for use in calculating State Aid for town highway maintenance.

http://vtransplanning.vermont.gov/maps/archive

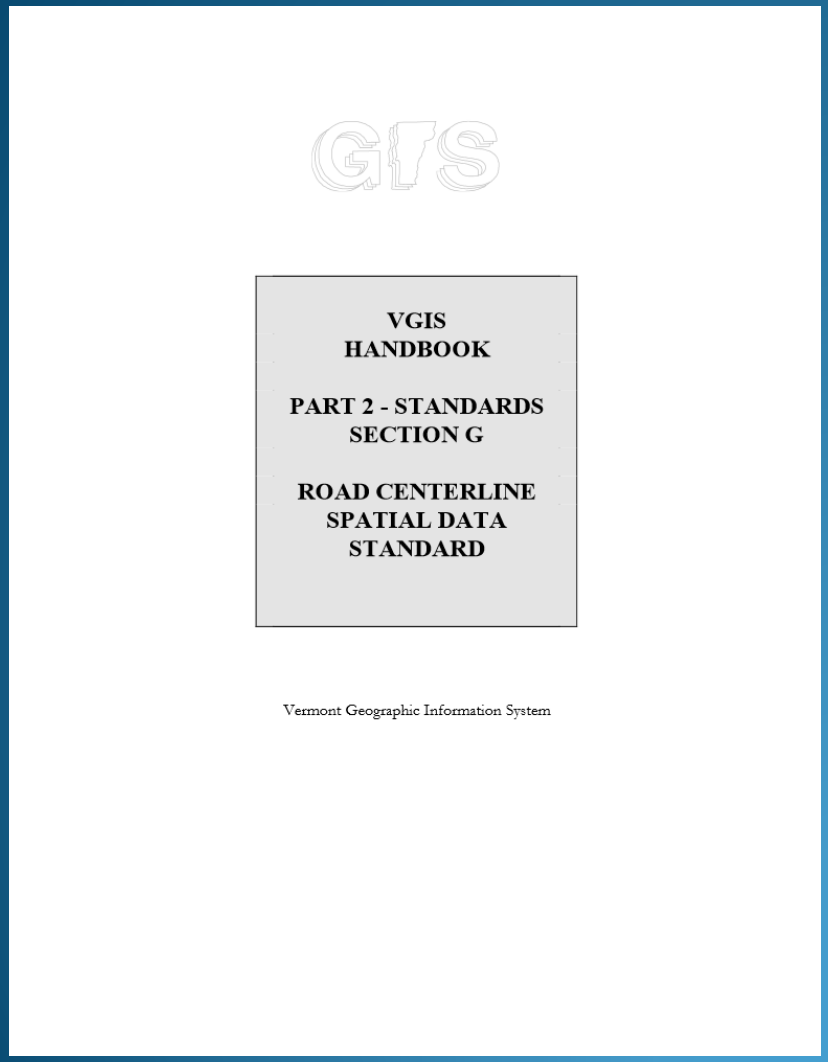
Fast forward to the digital 20th Century



GIS takes hold in Vermont and there is a need for a standardized statewide Road Centerline Data Layer.

In 1991 to 1992, contractor Greenhorne & O'Mara, Inc. digitizes an ArcInfo road centerline data layer using the 1:5,000 Vermont Mapping Program's RC Kodak orthophotos for the VT Office of GIS.

Setting the Standard


VGIS
HANDBOOK

PART 2 - STANDARDS
SECTION G

ROAD CENTERLINE
SPATIAL DATA
STANDARD

Vermont Geographic Information System

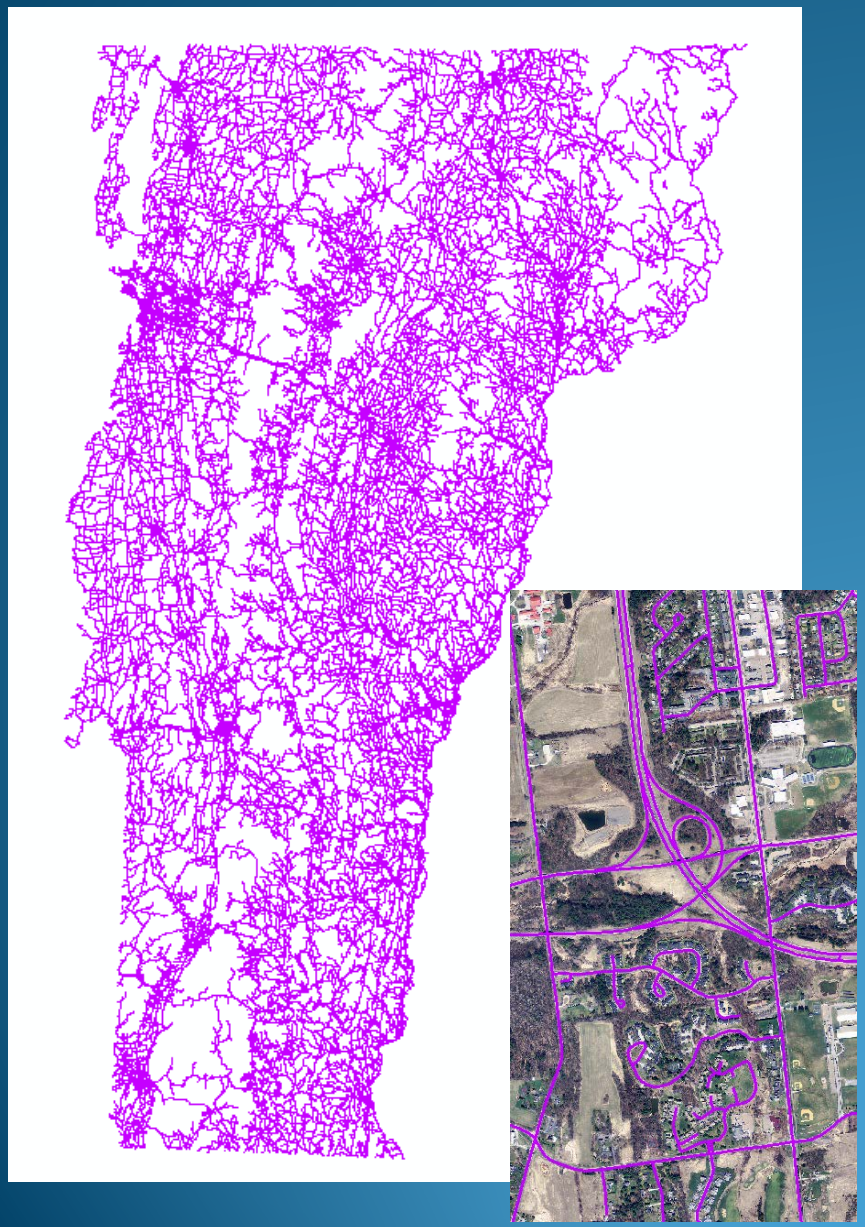
In 1995, a Road Centerline Standard is drafted and endorsed by the Vermont Center for Geographic Information (VCGI) Technical Advisory Committee (TAC).

The data evolves and the Standard is revised in 2005.

This is the current Standard.

vcgi.vermont.gov/sites/vcgi/files/standards/partii_section_g.pdf

The Road Centerline Data Layer



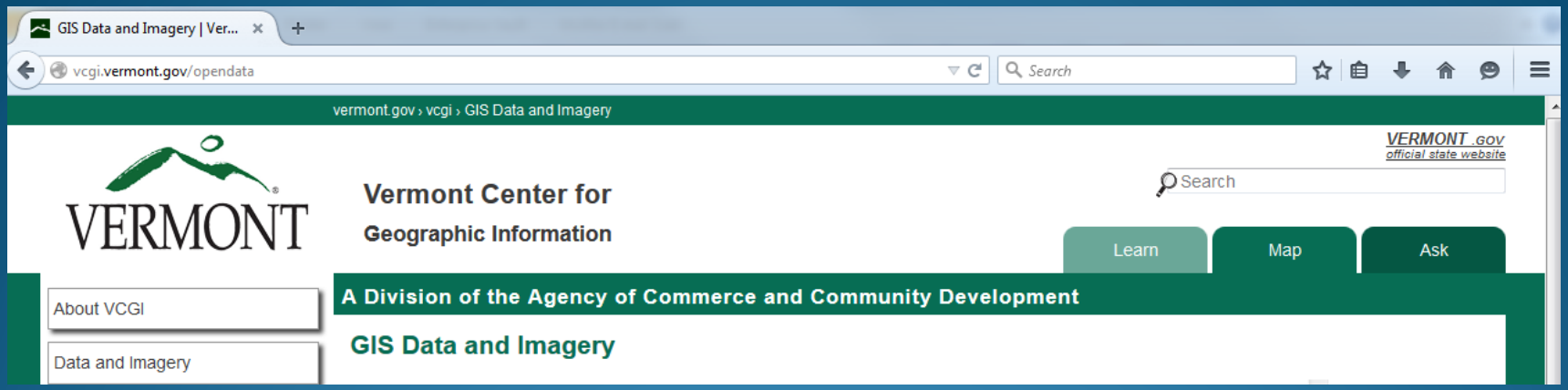
The Road Centerline Data Layer is the linear feature class that represents highways and roads within the State, with specific attributes.

In 2004, VTrans becomes the steward of the centerline data layer and leverages this data as a core feature class.

VT E911 is also the steward of the centerline data.

RDS on ArcGIS Online

RDS Data Available at VCGI



TransRoad_RDS

VTrans Master Road Centerline Data

EmergencyE911_RDS

E911 Road centerlines from 1:5000 orthophotos and GPS

VCGI Data & Imagery Warehouse

Tale of the Two Centerlines

VTrans and E911 both started with the master road centerline data layer from VCGI and modified the data to support operations and organizational missions.

Each organization maintains separate road centerline data layers.

The fork in the road is now merging.

Updated Road Centerline Schema

The road centerline attribute schema has been updated to include all the E911 fields and all the VTrans fields. Both use the same database schema.

The ultimate goal is to have VTrans and E911 working from a single master road centerline data layer.

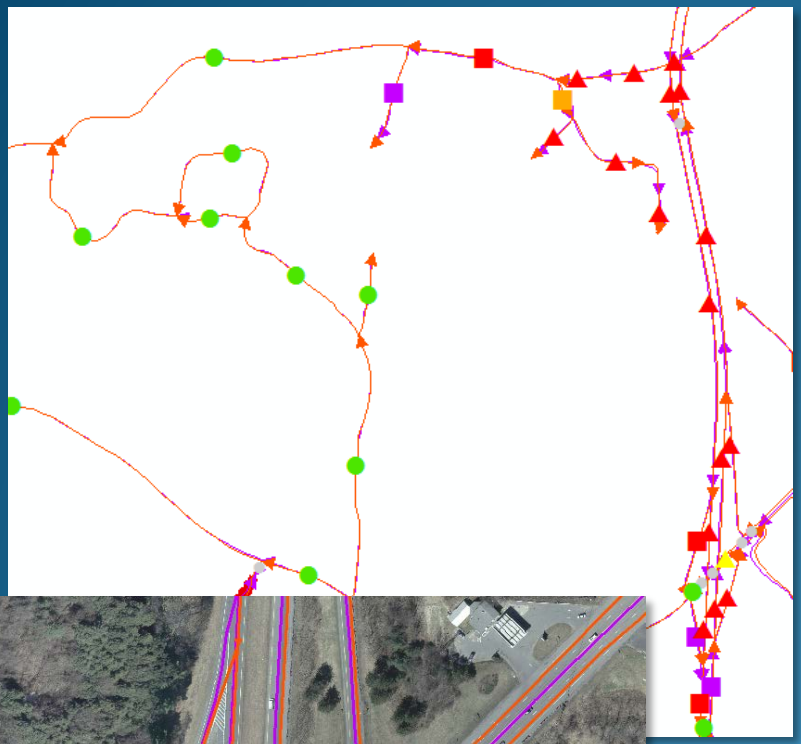
VTrans & E911 Roads Conflation

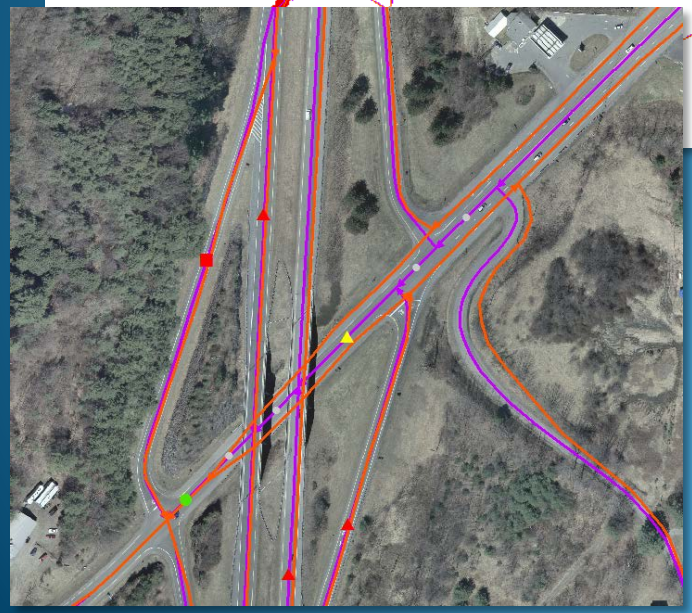
Field Name	Type	Width	Short Description	VTrans Edit	E911 Edit
OBJECTID	OID	4		Y	Y
SEGMENTID	Integer	4	VTrans & E911 Segment ID	Y	Y
FIPS8	Integer	8		Y	Y
ARCID	Integer	4	Old VTrans Segment ID	Y	N
FAID_S	Integer	12		Y	Y
STREETID	Integer	4	Old E911 Segment ID	N	N
PD	String	10	Prefix Direction	N	Y
PT	String	10	Prefix Type	N	Y
SN	String	80	Street Name	N	Y
ST	String	10	Street Type	N	Y
SD	String	10	Street Direction	N	Y
GEONAMEID	Integer	4	Geoname ID to Geoname Table	N	Y
USEGEONAMESALIASES	Integer	4		N	Y
PRIMARYNAME	String	100	Full Street Name (primary)	N	Y
ALINAME	String	100	Old E911 ALI Name	N	N
Alias1	String	60	Street Name Alias	N	Y
Alias2	String	60	Street Name Alias	N	Y
Alias3	String	60	Street Name Alias	N	Y
Alias4	String	60	Street Name Alias	N	Y
Alias5	String	60	Street Name Alias	N	Y
COMMENTS	String	255	Street Segment Comments	Y	Y
SURFACETYPE	SmallInteger	2	Surface Type	Y	Y
ONEWAY	String	1	Road segment is One Way only	Y	Y
ADDRESSLOCK	Integer	4		N	Y
NO_MSAG	Integer	4	To mark MSAG excpetions	N	Y
C1_EXCEPTION	Integer	4	To mark MSAG excpetions	N	Y
MCODE	Integer	4	Municipal Code	N	Y
LESN	Integer	4	Left ESN number	N	Y
RESN	Integer	4	Right ESN number	N	Y
LTWN	String	50	Town Name Left Side of Road	N	Y
RTWN	String	50	Town name Right Side of Road	N	Y
LLO_A	Integer	4	Low Actual Range Left Side of Road	N	Y
RLO_A	Integer	4	Low Actual Range Right Side of Road	N	Y
LHI_A	Integer	4	High Actual Range Left Side of Road	N	Y
RHI_A	Integer	4	High Actual Range Right Side of Road	N	Y
LZIP	String	10	Zip Code Left Side of Road	N	Y
RZIP	String	10	Zip Code Right Side of Road	N	Y
LLO_T	Integer	4	Low Theoretical Range Left Side of Road	N	Y
RLO_T	Integer	4	High Theoretical Range Right Side of Road	N	Y
LHI_T	Integer	4	High Theoretical Range Left Side of Road	N	Y
RHI_T	Integer	4	High Theoretical Range Right Side of Road	N	Y

ADDRESSLRANGEID	Integer	4		N	Y
ROUTEINCLUDE	Integer	4		N	Y
RTNAME	String	12	Route Name	Y	N
RTNUMBER	String	4	Route Number	Y	N
HWYSIGN	String	12	Highway Sign	Y	N
RPCCLASS	Integer	2	RPC Road Classification	Y	Y
AOTCLASS	SmallInteger	2	Agency of Transportation Road Classification	Y	N
NUTS	String	1	Not Up to Standard	Y	N
NHS	Integer	2		Y	N
FUNCL	Integer	2		Y	N
TWN_LR	String	15		Y	N
ETE_LR	String	11		Y	N
CTCODE	String	4		Y	N
UA	Integer	1		Y	N
CTUA	String	6		Y	N
CERTCODE	String	6		Y	N
ARCMILES	Integer	4		Y	Y
AOTMILES	Integer	4		Y	Y
AOTMILES_CALC	Integer	4		Y	Y
UPDACT	Integer	1		Y	Y
LOCMETH	Integer	2		Y	N
SRCORG	Integer	2		Y	N
SCENICHWY	Integer	1		Y	N
SCENICBYWAY	Integer	4		Y	N
FORMER_RTNAME	String	12		Y	N
PROVISIONALYEAR	Integer	4		Y	N
ANCIENTROADYEAR	Integer	4		Y	N
TRUCKROUTE	Integer	3		Y	N
SPEEDLIMIT	Integer	3		Y	Y
ROADCLOSED	String	50		Y	Y
INSET	String	1		Y	N
ISVISIBLE	Integer	1		Y	N
CERTYEAR	Integer	4		Y	N
MAPYEAR	Date	8		Y	Y
UPDATESOURCE	String	30		Y	Y
UPDATEDATE	Date	8		Y	Y
GPSUPDATE	String	1		Y	Y
Shape	Geometry	0		Y	Y
Shape_Length	Double	8		Y	Y
GlobalID	SmallInteger	38		Y	Y
STATE				N	Y
GAP				N	Y
GAPMILES				N	Y
GAPSTREETID				N	Y
RTNUMBER_N				Y	N
RDNAME				Y	N
RDFLNAME				Y	N
ISVISIBLE_UC				Y	N
FAID_N				Y	N

SEGMENTID	Integer	4	VTrans & E911 Segment ID	Y	Y
FIPS8	Integer	8		Y	Y
ARCID	Integer	4	Old VTrans Segment ID	Y	N
FAID_S	Integer	12		Y	Y
STREETID	Integer	4	Old E911 Segment ID	N	N
PD	String	10	Prefix Direction	N	Y
PT	String	10	Prefix Type	N	Y
SN	String	80	Street Name	N	Y

Data Merging - Conflation



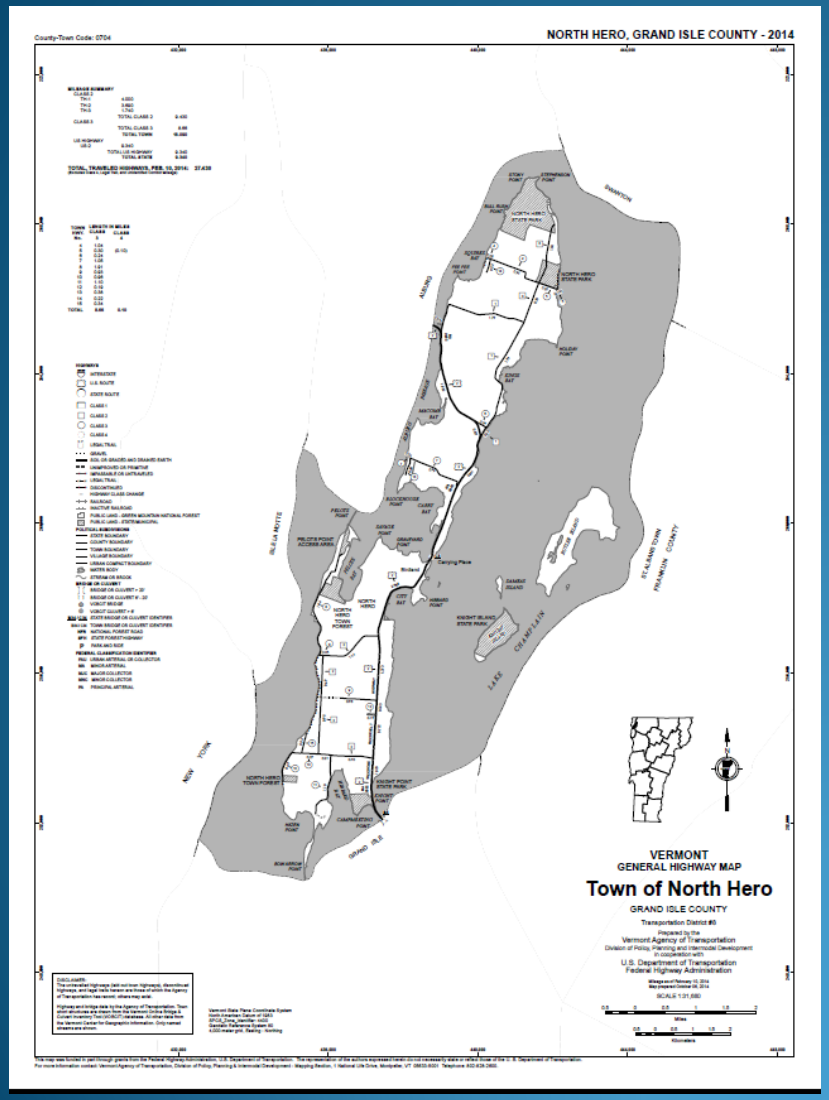


Conflation begins to synchronize the two road datasets into one master with the best geometry and complete attributes.

Over 40% of the arcs have been conflated to date and the remaining 60% are in the process of being reviewed and updated.

This is not an automated process, as arcs need to be evaluated against orthophotos and other sources.

Town Highway Maps & Mileage



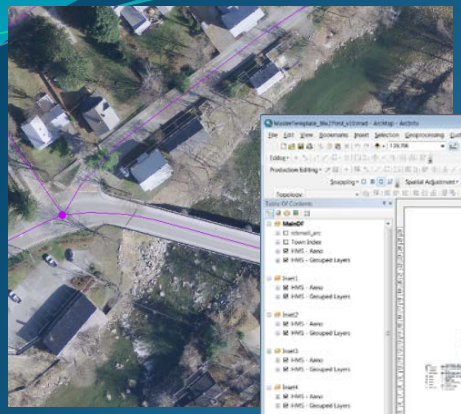
VTrans Mapping relies on the road centerline data to maintain the highway classification and mileage for all state and town highways.

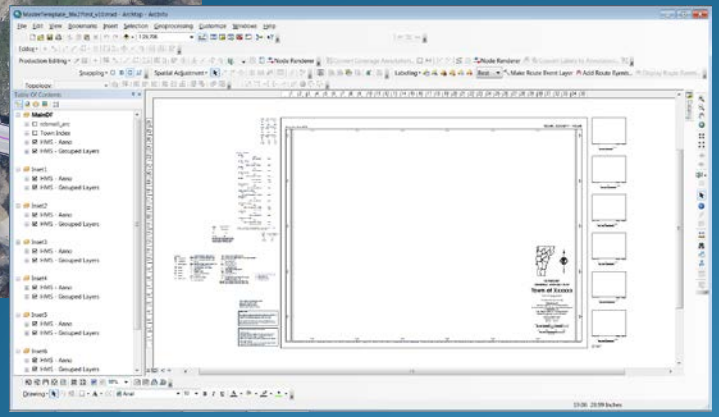
The Summary of Highway Mileage matches the classified highway mileage in the RDS data.

Mileage totals support federal reporting with the Certified Public Highway Mileage.

http://vtransplanning.vermont.gov/maps/publications

Highway Mapping System





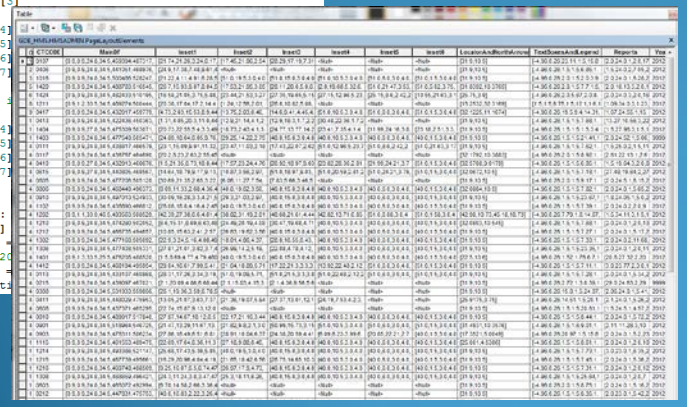
The Town Highway Maps are produced directly from the road centerline data layer, leveraging a data driven, Python-based suite of scripts and ArcMap Template.

```
import arcpy, json, os, sys, time

arcpy.env.overwriteOutput = True
relPath = os.path.dirname(sys.argv[0])

#CURRENT - Get GP tool CTCODE value
inputValue = arcpy.GetParameterAsText(0)

#Function that arranges data frames based on PageLayoutElements table
def arrangeDFs(row, dfName, dfText, dfScaleText, dfScaleBar):
  rowInfo = json.loads(row.getValue(dfName))
  df = arcpy.mapping.ListDataFrames(mxd, dfName)[0]
  df.elementPositionX = rowInfo[0]
  df.elementPositionY = rowInfo[1]
  df.elementHeight = rowInfo[2]
  df.elementWidth = rowInfo[3]
  newExtent = df.extent
  newExtent.XMin = rowInfo[4]
  newExtent.XMax = rowInfo[5]
  newExtent.YMin = rowInfo[6]
  newExtent.YMax = rowInfo[7]
  df.extent = newExtent
  #Must perform second time s
  newExtent = df.extent
  newExtent.XMin = rowInfo[4]
  newExtent.XMax = rowInfo[5]
  newExtent.YMin = rowInfo[6]
  newExtent.YMax = rowInfo[7]
  df.extent = newExtent
  df.scale = rowInfo[8]
  if not dfName == "MainDF":
    dfText.text = rowInfo[9]
    dfText.elementPositionX =
# next line modified since 20
    dfText.elementPositionY =
    dfScaleText.elementPositi
```

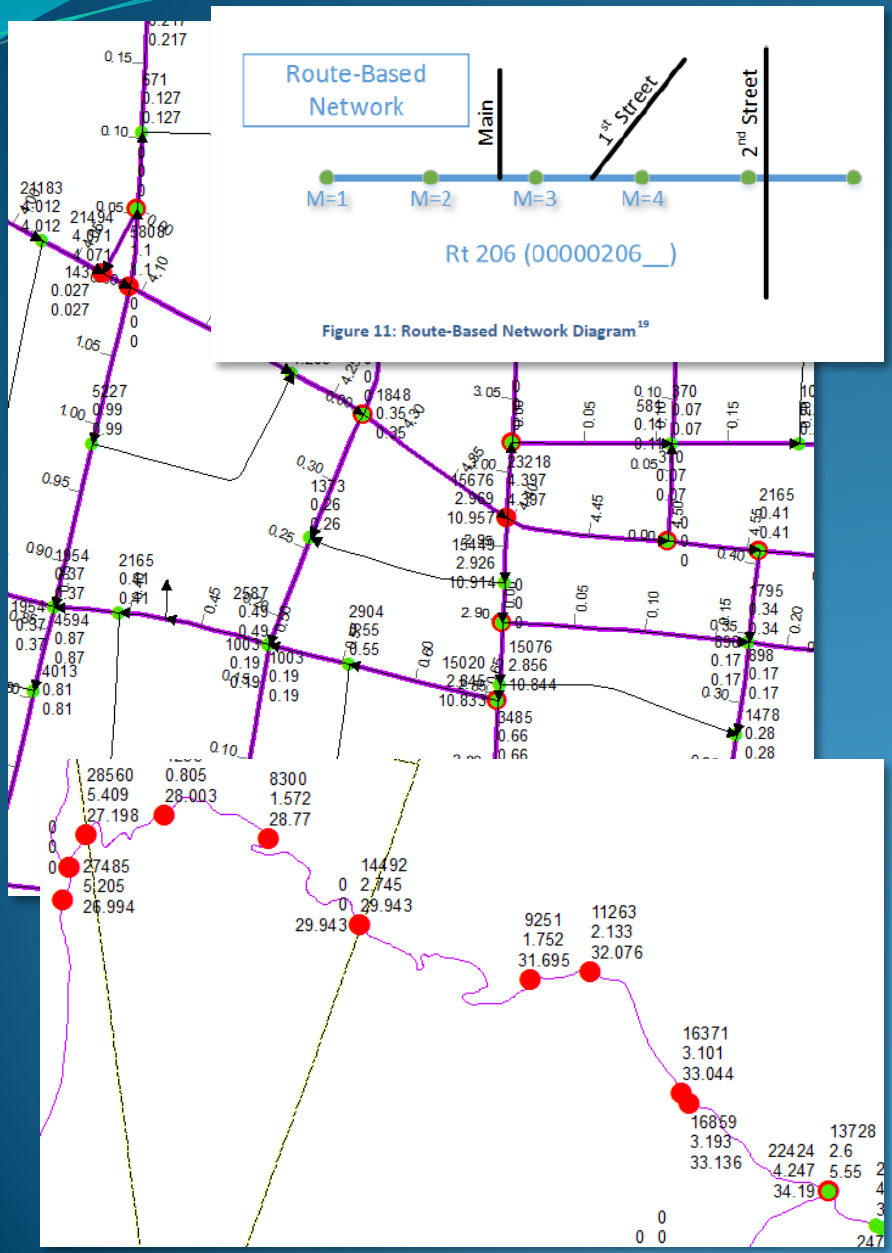


The Multiple Element Layout Manager 10.0 v1 from Esri provides the same Python functionality.

http://vtransplanning.vermont.gov/maps/

http://esriurl.com/5907

Linear Reference System (LRS)

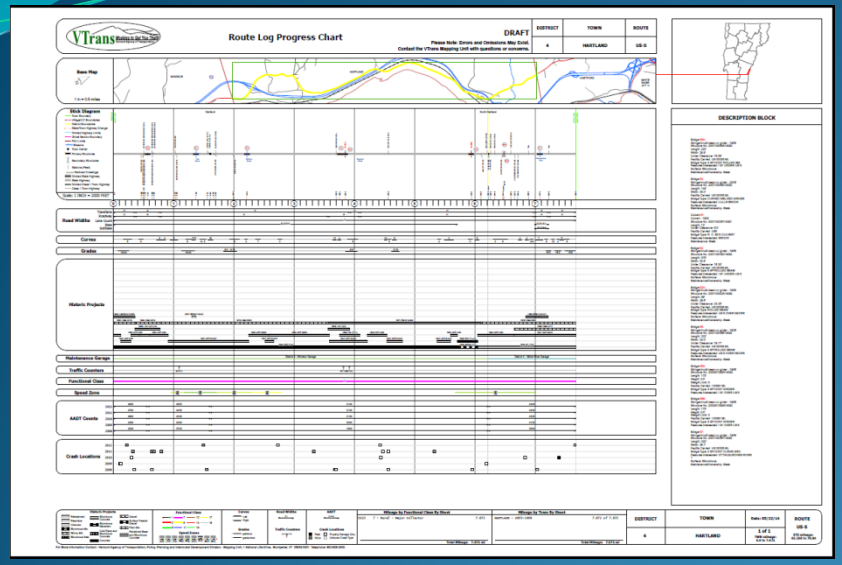


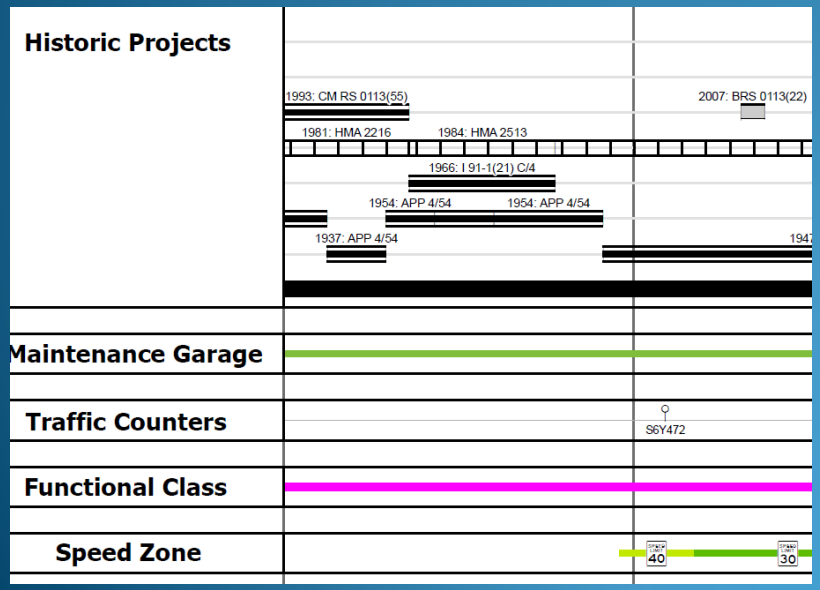
VTrans leverages the geometry of the RDS data to generate the linear reference system (LRS). The LRS has measures or M-values on each vertex, and an awareness of the measures.

This is done for the Federal Aid System and also Local Roads, creating the All Roads Network of Linear Referenced Data (ARNOLD).

ARNOLD Reference Manual

Route Logs and Event Mapping



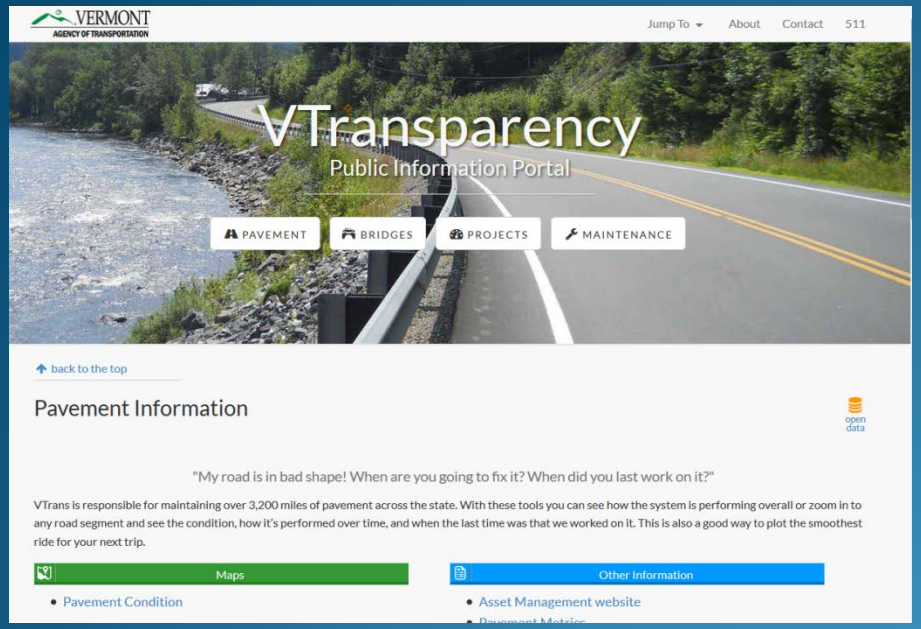


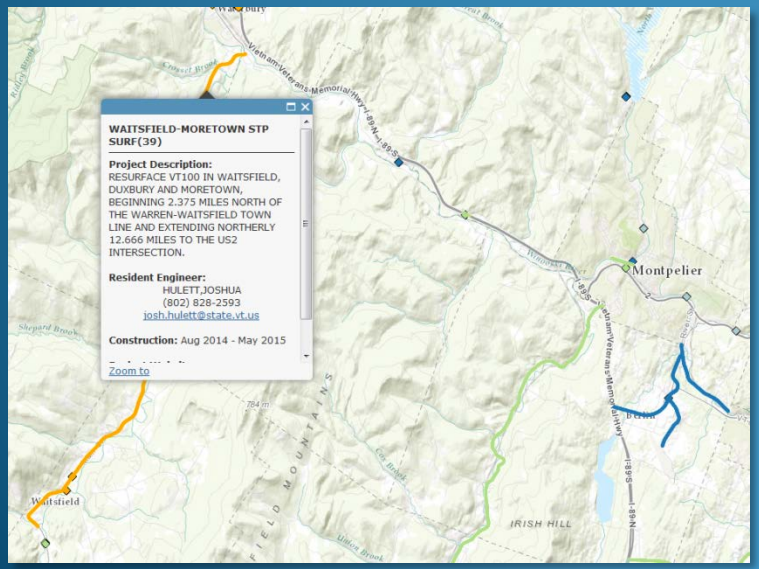
Routes Logs are straight line diagrams that use the linear referenced data and events for the same section of highway.

This is a powerful visualization and analysis tool for data that traditionally doesn't have geography associated, other than route and mile markers.

http://vtransplanning.vermont.gov/maps/routelogs

VTransparency





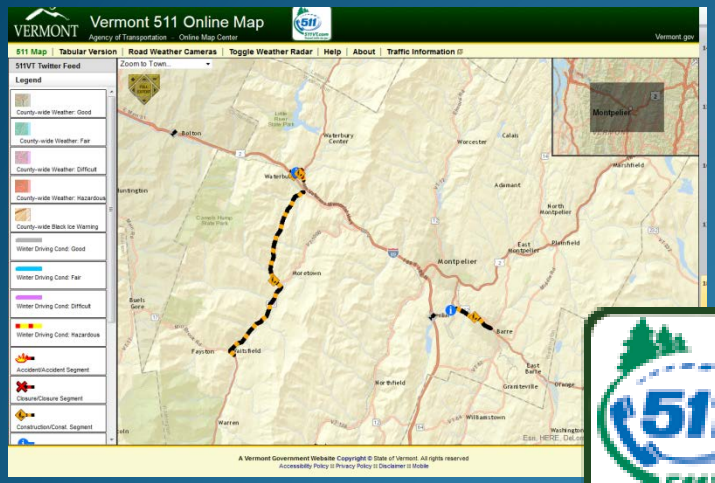
The linear reference system (LRS) supports other applications within VTrans, such as VTransparency.

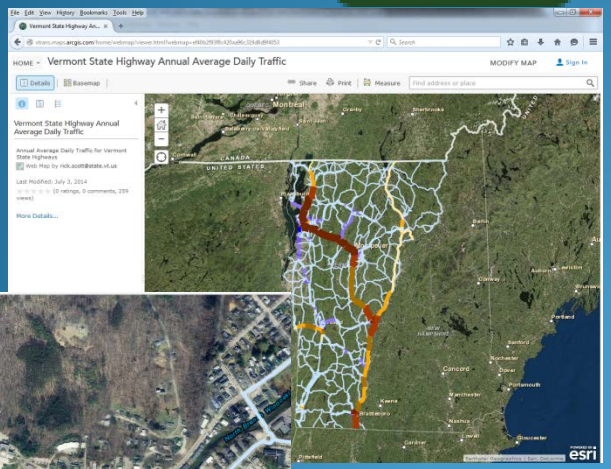
Event data is dynamically segmented on the LRS and deployed out through ArcGIS Online.

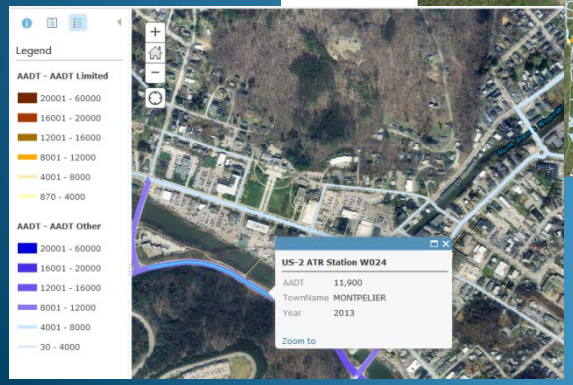
Such as project information.

http://vtransparency.vermont.gov/

RDS and LRS is a Core Dataset







The VTrans 511 System uses the LRS to locate projects, closures, and highway condition.

Multiple scripts are used to create feature classes through nightly batches for assets, maintenance activities, and other transportation features.

Many of these layers are deployed on-line.

http://vtransmaps.vermont.gov/VTrans511/511live.htm

AADT Map – ArcGIS On-Line

What will the Future hold?

Source: http://www.smashingmagazine.com/2009/06/08/retro-futurism-at-its-best-designs-and-tutorials

Continued cooperation and collaboration between VTrans and E911

More dynamic data and responsiveness to updates

Temporal data via Esri's Roads & Highways

Advanced linear referencing

More applications, tools and data on-line

Questions???

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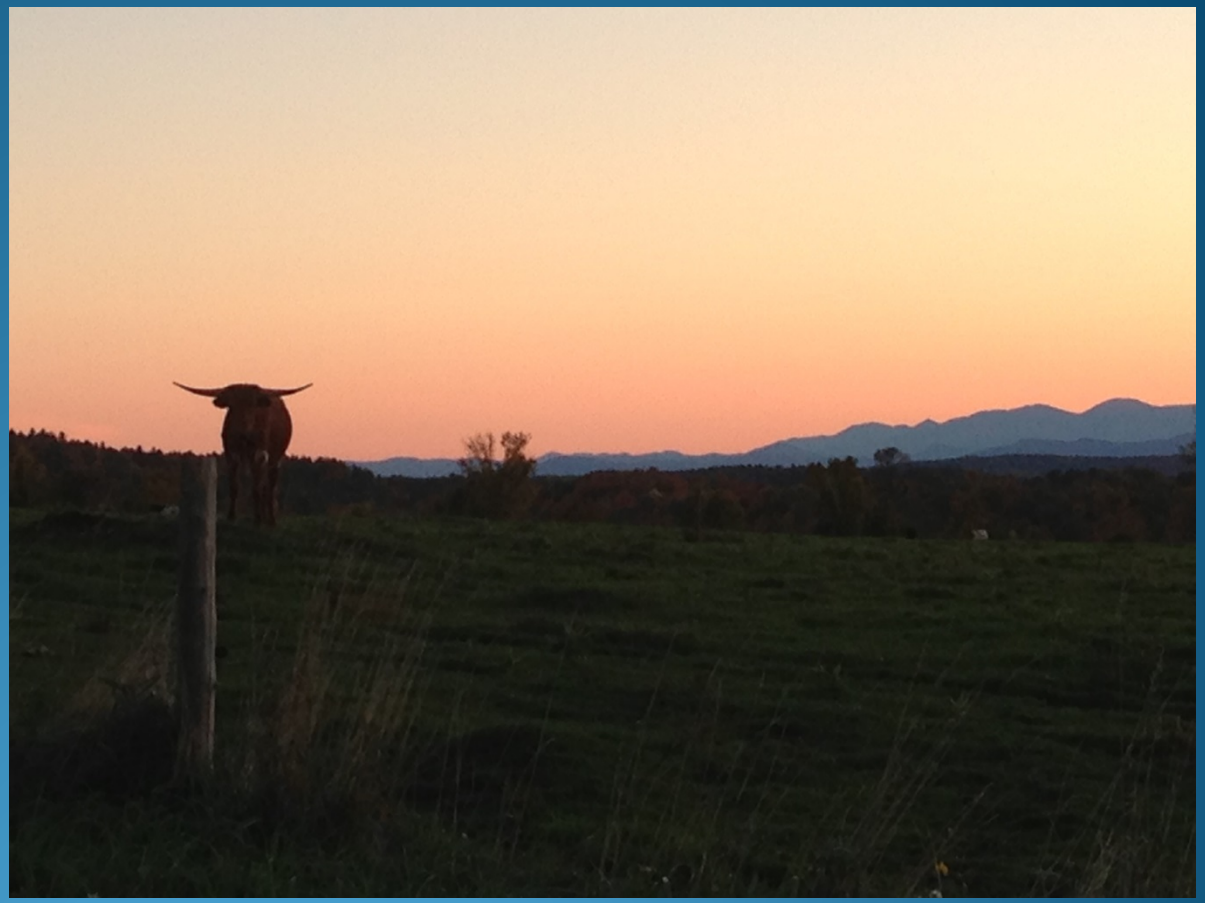
(802) 828-3666

VT Agency of Transportation
Policy, Planning & Intermodal
Development Division -
Mapping Section



VTrans Mapping Section:
http://vtransplanning.vermont.gov/maps/