VTrans Policy, Planning & Intermodal Development Division
Mapping Unit
Projects and Accomplishments

Light Detection & Ranging (LiDAR) Technology

VTrans Mapping is utilizing LiDAR data and technology to support VTrans activities and has acquired high resolution data for 122 miles of highway corridors damaged by TS Irene and the Interstate 89, 91 and 189 corridors.

LiDAR data is high resolution terrain data that allows for increased 3D modeling and analysis. Derived products include hill shades, contours, slope & aspect data, and other visualization layers. The primary uses at VTrans are as follows:

Project Design and Survey Support
Road Centerline Identification and Mapping
Environmental and Archeological Assessment
Geomorphology and Stormwater Assessment

VTrans is working cooperatively with the Vermont Center for Geographic Information and the US Geologic Survey on the acquisition of LiDAR data throughout the State, in support of Agency activities.

Highway Mapping System

The VTrans Mapping Unit annually produces General Highway Maps, also known as Town Highway Maps for municipalities that have supplied changes on the Certificate of Highway Mileage. Over the course of the last year, Mapping has implemented a new system that allows for the Town Highway Maps to be produced far more rapidly than in the past. In years past, Mapping would only produce the 50 to 60 maps for towns, cities and villages that had changes supplied. In 2013, 243 maps were produced.

The goal for 2014 is to produce the full series of Town Highway Maps, which includes roughly 320 maps.

Route Log System

Mapping is leveraging the same principles with the production of the Route Logs, which are the straight line diagrams of the Federal Aid Highway System. A draft series of the Route Logs have been produced and made available to Agency staff and are under review. Over the course of the next year, a new set of Route Logs will be produced and posted for on-line viewing and download.

The Route Logs provide an overview of the highway network and a snapshot of the information pertaining to a specific section of road, including widths, curve & grade, projects, AADT, crashes and other geometric information.

Mapping Unit Contacts

Johnathan Croft
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828-2600

Michael Trunzo
Transportation Technician III
828-3974

Sara Moulton
AOT Mapping & GIS Specialist II
828-2109

Kerry Alley
AOT Mapping & GIS Specialist I
828-3666

Gary Smith (50%) and Sarah Kepchar (20%) are also part of the Mapping Unit team, providing part-time assistance and specific expertise to the mapping effort.

On-Line Mapping Resources

- The Mapping Unit has made accessible a substantial amount of data in a digital format on-line. Please find links to the maps and data posted by the VTrans Mapping Unit.

Main Mapping Unit Page – http://vtransplanning.vermont.gov/maps

Annual Mileage Summaries - http://vtransplanning.vermont.gov/maps/publications

Town Highway Maps - http://vtransplanning.vermont.gov/maps/town_maps

Map Archive - http://vtransplanning.vermont.gov/maps/archive

Field Assessment Map Series – ftp://vtransmap.aot.state.vt.us./Maps/VTrans_data_Irene/VTrans_District_Maps/Field_Assessment_Series/

Rural Functional Class Map – http://vtransplanning.vermont.gov/sites/aot_policy/files/documents/highwayresearch/RuralFunclStatewide_2013.pdf

County-Town Map Series - http://vtransplanning.vermont.gov/maps/publications

Bridge & Culvert Inspection Maps - ftp://vtransmap.aot.state.vt.us./Maps/VTrans_data_Irene/Bridge_Inspection_Maps/

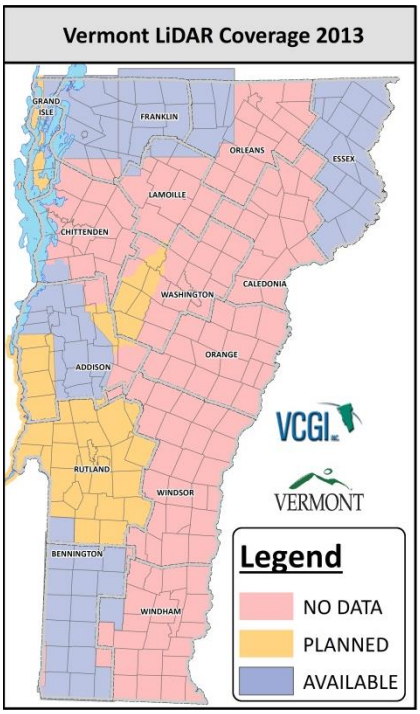
Federal Highway Map Series - ftp://vtransmap.aot.state.vt.us./Maps/FederalHighwaySystem/

VTrans District Map - ftp://vtransmaps.vermont.gov/Maps/DistrictMaps/StateMap_Districts_2013.pdf

Vermont LiDAR Initiative: Critical Infrastructure

Introduction

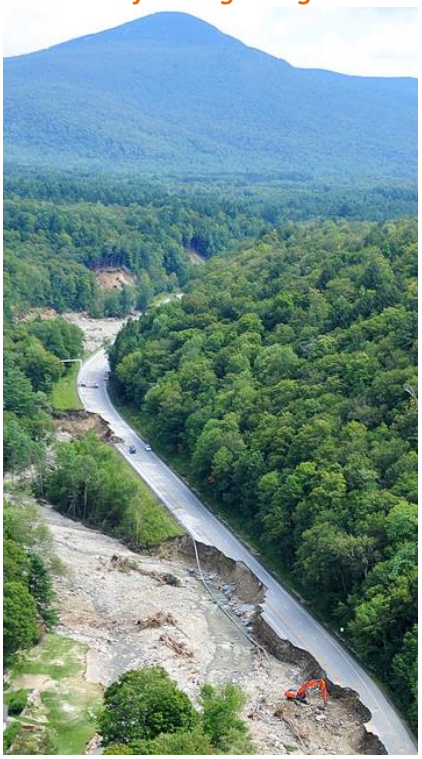
Highly accurate elevation data on hydrologic features, landforms, infrastructure and other features is beneficial for improving flood readiness, public safety and emergency management, water quality, conservation management and decision support. ***Light Detection and Ranging (LiDAR)*** technology is currently the most efficient and cost effective means of acquiring this data for the state. ***Current coverage is 45%*** with an estimated $1.9 million needed to complete the state.



Post TS Irene, the public safety, emergency and environmental resource communities joined a broad range of other critical state interests in identifying ***statewide high resolution elevation data as a critical need.*** With assistance from the state and matching funds from federal partners ***this initiative can achieve full state coverage by 2015***.

LiDAR = Critical Infrastructure

Just as roads, bridges and water supply were the physical infra-structure of the industrial age, ***electronic data is the infra-structure of the digital age.***



Rt 4 between Killington & Mendon, VT. Photo: Lars Gange & Mansfield Heliflight

Few sources of geospatial data offer the richness of "LiDAR as infrastructure" to inform todays more technical society.

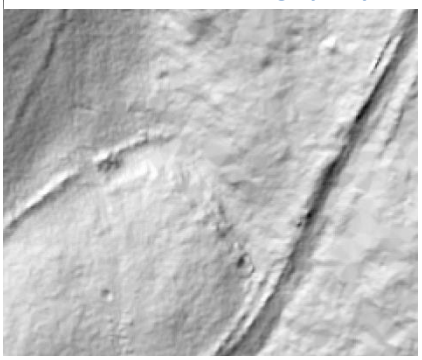
Flood Risk Management

Currently half the state is without Digital Flood Insurance Rate Maps (DFIRMs), and other areas need updated studies. DFIRMs help inform flood hazard areas permitting by municipalities and state agencies and also flood damage mitigation planning.

Infrastructure Management

LiDAR is used in preliminary project and construction planning of culverts, bridges and roads and provides more accurate storm water modeling results. It also improves road centerline data and linear referencing system accuracy and the identification of "Ancient Roads", class 4 town highways, legal trails and historic features.

Ancient Road on Aerial Imagery Only



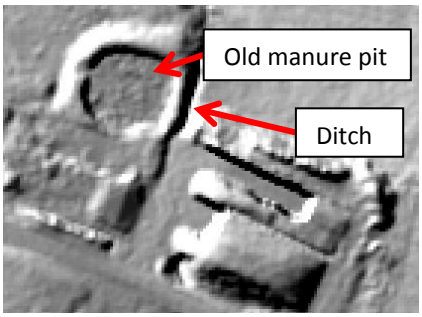
Ancient Road on "Bare Earth" DEM

Natural Resources Conservation

LiDAR helps identify water flow paths across farmland to aid water quality protection, the restoration activities of poor cropland back into wetlands, planning riparian area practices and ***reduces onsite engineering activities***.

Site specific maps afford technical staff the ability to conduct advance planning and assessment at the individual site level, thus ***improving conservation planning efficiency***, identification of site

specific water quality concerns and focusing outreach.

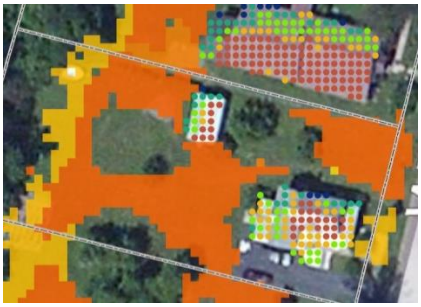


Water Supply and Quality

Enhanced elevation data also supports fluvial geomorphic assessments, river corridor delineation and informs critical analyses ***identifying non-point phosphorus inputs to Lake Champlain and other basins.***

Renewable Energy

LiDAR derived 3-D Digital Surface Model (DSM) accounts for tree canopy, shading, building shape, rooftops and other infrastructure affording the ability ***to model solar potential*** for both roof and ground mount solar photovoltaic (PV) and thermal arrays.



Solar Potential Mapping

Other renewables such as wind, biomass, hydro and their support infrastructure also benefit from the use of highly accurate Digital Elevation Models (DEM's) and "derivatives" such as slope, aspect and contour data.

Goals and Benefits

Completed in 2011, the National Enhanced Elevation Assessment (NEEA) sponsored by the National Digital Elevation Program's (NDEP) 12 Federal member Agency documents the need and value of high quality topographic information, acquired via terrestrial or airborne LiDAR. Subsequently, NDEP created the "3D Elevation Program" initiative adopting the ***top ten "enhanced elevation data support critical applications"*** identified in the NEEA that apply to Vermont:

Table 1. Top NEEA business uses

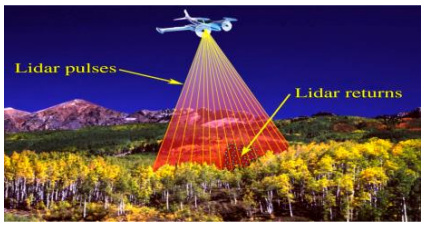
#	Business use
1	Flood risk management
2	Infrastructure/constr. mngmnt
3	Natural resources conservation
4	Agriculture and precision farming
5	Water supply and quality
6	Wildfire manage/plan/response
7	Geologic resources and hazard
8	Forest resources management
9	River/stream resource mngmnt
10	Aviation navigation and safety

This initiative was also endorsed by the National States Geographic Information Council and the National Geospatial Advisory Committee. The confluence of support for data acquisition is reflected in the 3DEP primary goal to ***"systematically collect enhanced elevation data … over the conterminous United States…on an 8-year schedule."***

LiDAR at a Glance

LiDAR is a remote sensing method using light in the form of a pulsed laser to measure ranges (variable distances) to the Earth yielding precise elevation data. When combined with other data it generates ***precise, 3D information about the shape of the Earth, i.e., "Bare Earth" DEMs, DSMs and their "derivatives".***

The combined utility of LiDAR elevation products supports such a wide array of applications that it can truly be considered a form of critical digital infrastructure. For more technical details see the ***"More Info"*** section below.



Graphic courtesy of USGS

Coordination/Implementation

In 2012 the Vermont Center for Geographic Information ***(VCGI) formed the "LiDAR Workgroup"*** as a strategic response to Hurricane Irene with the goals of supporting the coordination, acquisition and dissemination of statewide LiDAR. The group is currently comprised of federal, state and local partners: U.S. Geological Survey, National Resource Conservation Service, UVM Spatial Analysis Lab, VT Assoc. of Planning & Dev. Agencies, VCGI, VT Agency of Natural Resources, Lake Champlain Basin Program, U.S. Forest Service, VT Electric Coop, VT Sustainable Jobs Fund and the VT Geological Survey.

Summary

As the state GIS coordinating organization, VCGI is committed to the success and long-term support of this effort. Existing and future data from this program will be shared with appropriate federal data portals to provide the public with multiple data access points.

For More Information

What is LiDAR?
http://tinyurl.com/o7q97fw
"What is LiDAR data?" -
http://tinyurl.com/nmxfaqo

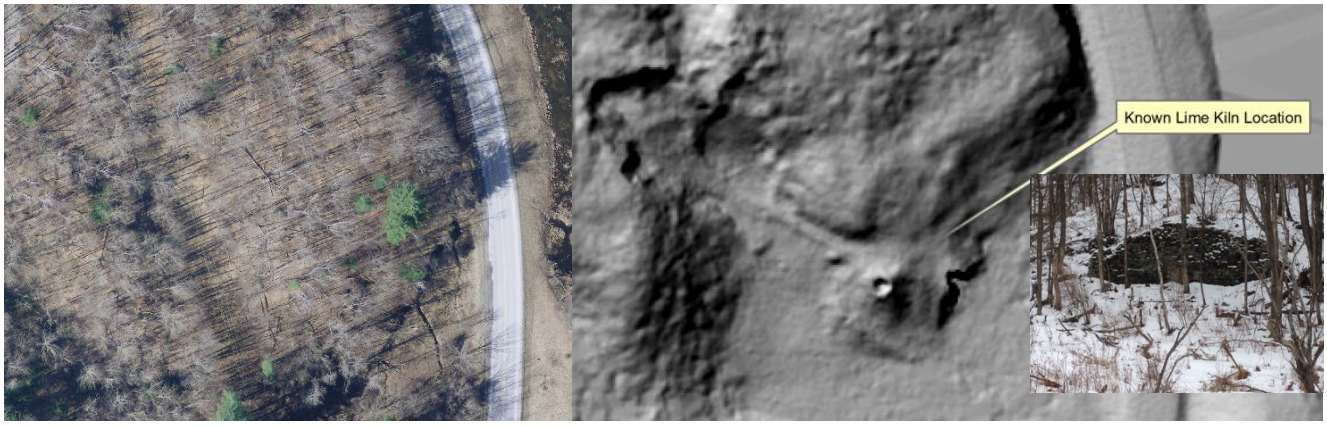
Mike Brouillette (VCGI LiDAR Coord.);
58 S. Main St., Waterbury, VT
(802) 882-3008; mikeb@vcgi.org;

LiDAR Web page -
vcgi.vermont.gov/lidar

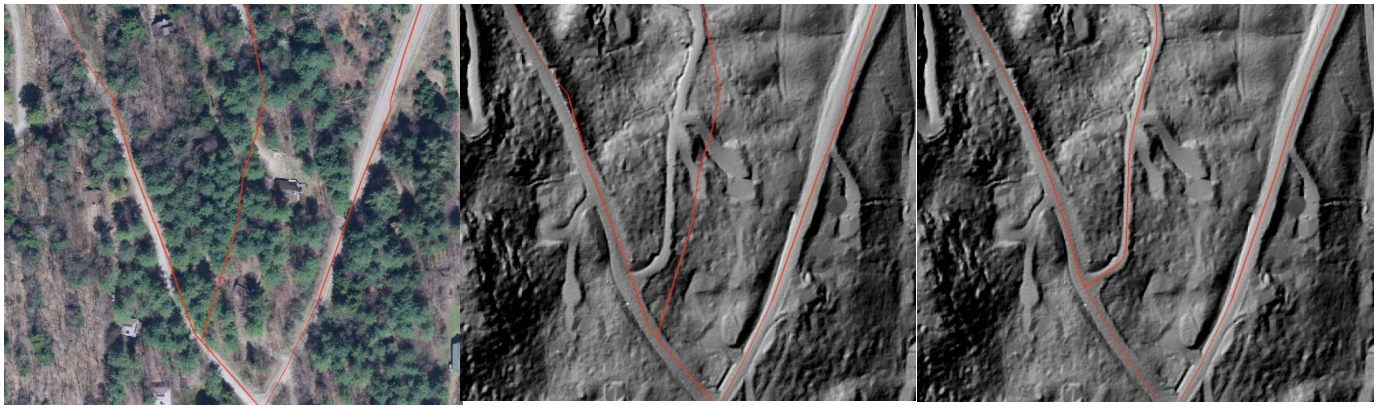

I-91 Putney LiDAR - 2008
VTrans Mapping Unit
0 0.02 0.04 0.08
Miles
N

VTrans Use of Light Detection & Ranging (LiDAR) Technology

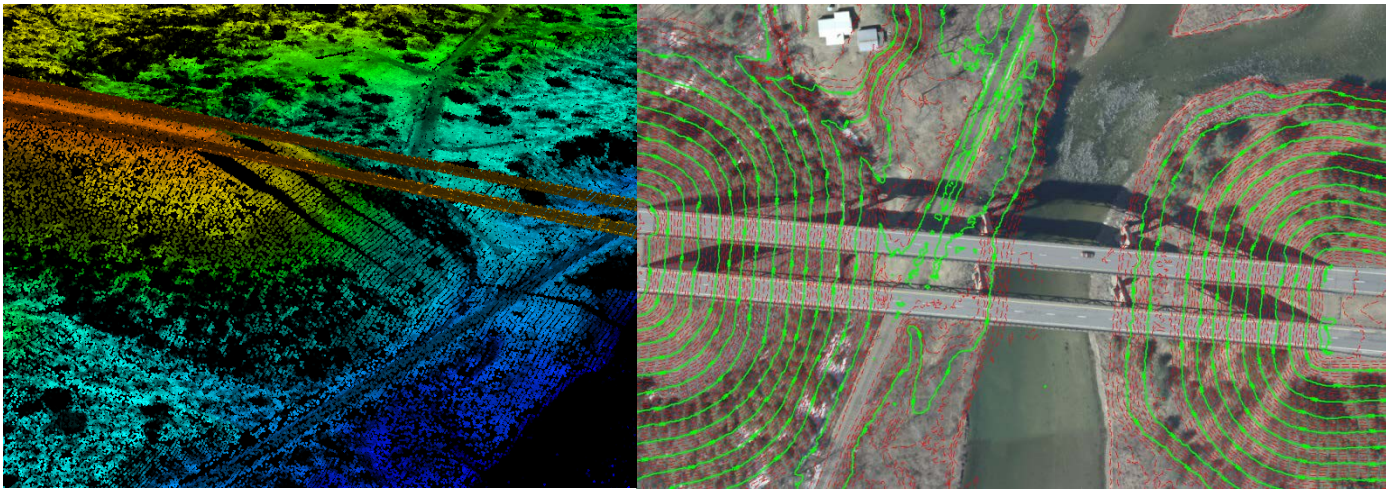
LiDAR in Archeology

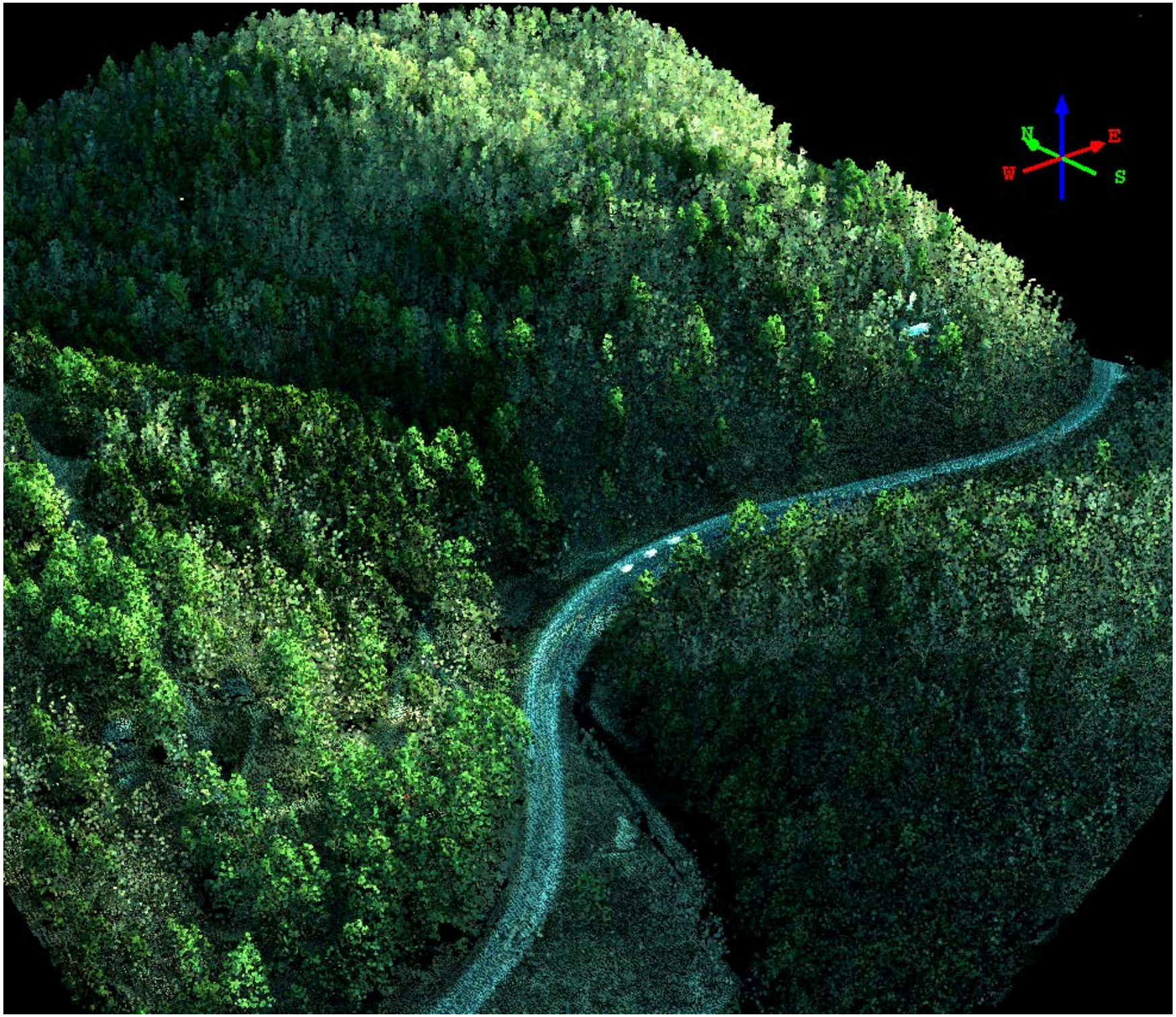


LiDAR to Improve Road Centerlines



LiDAR in Project Design





LiDAR 3D Example

TS Irene Corridor Imagery

Spring 2012

VTrans Mapping

County-Town Code: 0101

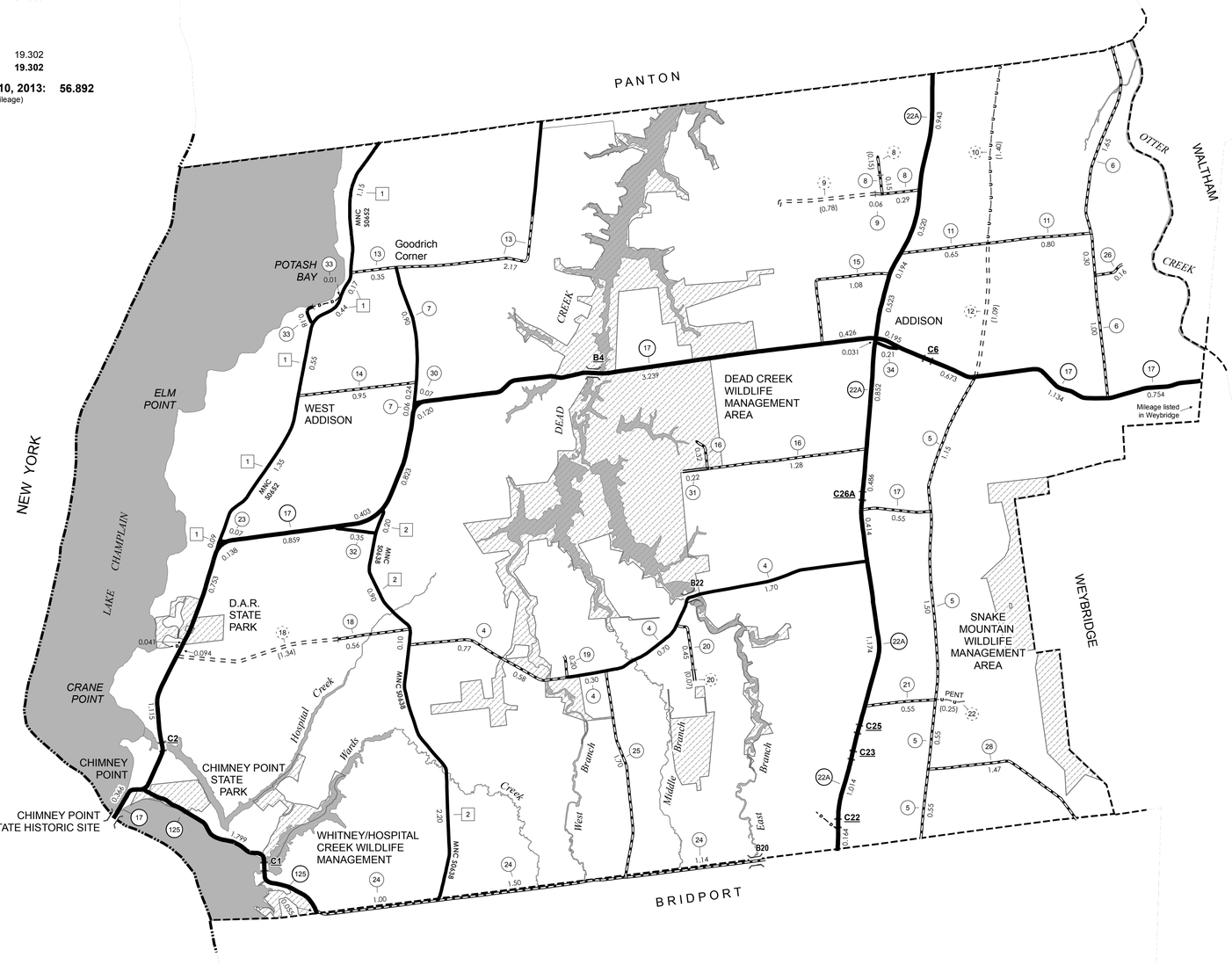
ADDISON, ADDISON COUNTY - 2013

TOWN HWY. No.	LENGTH IN MILES CLASS 3	CLASS 4
4	4.05	
5	3.75	
6	2.95	
7	1.20	
8	0.44	(0.15)
9	0.06	(0.78)
10		(1.40)
11	1.45	
12		(1.09)
13	2.52	
14	0.95	
15	1.08	
16	1.60	
17	0.55	
18	0.56	(1.34)
19	0.20	
20	0.45	(0.07)
21	0.55	
22		(0.25)
23	0.07	
24	3.64	
25	1.70	
26	0.16	
28	1.47	
30	0.07	
31	0.22	
32	0.35	
33	0.19	
34	0.21	
TOTAL	**30.44**	**5.08**

MILEAGE SUMMARY

CLASS 2		
TH-1	3.750	
TH-2	3.400	
	TOTAL CLASS 2	7.150
CLASS 3		
	TOTAL CLASS 3	30.44
	TOTAL TOWN	**37.590**
STATE HIGHWAY		
VT-17	11.133	
VT-22A	6.315	
VT-125	1.854	
	TOTAL STATE HIGHWAY	19.302
	TOTAL STATE	**19.302**

TOTAL, TRAVELED HIGHWAYS, FEB. 10, 2013: 56.892
(Excludes Class 4, Legal Trail, and Unidentified Corridor Mileage)



VERMONT
GENERAL HIGHWAY MAP

Town of Addison

ADDISON COUNTY

Transportation District #5

Prepared by the
Vermont Agency of Transportation
Division of Policy, Planning and Intermodal Development
in cooperation with
U.S. Department of Transportation
Federal Highway Administration

Mileage as of February 10, 2013
Map prepared October 09, 2013

SCALE 1:31,680

0.5 0 0.5 1 1.5 2
Miles
0.5 0 0.5 1 1.5 2
Kilometers

HIGHWAYS
- INTERSTATE
- U.S. ROUTE
- STATE ROUTE
- CLASS 1
- CLASS 2
- CLASS 3
- CLASS 4
- LEGAL TRAIL

- INTERSTATE OR DIVIDED HIGHWAY
- STATE - HARD SURFACE OR PAVED
- TOWN - HARD SURFACE OR PAVED
- GRAVEL
- SOIL OR GRADED AND DRAINED EARTH
- UNIMPROVED OR PRIMITIVE
- IMPASSABLE OR UNTRAVELED
- LEGAL TRAIL
- DISCONTINUED
- HIGHWAY CLASS CHANGE
- RAILROAD
- INACTIVE RAILROAD
- NFR NATIONAL FOREST ROAD
- SFH STATE FOREST HIGHWAY
- P PARK AND RIDE

- PUBLIC LAND - GREEN MOUNTAIN NATIONAL FOREST
- PUBLIC LAND - STATE/MUNICIPAL

POLITICAL SUBDIVISIONS
- STATE BOUNDARY
- COUNTY BOUNDARY
- TOWN BOUNDARY
- VILLAGE BOUNDARY
- URBAN COMPACT BOUNDARY
- WATER BODY
- STREAM OR BROOK

BRIDGE OR CULVERT
- BRIDGE OR CULVERT GREATER THAN 20'
- BRIDGE OR CULVERT 6' - 20'
- B34 / C34 STATE BRIDGE OR CULVERT IDENTIFIER
- B34 / C34 TOWN BRIDGE OR CULVERT IDENTIFIER

FEDERAL CLASSIFICATION IDENTIFIER
- FAU URBAN ARTERIAL OR COLLECTOR
- MA MINOR ARTERIAL
- MJC MAJOR COLLECTOR
- MNC MINOR COLLECTOR
- PA PRINCIPAL ARTERIAL

DISCLAIMER:
The untravelled highways (laid-out town highways), discontinued highways, and legal trails hereon are those of which the Agency of Transportation has record; others may exist.

Highway and bridge data by the Agency of Transportation. All other data from the Vermont Center for Geographic Information. Only named streams are shown.

Vermont State Plane Coordinate System
North American Datum of 1983
SPCS_Zone_Identifier: 4400
Geodetic Reference System 80
4,000-meter grid, Easting - Northing

420,000 424,000 428,000 432,000 436,000 440,000 444,000
180,000 175,000 172,000 168,000

For more information contact: Vermont Agency of Transportation, Division of Policy, Planning & Intermodal Development - Mapping Unit, 1 National Life Drive, Montpelier, VT 05633-5001 Telephone: 802-828-2600.

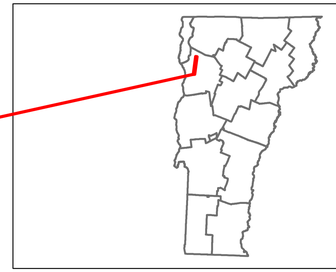
This map was funded in part through grants from the Federal Highway Administration, U.S. Department of Transportation. The representation of the authors expressed herein do not necessarily state or reflect those of the U. S. Department of Transportation.

Route Log Progress Chart

DRAFT

Please Note: Errors and Omissions May Exist.
Contact the VTrans Mapping Unit with questions or concerns.

DISTRICT	TOWN	ROUTE
5	COLCHESTER	US-7



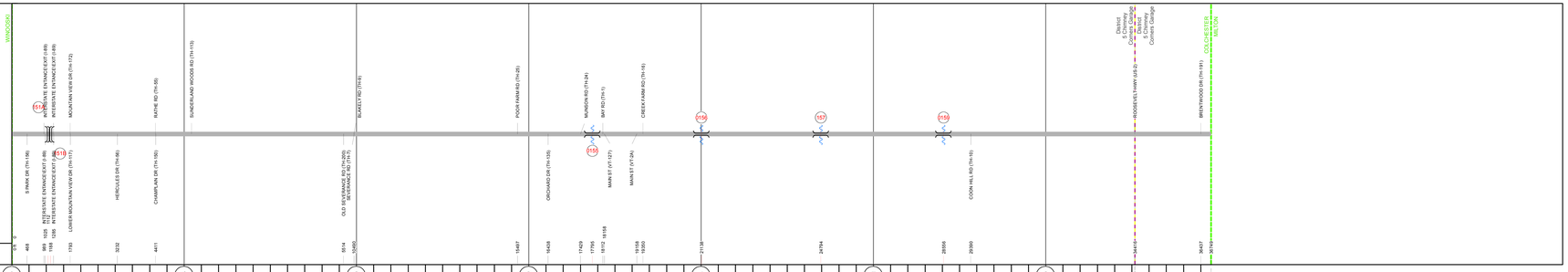
Base Map

1 in = 0.5 miles

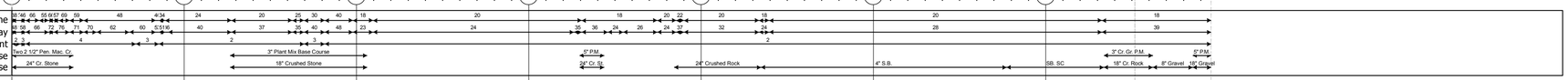
Stick Diagram

Primary Structures
Secondary Structures
Stations (Feet)
Railroad Crossings
Divided State Highway
State Highway
Divided Class 1 Town Highway
Class 1 Town Highway
Town Boundary
District Boundaries
State/Town Highway Change
Divided Highway Limits
Ghost Section Boundary
Streams

Scale:1in = 2000 FEET



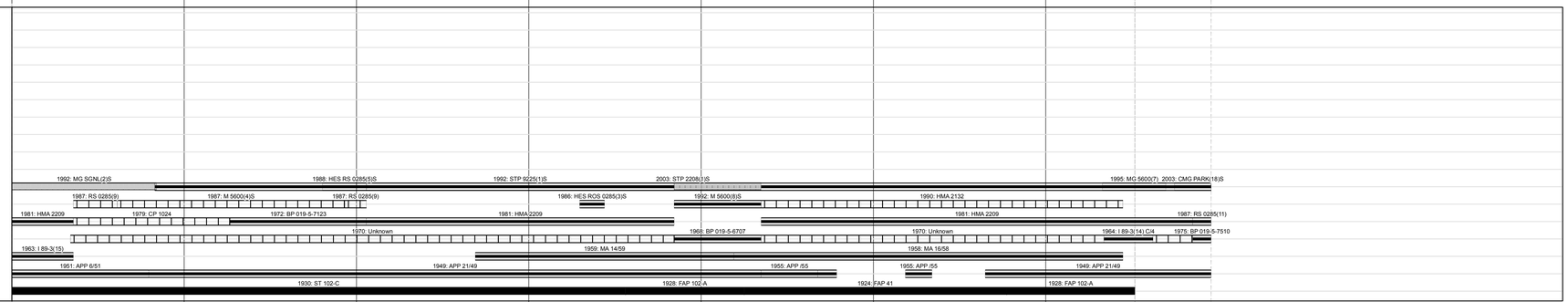
Road Widths



Curves

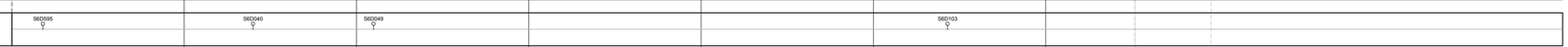
Grades

Historic Projects

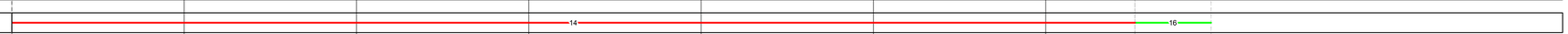


Maintenance Garage

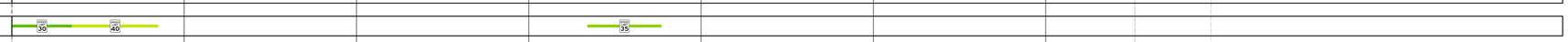
Traffic Counters



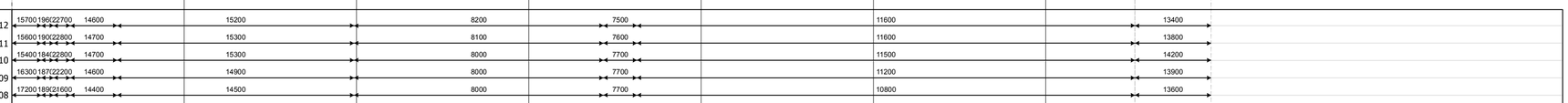
Functional Class



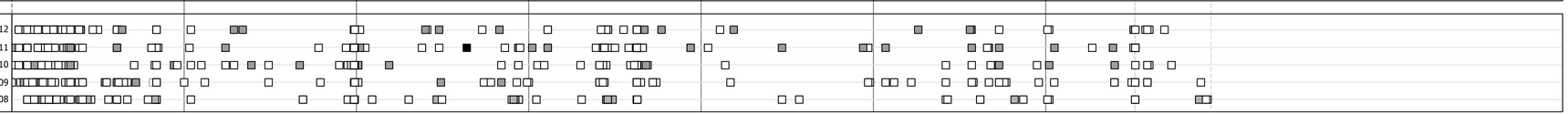
Speed Zone



AADT Counts



Crash Locations



DESCRIPTION BLOCK

Bridge 151A:
Stringer/multi-beam or girder - 1963
Structure No. 200089074S04052
Length: 152'
Height: 0.0'
Weight Limit: 0
Facility Carried: I 00089 ML
Bridge Type: 3-SP ROLLED BEAM
Features Intersected: I 89 OVER U.S.7

Bridge 151B:
Stringer/multi-beam or girder - 1963
Structure No. 200089074N04052
Length: 152'
Height: 0.0'
Weight Limit: 0
Facility Carried: I 00089 ML
Bridge Type: 3-SP ROLLED BEAM
Features Intersected: I 89 OVER U.S.7

Culvert 155:
Culvert - 1929
Structure No. 300285015504051
Length: 20'
Under Clearance: 20.0'
Facility Carried: US7
Bridge Type: R. C. BOX CULVERT
Features Intersected: INDIAN BROOK
Maintenance: State

Culvert 156:
Culvert - 1968
Structure No. 300285015604051
Length: 9'
Under Clearance: 10.0'
Facility Carried: US7
Bridge Type: MULTI PLATE PIPE
Features Intersected: POND BROOK
Maintenance: State

Bridge 157:
Tee Beam - 1924
Structure No. 200285015704052
Length: 34'
Width: 31.8'
Facility Carried: US 00007 ML
Bridge Type: T BM WIDEN W ROLL BM
Features Intersected: MALLETTS CREEK
Surface: Bituminous
Maintenance/Ownership: State

Bridge 159:
Slab - 1924
Structure No. 300285015904051
Length: 15'
Width: 30.0'
Under Clearance: 4.0'
Facility Carried: US7
Bridge Type: CONCRETE SLAB
Features Intersected: ALLEN BROOK
Surface: Bituminous
Maintenance: State

Historic Projects

Retreatment
Resurface
Unknown
Bituminous Mix
Skinny Mix
Bituminous Seal
Bituminous Concrete
Bituminous Macadam
Cold Plane and Bituminous Concrete
Concrete
Gravel
Surface Treated Gravel
Plant Mix
Reclaimed Base and Bituminous Concrete

Functional Class

1 7 12 17
2 8 14 19
6 11 16

Speed Zones

25 30 35 40 45 50 55 60 65

Curves

curve left
curve right

Grades

grade up
grade down

Road Widths

(ft)

Traffic Counters

(counter ID)

AADT

(count)

Crash Locations

Fatal
Injury
Property Damage Only
Unknown Crash Type

Mileage by Functional Class By Sheet

5600	14 - Urban - Principal Arterial - Other	6.518
5600	16 - Urban - Minor Arterial	0.442

Total Mileage: 6.960 mi

Mileage by Town By Sheet

COLCHESTER - U007-0405	6.96 of 6.96

Total Mileage: 6.96 mi

DISTRICT	TOWN	Date: 11/15/13	ROUTE
5	COLCHESTER	1 of 1 TWN mileage: 0.0 to 6.96	US-7 ETE mileage: 135.633 to 142.593

For More Information Contact - Vermont Agency of Transportation, Policy, Planning and Intermodal Development Division - Mapping Unit, 1 National Life Drive, Montpelier, VT 05633-5001 Telephone: 802-828-2600.