Observations about Adding Ancient Roads to the VTrans Road Centerline Data Layer

S.E. Moulton, Mapping Unit, Vermont Agency of Transportation (VTrans)
Montpelier, Vermont -- June 2010

Introduction

In response to Act 178 of 2006 (Unidentified Corridors)[1], the VTrans Mapping Unit was presented with the challenge of mapping the additions of Class 4 town highways and legal trails using information provided from towns and any ancillary data that was available. In most cases, a rudimentary sketch map accompanied the volumes of deeds, surveys, old maps, and other documents from the towns, providing a general idea of where to add the highway or trail. A sophisticated suite of tools was employed to make the town highway map update possible, leveraging imagery, geo-referencing old maps, and running traverses using COGO tools.

Overall Statistics

About 100 towns and villages in Vermont have submitted "ancient" roads to the Vermont Agency of Transportation for inclusion on the Town Highway Maps. During the past four years, several hundred miles of Class 3 and 4 town highways and Legal Trails have been added. Highways whose discontinuances were not previously recorded were also processed. Table 1 shows the breakdown of these additions.

Table 1

	Number of Highways or Legal Trails	Miles
Class 3	19	3.66
Class 4	213	148.44
Legal Trail	349	248.93 (mostly reconfirmations of VTrans records)
Discontinued	11	4.60

Technical Aspects of Mapping the Highways

Over 800 arcs[2] identified as "ancient roads" have been added to the road centerline data layer since 2006. One of the most difficult aspects of adding these highways was trying to determine their location. Many of them had not had significant traffic for many years, making them invisible on orthophotos.

Many descriptions and information of the roads supplied by towns included surveys. Almost 130 traverses were run based on the survey descriptions submitted. The traverses were plotted into our road centerline data layer using ArcMap's COGO tools.

Depending on the situation, other data sources were used for supplemental information in determining the location of a highway. These sources included:

Secretary of State lotting plans[3]
digital F.W. Beers Atlas maps[4]
digital U.S. Geological Survey geo-referenced quad sheets,

digital property information,
various vintages of orthophotos ranging from black & white versions from the 1990's to the NAIP 2009 imagery, and
1962-1963 aerial photos.

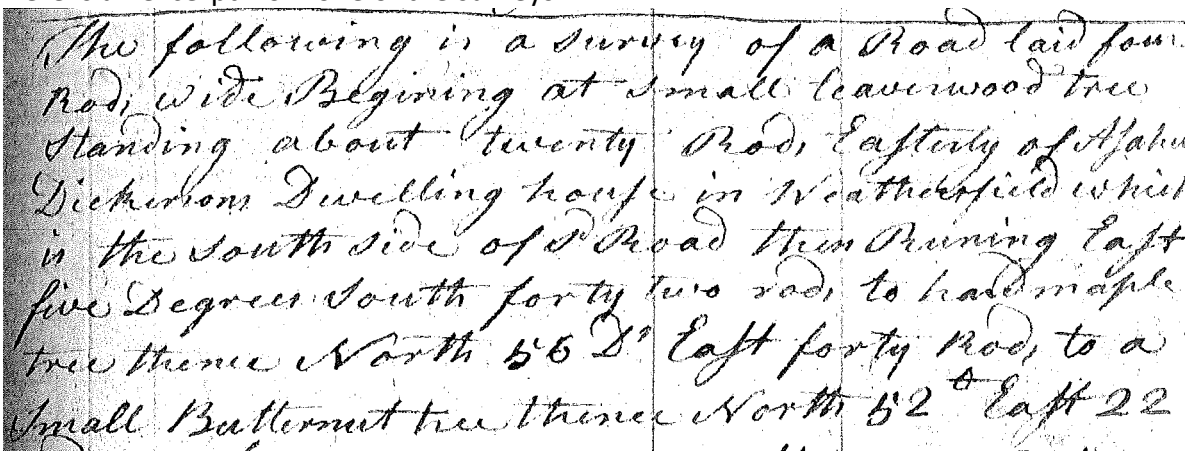
In order to make effective use of the lotting plans and Beers maps we used ArcMap's Georeferencing Tools.

Examples of Submitted Surveys

One of the earliest surveys submitted was dated 1784, from Putney's Volume 1. Typical of many of the surveys, the turning points were various types of trees, such as ash, beech, birch, hemlock, and maple. Here's an excerpt: N5ºE 10 rods to white ash, N10ºE 15 rods to hemlock, N16ºW 16 rods to maple, N13º 6 rods to white birch, N12ºE 14 rods to hemlock,
… and so forth.

Other surveys were from the 1790's and early 1800's. These surveys were recorded before the production of typewriters, and were hand-written using a different cursive style than is in use today. Of course, there was variation between the handwriting of different clerks. The handwriting styles also changed over time.

Here is an excerpt from one of the surveys:


The following is a survey of a Road laid four Rod, wide Begining at small leavenwood tree Standing about twenty Rod, Easterly of Asahel Dickersons Dwelling house in Weathersfield which is the south side of s^d Road then Running East five Degrees South forty two rod, to hard maple tree thence North 56 D^g East forty rod, to a small Butternut tree thence North 52 ^o East 22

The above reads as:
"The following is a survey of a Road laid four Rods wide Beginning at small leavenwood tree Standing about twenty Rods Easterly of Asahel Dickersons Dwelling house in Weathersfield which is the south side of S^d [said] Road then Running East five Degrees South forty two rods to hard maple tree thence North 56 D^g [degrees] East forty Rods to a Small Butternut tree thence North 52º East 22 …"

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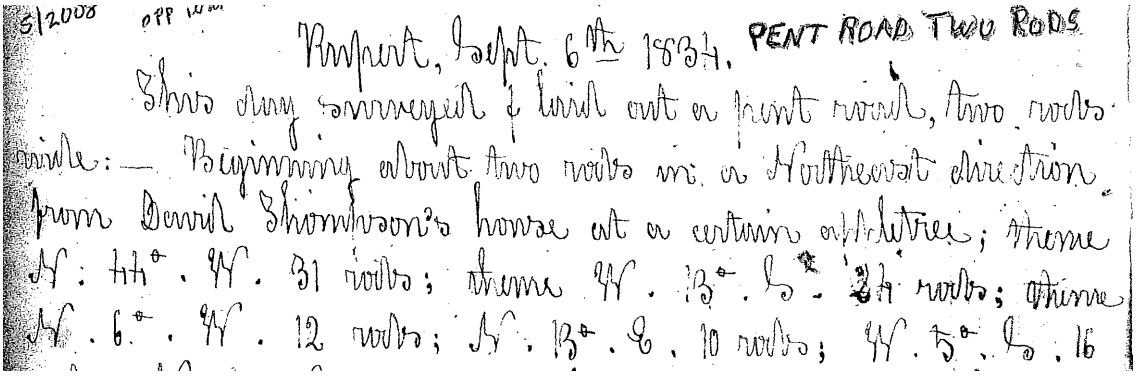
The following excerpt shows the distinctive writing of the Rupert town clerk:



The above reads as: "Rupert, Sept. 6th 1834. This day surveyed & laid out a pent road, two rods wide: __ Beginning about two rods in a Northeast direction from David Thompson's house at a certain appletree; thence N. 44º W. 31 rods; thence W. 13º S. 24 rods; thence N. 6º W. 12 rods; N. 13º E. 10 rods; W. 5º S. 16 …"

Several adaptations were needed in order to prepare the original survey traverse descriptions for use in ArcMap COGO. One adjustment was to convert the units of measurement from rods, chains, or links into meters (the data's unit of measurement).

Another was to convert certain bearing formats into the current standard. A common practice in the past was to allow the four compass directions (north, east, south, and west) to have equal weight as the primary reference. In comparison, the current practice is to base bearings off north or south references with east and west being secondary.

For example, if a course bears 10 degrees south of due west, the current practice is to identify the bearing as S 80º W. Many of the older surveys would have referred to that bearing as W 10º S. These East- or West-dominant bearings had to be adjusted in order to appropriately use them in ArcMap COGO. The conversions were necessary as E 20 N does not equal N 20 E.

Based on how the starting points of the surveys were written, we had to rely heavily on the town to translate the references into modern locations. Without an accurate origin, the plotting of the surveys would have been meaningless.

On a side note, it was interesting to notice a change in first names since about 200 years ago. Weathersfield had the most unusual first names (unusual in the context of 2010 first names). Some of these names included: Asa, Asahel, Elihu, Eliphalet, Gershom, Hilkiah, and Zenas.

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Documentation Standards

The Supreme Court decision commonly referred to as Austin vs. Middlesex[5] was a significant influence on our review of the documentation submitted by the towns for the addition of ancient roads. Fortunately, this decision came out in October 2009, before our review of the 2010 Mileage Certificates started in January 2010. The following is an excerpt from that decision:

> "The Town argues that the only legal requirements for establishing a road in 1833 were a recording of the survey and a certificate of opening, and that the certificate requirement was repealed by the Legislature in 2000. This argument, however, ignores the third and vital requirement that the road be formally "laid out" and claimed by the municipality. As our prior case law shows, the selectboard of the Town had to take this formal action. Young, 18 Vt. at 495; Patchin, 3 Vt. at 459. Moreover, the statutes in effect in 1833 regularly referred to "laying out" the road as a formal act by the selectboard. See, e.g., Laws of Vermont, 1824, Ch. LIII, No. 1, § 1 ("selectmen . . . shall have power . . . to lay out new highways"); id. No. 9, § 3 (highway "laid out" and "established" must be opened "within one year from the time it is established"). The provision requiring a duly recorded survey explicitly distinguishes that requirement from the road "lay out." Id., No. 1, § 1. ("[E]very highway or road which shall in future be laid out or opened, shall be actually surveyed . . . ."). Without proof that the road was officially "laid out," the Town lacks evidence that it substantially complied with the legal requirements in effect in 1833 and thus cannot successfully claim that T.H. 15 is a town highway." [5]

The influence the decision had was to increase our minimum standard for documentation. The towns had to show that the highways had been at least recorded and accepted by the towns through official means. For example, the only documentation some towns submitted showed the roads on F.W. Beers Atlas maps, U.S. Geological Survey maps, or National Geographic maps, but did not include any documentation that the towns had accepted these roads officially as town highways. The fact that there was no ancient documentation for the roads would not preclude the roads from being adopted through modern methods, as defined in Vermont Statutes Annotated, Title 19, Chapter 7 [6] , but these towns did not supply documentation to support that the roads had been add through modern means either. In these cases, the roads were not accepted as town highways as part of the 2010 Certificate process.

In all of the cases where the documentation did not meet our minimum standards, letters were sent to the towns describing the problem and asking the town for clarification. If we did not receive the documentation needed, the road in question was not added.

Classification

The default category assigned to most of the ancient roads was "Class 4", largely because of how the various classes of town highways are defined in statute[7] which states that all town highways that are not otherwise classified as Class 1, 2, or 3, are Class 4. Bennington was one exception in that it had ancient roads which were Class 3 highways. Other towns had ancient roads which were brought back and then were reclassified to Legal Trails.

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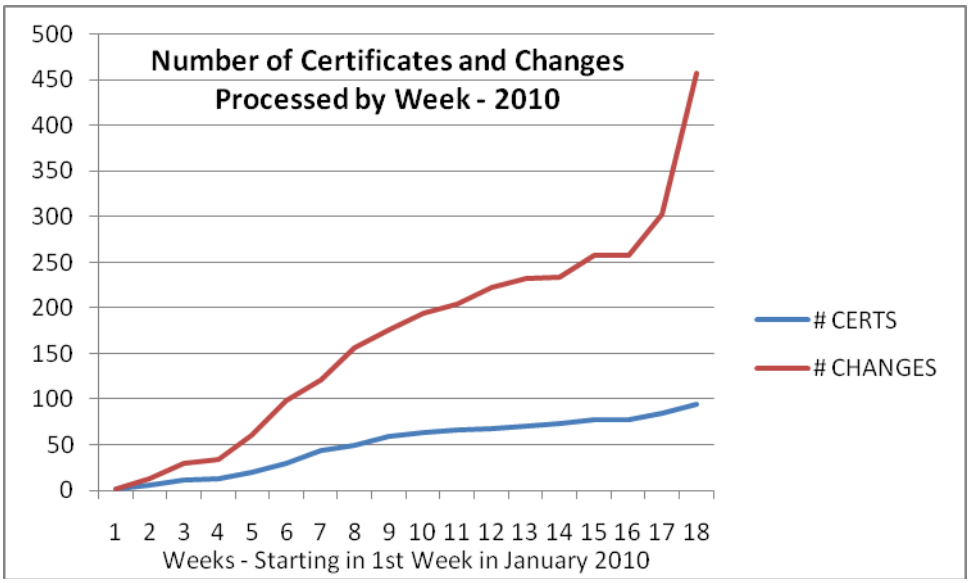
Processing Timeline and Volume

The Certificates of Highway Mileage were mailed to the towns during the first week in January 2010. According to statute[8], the Certificates are to be filed with the town clerk by February 10. The Mapping Unit requested the signed Certificates be returned to the Vermont Agency of Transportation by February 20. Before Act 178 was enacted in 2006, the average number of Certificates the Mapping Unit would receive was around 55 containing about 100 changes.

This year, because of the Unidentified Corridor deadline, we received more Certificates with many more ancient road additions than usual. In 2010, 94 Certificates containing over 450 changes were processed. These figures included the Certificates for which we did not accept any of the town's submitted changes. The Mapping Unit still had to review and process (accept or deny) each submitted change.

In previous years, the Certificate process was completed and the mileage figures forwarded to the VTrans Finance and Administration Division around the end of week 12 (the first week in April). This year the Certificate process was not closed until May 19, a full six weeks later.

Below is a graph showing the number of Certificates processed per week. The spike in the number of changes processed during weeks 17-18 was due to closing out the Certificates for which we had unresolved questions. Even when a change was not accepted, it was still counted.



Summary

Mapping the "ancient roads" in the Geographic Information System (GIS) has been a challenge and the Vermont Agency of Transportation Mapping Unit put significant effort into it.

References/Resources

1. An Act Relating to Unidentified Corridors. Act 178 of 2006. H 0701. 1 July 2006. Acts and Resolves of Vermont 2006. 27 May 2010. <http://www.leg.state.vt.us/docs/legdoc.cfm?URL=/docs/2006/acts/ACT178.htm>.

2. A highway or trail may consist of one or several arcs. An arc is a Geographic Information System (GIS) term and is defined as: "On a map, a shape defined by a connected series of unique x,y coordinate pairs. An arc may be straight or curved."

"Glossary | ArcGIS Resource Centers." *ArcGIS Resource Center*. ArcGIS, n.d. Web. 1 Jun 2010. <http://resources.arcgis.com/glossary/term/137>.

3. "Vermont State Archives: Maps Database." *Vermont State Archives and Records Administration (VSARA)*. Vermont Secretary of State, 16 Dec 2009. Web. 27 May 2010. <http://vermont-archives.org/lottingplans.asp>.

4. "Beers Atlas." *Old Maps*. Old Maps, 13 Jan 2010. Web. 27 May 2010. <http://www.old-maps.com/vermont/vt-beers.htm>.

5. Austin, Flanagan et al. v. Town of Middlesex, No. 2008-428. Vermont Supreme Court. Oct. 2009. <http://info.libraries.vermont.gov/supct/current/eo2008-428.html>

6. Vermont Statutes Annotated Title 19 Chapter 7. 27 May 2010. <http://www.leg.state.vt.us/statutes/sections.cfm?Title=19&Chapter=007>

7. Vermont Statutes Annotated Title 19 § 302. 27 May 2010. <http://www.leg.state.vt.us/statutes/sections.cfm?Title=19&Chapter=003>

8. Vermont Statutes Annotated Title 19 § 305, 27 May 2010 <http://www.leg.state.vt.us/statutes/fullsection.cfm?Title=19&Chapter=003&Section=00305>