

Technical Compendium to:

Identifying Colonial Roads in Southern New Jersey: An application of remote sensing, field and archival methods to document the locations, condition and routes of critical American Revolutionary War supply chains

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The application of geospatial techniques and modern mapping methods to historical data is facilitated in many ways by the development of modern Geographic Information Systems (GIS). There is a bit of a learning curve when one attempts to apply modern methods to historical data. In this technical compendium, we will explain methods that might be of use to historians and public policy officials in determining if a particular route has a well-established history and thus may be a candidate for historic preservation and protection via the National Register of Historic Places in the United States or by the appropriate state or regional government in other countries.

In our case we will utilize the historical document known as a Road Return as the source document for our geographic information. A road return is the formal document that is filed in most cases at the county courthouse to record the physical location of a given road and its rights of way. This document provides a physical description of the road in many cases using surveying metes and bounds – which are compass bearings and distances with references to artificial or natural monuments. They also generally include information on the width of the road rights of way and the dates of the survey and recording. An example of a road return from Burlington County, New Jersey is provided below. These hand written documents date from as early as the 1760's in Burlington County. Similar documents are available at county court houses or halls of records in many jurisdictions.

To fully tap into the wealth of information that these historic documents provide requires a significant amount of archival research. The first components of analysis are to identify candidate routes of interest and then explore the various historical and current names that have been applied to that route. Further archival research may allow the researcher to locate the appropriate historical record for additional review. These records may be located in the local county court house, regional archives or state archives. They may also be lost or poorly indexed. Once an appropriate record is located - it then has to be translated into modern geographical coordinates.

The first stage in the translation from a historic record to a GIS mappable route involves transcription of the historical record from longhand script into a typed record. This is not an insignificant activity as interpretation of ancient scripts in term of the shape of letter formation, ink quality, spelling and the penmanship of the scrivener presents unique and significant challenges to modern researchers. Further analysis of the document and some degree of photo

enhancement may help in accurate transcription of the historical document. Once a vetted and agreed to final transcription is established, then the bearings (compass bearings – NE,NW,SE,SW) and distances (chains and links) can be extracted and converted into modern measurements and coordinates. The author's transcription of the sample road return is also provided.

One key element in this analysis is the need to locate with some certainty a physical location that is identifiable in the field or from current maps by which one can tie the historic data to the current physical world. It is important to note that surveying and mapping in the historical period (prior to GPS) tied the particular survey coordinates to local landmarks and benchmarks. Today, with GPS technology, we have measurements that are absolute in terms of their location, but are subject to continental drift (In the case of New Jersey where our sample case is located, according to the US Geological Survey, the physical location of a given point is actually drifting Southwest by 1-2 centimeters per year).

Identifying a known landmark on which to locate the given route is of critical importance to this analysis. In some cases, the historical records reference a landmark that may well be unidentifiable 200 to 300 years later – be that a tree or a wooden stake in the road or a fence post. Other landmarks may be of a long-lasting nature – such as stream bank (while definitive, may meander over time), a bridge or stone. Further, the rather unique series of bends that are created by a given route may allow the researcher to fine tune the particular mapping of a given route to align with a segment of the existing road network. In the end, to perform this analysis, one needs to locate a starting or ending point for each road route and tie the road return to a physical location in the current geography.

We also may have to correct for the drift in the Magnetic North Pole, as the location of this pole affects where a magnetic compass points. If a surveyor was working with the same instrument at the exact same location but 20 years apart – one would likely find variation in the bearings found as compared to those recorded in the historical documents. There are historical estimates of the location of the Magnetic North Pole and the proper correction factors for a given time period at a given location. In the end, there are a number of sources of variation that may contribute to some error in our recreations of these historic routes.

Again, it is important to note that all surveying from the 15th Century to the Late-20th Century relied on local landmarks and benchmarks. Not until the advent of Global Positioning Systems have we had a true international reference for long distance measurement. We literally did not know how far Paris was from New York in an accurate way – and now we only know that actual distance at a given point in time – as both cities are continually moving apart due to continental drift and expansion of the Mid-Atlantic Ridge.

Historic survey data is generally provided in magnetic compass bearings – North or South with East and West deviations. These can be converted into a 360 Degree Compass bearing or azimuth which is measured in a clockwise direction with North as 0 Degrees. As follows based on an example from each of the four quadrants of the compass:

North 36 Degrees East = 0 Degrees + 36 Degrees East = 36 Degrees

North 36 Degrees West = 360 Degrees – 36 Degrees West = 324 Degrees

South 36 Degrees East = 180 Degrees – 36 Degrees East = 144 Degrees

South 36 Degrees West = 180 Degrees + 36 Degrees West = 216 Degrees

We include below a photograph of the dial of a Mid 18th Century Surveyors compass that was used in New Jersey. The inner ring of the dial shows the typical markings that would relate to the generally recorded surveying coordinates.



Similarly, we convert distances typically measured in chains (66 feet) and links (1/100th of a chain). These are converted into distance in meters. Once the coordinates are converted into modern distances and bearings, we then need to locate a definitive reference point along the route is identified – this could be at either end or at some point along the route. This point is then used to anchor the horizontal position of the route.

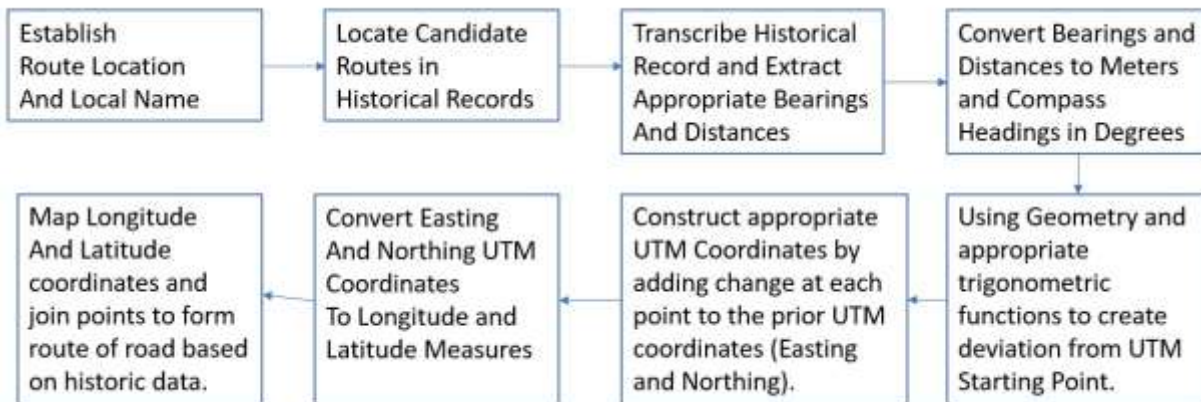
Once we have located a physical starting point for a given route, we then can calculate the physical locations of various turning points on the route. Converting the bearings and distance measures into 360-degree bearings and meters then allows us to utilize simple geometry to

recreate the route. These positions will be in current geographic locations (modern longitude and latitude) and will relate to existing georeferenced maps. The authors use a standard of WGS1984 for all of their historic map georeferencing and route conversions.

By identifying the likely landmark to start the route, one then can plot the points using Universal Transvers Mercator and geometry to step from one point to another and thus sequentially complete the route. A sample spreadsheet is provided that perform these calculations for the specimen road return shown below.

Once the UTM coordinates are created, one can then convert them into Longitude and Latitude locations for each point. One then can use various GIS tools to create a linked route from that series of points. The use of UTM coordinates will allow us to approximate well the general location of a historic route. Further analysis may be needed if one wishes to examine the precise location of a given segment of a given route. A GIS map is provided below that maps the route of the sample route over existing USGS base maps

The authors welcome requests to discuss these methods further via email. Please feel free to contact jonathan.peters@csi.cuny.edu if you have any specific questions or conversion issues.



345
Road in Washington } When application hath been made to the superior
Court of common pleas of the county of Burlington
by a due & lawful inhabitants of the county of Washing-
ton in the term of May last last praying the said court
to appoint surveyors of the Highway, to lay out a public road
of two rods wide in the township of Washington to & from
a state on the southern side of the said leading from
New Bridge to Abbea near a bridge over Deep Run and
from thence the most eligible west & southern course to
the middle of Abbea creek where a bridge known by the name
of the Log Cabin high bridge formerly crossed the same said
creek being the line between the County of Burlington &
Hancocock And whereas the said court in the term aforesaid
did nominate & appoint Daniel Cromer & Eldon Small
wood of Washington, Samuel Jones & Joseph Dun of
Southampton, Eli Mathis and Esab Cromer of Little
Egg Harbour, surveyors of the Highway, of the county of
Burlington to meet at Abbea on work at ten o'clock
in the forenoon of Friday the twentieth day of June
for the purpose of laying out & said road And whereas three
of the said surveyors, to wit, Eldon Small wood, Samuel
Jones & Joseph Dun did meet at the time & place aforesaid
but not being a legal Quorum to transact business did
with the consent, and at the request of the applicants
they & there attending adjourn the further proceedings
thereon until Friday the second day of September instant
giving the absent surveyors written notice of thereof and
whereas on the subscribers four of the said surveyors of
the Highway appointed as aforesaid being just equi-
table & convenient proceeded to view the ground
where the road was proposed to be laid out, and
the allegations of the parties thereon and after due delibera-
tion thereon had do hereby lay out a public road of
two rods wide as follows, viz. Beginning at a state on
the east leading from New Bridge to Abbea, & by

Burlington County Road Return

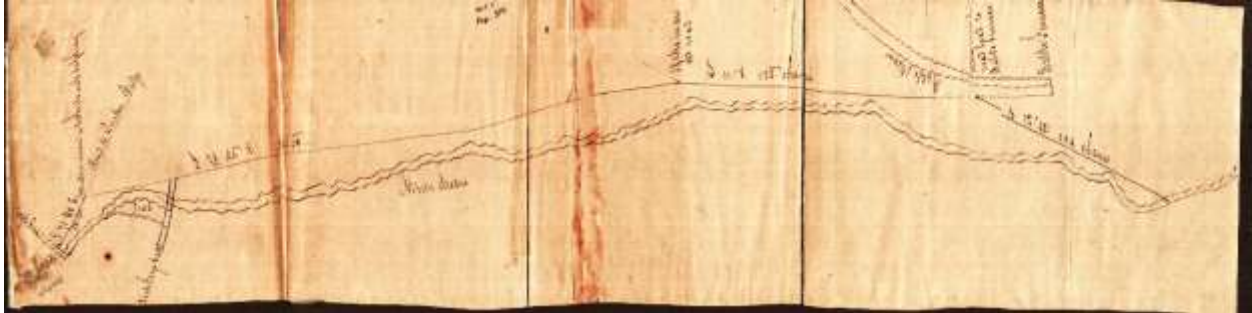
"Road in Washington" Road Return Book B - Page 346

346
 Run from a bridge on said road 500 Deep Run in the
 Township of Washington on running from thence on
 South Sixty one degree & forty minutes East twenty
 two chains & twenty links to a stake near a lot the
 splitting marked thence 2^d South twenty two degrees &
 forty five minutes East three hundred & twenty five
 & fifty links to a stake in an old road thence running
 nearly along said old road 3^d South eleven degrees
 East one hundred & thirty five chains to a stake in
 said thence 4th South twelve degrees West one hundred
 & thirty chains to the middle of extra creek where
 bridge formerly crossed the 1st deep called the Lower high
 bridge in the Township of Washington which road we
 shall lay out two rods wide that is to say one rod wide
 on each side of the foregoing line, and order the same
 cleared out made fit for public use on or before the first
 day of September next ensuing the date hereof in
 witness whereof we have hereunto set our hands this
 second day of September eighteen hundred & fourteen
 A. D. 1814
 Daniel Brewer of Washington
 Eldon Smallwood - Town

NOTE: For Map see File # R-8 346

Burlington County Road Return Period Map

For "Road in Washington" Road Return Book B – Pages 345-346. Map saved in separate file.



Transcription of 1814 Burlington County Road Return

“Road in Washington” Road Return Book B – Pages 345 and 346

Whereas application hath been made to the interim? court of common pleas of the of Burlington by above six Freeholders inhabitants of the county of Burlington in the term of May last pas praying the said court to appoint surveyors of the Highways to lay out a public road of two rods wide in the township of Washington to begin at a stated on the southerly side of the road leading from Quaker Bridge to Atsion near a bridge over Deep run and from thence the most eligible route a southerly course to the middle of Atsion creek where a bridge known by the name of the Lower high bridge formerly crossed the same said creek being the line between the county of Burlington & Gloucester And whereas the said court in the term afore did nominate and appoint Daniel Cramer & Weldon Smallwood of Washington, Samuel Homes & Joseph Burr of Southhampton, Eli Mathis and Caleb Cramer of Little Egg harbour surveyors of the Highways of the county of Burlington to meet at Atsion Iron Works at ten oclock in the forenoon of Friday the seventeenth day of June for the purpose of laying out said road And whereas three of the said surveyors to wit, Weldon, Smallwood, Samuel Haines & Joseph Burr did meet at the time & place ascribed but not being a legal quorum to transact business did with the consent and at the request of the Applicants then & there attending adjourned the further proceedings thereon until Friday the second day of September instant giving the absent surveyors written notice of there of auo? Whereas we the subscribers four of the said surveyors of the Highways appoints as fore....

Beginning at a stake in the road leading from Quaker Bridge to Atsion fifty links from a bridge on said road over Deep run in the township of Washington and running from thence 1st South seventy one degrees & forty minutes east twenty two chains & twenty links to a stake near a white oak sapling marked thence 2nd South twenty two degrees & forty five minutes East three hundred and twenty five ch. & fifty links to a stake in an old road thence running nearly along said old road 3rd South eleven degrees East one hundred & thirty five chains to a stake in said? Road thence 4th South twelve degrees west one hundred and three chains to the middle of a Atsion Creek where a bridge formerly crossed the said creek called the Lower high bridge in the township of Washington which said road we do lay out two rods wide that is to say one road on each side of the foregoing line and order the same cleared out made fit for public use on or before the first day of September next ensuring the date here of where of we have Our hands this second day of September eighteen hundred & fourteen

Caleb Cramer } Little

David Cramer } Washington

Eli Mather } Egg Harbour

Weldon Smallwood} Tow

Transcribed – Jonathan Peters – June 5, 2022

