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THE COMPASS STONES OF "FREDERICK TOWN"

It may be 99 degrees in the shade right now, but there was snow on the ground back in February when our **M.S.S. Appalachian Chapter**, **NGS** and **Spectra-Precision** teamed up for an all-volunteer GPS Survey of the puzzling, century-old "**Meridian Stones**" at Court House Square in Frederick (right).

30-year Maryland surveyor **Wayne Twigg** of M.S.S. Appalachian Chapter, who organized the effort, wrote a fine article about it, beginning on page 16.



OUR 33rd ANNUAL CONVENTION IS "COMIN' ROUND THE MOUNTAIN"

Join us for an old-time **steam train ride** through the beautiful Blue Ridge Mountains of western Maryland, never more scenic than in early autumn. It's all part of our **33rd Annual M.S.S. Convention**, to be held this year with MSPE at **Rocky Gap**, on the historic "Cumberland Trail," **September 16 through 19, 1999**. Fall Conference information starts on page 22.



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AND MORE!

THE COMPASS MERIDIAN STONES OF FREDERICK, MARYLAND

By: *R. Wayne Twigg*

"THE PAST IS PROLOGUE"

This motto of the **National Archives of the United States** has always been meaningful to our profession of land surveying. We surveyors begin with history, do our small part and then leave our work for future generations. We routinely straddle the present with one leg in the past and the other in the future, especially in this era of satellite technology. As a consequence, we tend to take the importance of what we do for granted, never knowing its significance.

But **Lawrence Brengle** and **Thomas Woodrow** knew. Lawrence Brengle, early commissioner and surveyor, laid out the incorporated portion of "Frederick Town," Maryland in 1817 and became its first mayor in 1820. During his layout work, Brengle discovered that the compass and measuring rod he was using were slightly inaccurate. Thomas Woodrow, County Surveyor at the time, was the "expert" called in to determine why the measurements weren't checking. (The exchange of information between these two professionals makes for some very interesting reading. Woodrow's letter of report is especially so.) These two men helped set the stage for others in Frederick County by establishing primary reference monuments and survey baselines so fundamental to successful future development.

THE OLD MERIDIAN STONES "RE-DISCOVERED"

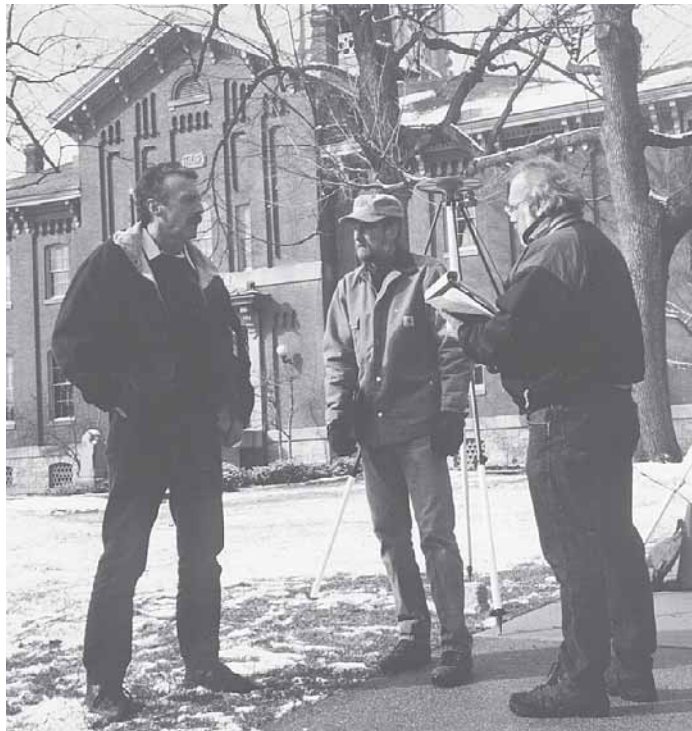
The two old stones were obviously not parallel with the public street, as property markers likely would be,

which is what caught my attention the first time. They weren't "ordinary" either, each being six-inch-square granite with a sealed-in copper rod. The exposed top four inches had a finished surface. "Non-magnetic, now that's significant," I thought. "No one uses that anymore. No one even *makes* these type of markers any more. The north one seems solid, but that south one looks as if it was hit by something . . . Hmmm, north, south. Maybe it's a **True North Baseline!**" A late visit on a clear evening, with a flashlight on the north stone and a plumb bob string over the south stone, and there was **Polaris** as pretty as you please, just above a rooftop over the north stone.

Later, referring to **Jim Demma's** original "**Blue Book**" *Annotated Code of Maryland Relating to Land Surveyors*, I found (on the first page) Article 25, Sections 123-127, the mandate to all County Commissioners to install a True Meridian baseline consisting of two substantial stone pillars,

marked with latitude and longitude. Every surveyor working in any given Maryland county was (and still is, technically) required to annually check the variation of his compass at the county baseline and record it in the Registry Book of the Clerk of Court, or be *fined*.

Those two stone markers today sit in the front lawn of Frederick City Hall, the old County Courthouse. They *have* to be the meridian baseline, I thought, perhaps installed as long ago as 1870. If they are what they *seem* to be (the pillars described in the Annotated Code), then these two forgotten and ignored old stones are actually the first official GIS monuments in Frederick County!



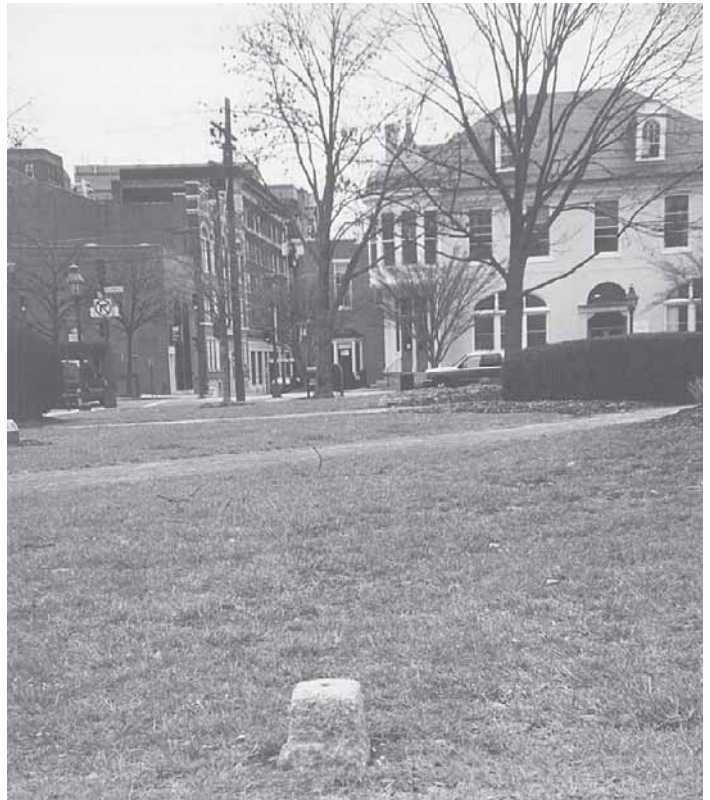
Roy Anderson of NGS (left), **Jim Rahochik** of Loiederman (center) and **Rob Ferrar** of Spectra-Precision (right) gather GPS data on century-old "North Magnetic" in front of the 1862 Courthouse at Frederick, Maryland, February 1999.



“South Magnetic,” shown here, and its twin “North Magnetic” were set in 1896 by the Maryland Geological Survey, using the most sophisticated equipment of their era. Similar compass monuments were also installed in Wicomico County that same year, and were later “rediscovered” and documented by long-time M.S.S. stalwart Dick Cooper of Salisbury.

Thinking about GPS-ing the stones, I searched the NGS database for horizontal and vertical reference monuments in the area. There among the listings were *“North Magnetic”* and *“South Magnetic,”* second-order benchmarks whose descriptions exactly fit the stones! Years ago, I had asked former City Surveyor **Harry Sanders** about them. He replied that all he knew was that they were USC&GS benchmarks, and he used them. The present City Surveyor **Bill Lankford** does too. But the names intrigued me: “North and South Magnetic.” Why call them Magnetic, unless the government survey crew *knew* their purpose? So, like many others before me seeking answers, I called my friend, **Roy Anderson** of **National Geodetic Survey** and shared my theories about the stones. Roy came up with the *original* 1941 field notes of the USC&GS leveling party, and an astounding offer. Since they were Agency Benchmarks, why not GPS the stones with *NGS participation*?

It was an offer we couldn’t believe, much less refuse.



Although few surveyors come by these days to check their compasses, “North Magnetic” still faithfully awaits them, as it has for a century, at Court House Square in Frederick.

Using a copy of **Lawrence Brengle’s** original field notes, I discovered that “Courthouse Square” (now City Hall) is the southeast portion of Original Square No. 47. The bearings are referenced to the True Meridian. Assuming that the present-day streets roughly follow Brengle’s 1817 layout, and combining his courses with USC&GS’s Station Descriptions and a few rough field confirmations of my own, I plotted the stones. They aligned with north almost perfectly.

M.S.S. APPALACHIAN CHAPTER RESPONDS

At the next monthly meeting of **M.S.S. Appalachian Chapter**, these “discoveries” were laid out, and our members all agreed that it was a project worth pursuing. Several noteworthy chapter projects were already underway, but the group responded enthusiastically. (I’ve got to say here that, in my opinion, these Washington-Frederick County surveyors are among the finest professionals that a man can be associated with. Those who attend our meetings are the “cream of the crop.” I’m proud and privileged to have served them as a chapter officer for thirteen years).

Suggested phases of the project were discussed. GPS data would reestablish the mandated latitude and longitude on the still-solid “North Magnetic,” but the



Where surveyors of old once checked their compasses, **Bill Orsinger** of VIKA sets up a Seco 2-meter pole with NGS choke-ring antenna, over "North Magnetic" in Frederick.

other stone was loose and needed to be stabilized. A celestial observation would have to be performed in order to reset "South Magnetic" correctly. Polaris can still be seen from there, but unfortunately City Hall is today lit up like a Christmas tree during the night hours. There is too much foreground lighting at the stones to adequately see the star with a theodolite. Nearby (and intervisible) is **Baker Park**. We'd simply have to put a station there, and then transfer Astronomic North via a two-leg traverse to the stones.

Bill Orsinger of VIKA and I installed Station "Compass Ref" on a Saturday morning in Baker Park, according to NGS's "Installation Instructions for FENO Monuments." **Joe Walker** of Hagerstown donated the FENO, the ground plate and the driving rods. The City of Frederick's **Department of Public Works** donated an 8-inch PVC pipe, some sand and a screw-type PVC cleanout cover. The stamped FENO disc is 4 inches below ground level, set in compacted sand inside the 8-inch pipe. An 80-pound sack of concrete mix stabilized the outside. The grass was replaced and surplus dirt carried away.

ROY & ROB: NGS & GPS

Roy Anderson *did* call back. If the Chapter could come up with dual-frequency receivers, NGS would supply three 2-meter poles and choke-ring antennas. This type of antenna is specifically designed to minimize the effects of multipath. The 2-meter poles ensure consistent, reliable antenna heights. We would occupy USC&GS's "North Magnetic," our own "Compass Ref" and nearby NGS A-Order Station "Patrick." This would be supplemented with CORS data downloaded from Station "Gait" on a simultaneous Montgomery County NGS project. Also **Ed Carlson** of NGS would process the GPS observational data if it was supplied to him in raw and Rinex formats. The observations would have to be performed in two, 2-hour sessions whose starting times would be separated by four hours on two consecutive days. This would ensure a completely different satellite configuration. After considering several other dates, Roy decided on February 24th and 25th of this year.

Having had some experience with **Geodimeter/Geotracer's** GPS equipment (and their reputation for world-wide accuracy and reliability), I contacted **Rob Farrar** of **Spectra-Precision**. He is a man as enthusiastically in love with this profession as the rest of us. "Sounds like a great project, Wayne. I'll be there."

GPS-ING THE STONES

Roy delivered three 2-meter poles, three Ashtech choke-ring antennas and a battery-powered psychrometer for determining relative humidity. As for Rob, he was better than his word. Driving 4 hours (one-way), he appeared long before our scheduled starting time in order to distribute equipment and make sure the observers were familiar with it. He brought not three, but *four* dual-frequency **Geotracer Model 2204** receivers, a Geotracer choke-ring antenna and a **Seco** adjustable fixed-height pole. This meant that we could include *another* NGS station, First-Order "Strip," in our network.

At 9:00 a.m. on February 24th (Julian Day 055), **Gordon Conner**, who is another chapter officer, and **Matt Crouse** of **Conner Land Surveying** switched on "Compass Ref." **Bill Orsinger** of VIKA occupied "Patrick." The third receiver was placed on "Strip," which is in a protected place at Frederick Airport. I

observed from **“North Magnetic,”** while Rob coordinated between all stations. We stayed busy during the occupations by taking station rubbings, relative humidity and barometric pressure readings, completing Observation Log sheets and preparing Obstruction Diagrams (skyplots). Also, since **“Compass Ref”** was a new station, Gordon and Matt did a complete site diagram with measurements. Next day the sessions took place between 1:00 and 3:00 p.m.

Our activities attracted quite a crowd. Chapter chairman **Bryan Hale** (Washington County Engineering Department), M.S.S. past-president **Bob Gauss** (R. F. Gauss & Assoc.) and other chapter members stopped by to take pictures and show support. **Marc Cheves**, editor of **Professional Surveyor Magazine** (always the professional-on-the-alert), visited us as well. The project was front-page news in the **Frederick News-Post**, thanks to Business Editor **Ed Waters, Jr.**, and **NBC Channel 25** news reporter **Brad Puffer** conducted an interview during which **Mr. Kenn Starr** and **Mr. Ken Hammond** of the **Frederick County Historical Society** participated. It aired several times on local TV. Reporter Brad Puffer even included a picture of **Lawrence Brengle**, the surveyor and mayor who laid out the Squares of old Frederick Town so long ago.



FENO monument “Compass Ref” was set by M.S.S. Appalachian Chapter in Baker Park, 2-blocks west of the Meridian Stones, for better “GPS-ing” and Polaris observations than could be obtained at the stones themselves.

That evening Rob and I downloaded the data from the two sessions. Preliminary processing revealed good-looking plots with no apparent glitches. Several disks of observational data in raw and Rinx formats were delivered to NGS headquarters (along with their borrowed equipment), soon after.

NOT WITHOUT PROBLEMS

It’s always interesting to review the problems and events that affect a project. Most of the time, professional creativity can solve them. Hard-working optimists can “turn lemons into lemonade.”

Roy had hoped to occupy both of the stones, but a vehicle accident had disturbed (perhaps broken) **“South Magnetic.”** We plan to restore and reset the monument, which presents a perfect opportunity to place a bronze historical marker at the stone. In addition to explaining to the public the purpose of the stones, it will list the Latitude and Longitude. We’ll be *fulfilling* the original Annotated Code instructions by listing the geographic coordinates of the stones.

The excessive amount of night lighting at City Hall will force us to conduct our Polaris observation at nearby Baker Park. However, by installing a good recoverable monument there and including it in the GPS sessions, the chapter can offer to the City of Frederick (and all future surveyors) not one but *two* GIS monuments for permanent use.

“North Magnetic” is situated in what can only be considered a “GPS-unfriendly” area, surrounded by



“The monuments are in the sky.” Rob Ferrar (left) of Spectra-Precision discusses GPS parameters with Matt Crouse (partially hidden) and Gordon Connor (right, foreground) near Station “Compass Ref” at Baker Park in Frederick.



Maryland surveyor (and story author) **Wayne Twigg** (left) of M.S.S. Appalachian Chapter sets up former County Surveyor **Harry Sanders'** antique K&E transit to check magnetic north between the two stones, using the old instrument's built-in compass.

buildings and trees. But geodesist Anderson (an incurable optimist) said "Put that antenna on there. You'd be amazed at what we can do." So up it went, and Roy was right as usual.

On Day 2, a connection on one of NGS's cables appeared faulty on hookup. That meant we couldn't use the choke-ring antenna with which it was paired. Rob Farrar came to the rescue: he substituted a Geotracer antenna with geodetic ground plane.

WE'RE CATCHING ON!

Our efforts so far have proceeded well. **Mayor Grimes** and other government officials are very

Excerpts from the
ANNOTATED CODE OF MARYLAND, 1870
COMPASS MERIDIAN STONES
(Note: This old law is still in effect!)

ARTICLE 25

Section 123. How established.

*It shall be lawful for the county commissioners of each county in the State . . . to cause to be erected at some public spot adjacent to the courthouse of each county **two good and substantial stone pillars**, one hundred feet distant apart, the one from the other, and upon the same true meridian line. And upon the summit of one of the said pillars there shall be placed a distinctly visible needle point; and upon the summit of the other there shall be erected a hair sight, in such a manner that a straight line passing through the centre thereof and continued until the same shall strike the centre of the needle point upon the other, shall be in and upon the line of the true meridian running north and south, and they shall enclose and protect the same properly; the said pillars and enclosures to be subject to the custody of the county clerk, to be free to the access of any surveyor of lands or civil engineer residing in said county, or engaged in surveying therein, for the purpose of testing the variation of the compass for the time being and to cause the said meridian line to be verified at any time when required so to do by order of the circuit court for the said county; and furthermore, it shall be lawful for the said county commissioners to cause to be determined the accurate latitude and longitude of the pillars aforesaid, reckoning the latter from the meridian of Washington, and to have the same marked distinctly and legibly in degrees, minutes, seconds and parts of seconds, on one of the pillars aforesaid.*

Section 124. Adoption by surveyors; noting variations from.

*It shall be the **duty of each and every surveyor** surveying land in any county of this State to **test and note** the actual variation of his compass from the aforesaid true meridian line **at least once in every year**, and to deposit a copy of the same, with the date and time of such test, accompanying the same with an affidavit verifying its correctness, with the clerk of the county in which he may reside, to be by him recorded in a book kept for that purpose, and every surveyor neglecting or refusing to comply with the provisions of this section shall be liable to a penalty of **fifty dollars** . . .*

supportive. Late last fall a few preliminary paragraphs explaining the presence and function of the stones were delivered in the Chapter's name to the Frederick County Historical Society and Council on Tourism. They are already including the story of the Compass Meridian Stones in their "Walking Tours" of the city. The profession of land surveying is beginning to get some well deserved public attention here. And wait 'til they see what we do next! We're going to use **Ralph Donnelly's** superb replica of **Mason and Dixon's portable observatory** to block out the city lights and shoot Polaris!

MORE TO COME...

In the next article, we'll delve into *more history*, discuss the use of **Mason & Dixon's replica observatory**, answer the question *why Polaris?*, lay out the calculations and report on *resetting "South Magnetic."*

R. Wayne Twigg, a practicing land surveyor in Maryland for 30 years, serves as Secretary of **M.S.S. Appalachian Chapter** and volunteers his time as chairman of the chapter's **Compass Meridian Stone Project**.

THOMAS WOODROW'S LETTER OF REPORT — 1820

Mr. Brengle will observe that in general our measurements have a little exceeded his in the number of feet or inches: — for instance, the whole distance along the west side of Love Lane to Patrick Street in 1817 was 3148 feet 2 inches; — by our measurement over the same ground, the whole distance is 3153 feet 6 inches. — We have endeavored, throughout the whole work to take the horizontal measure as accurately as we could. — The 12 foot pole which was used in the survey of 1817 was found to be about 1/4 of an inch longer than the pole used by us, which will reasonably account for the small difference between the measurements.

*The pole used by us was compared with an accurate scale in the possession of Major Mantz, and found to agree exactly therewith. — The distance from the center of Patrick Street, where it intersects Bentz's first line, to the end of said line, near the N.E. corner of Ramsberg's Mill, by the survey of 1817 was 831 feet 2 inches — By the late measurement over the same ground the distance is 851 feet 2 ½ inches, making a difference of about 20 feet. — This line was measured twice over with great care, and found each time to be exactly the same distance. — Mr. Brengle will particularly observe, that the course of the northern boundary of the town, which he has stated as S. 85 1/4 E. and N. 85 1/4 W. is here called S. 85 ½ E. and N. 85 ½ W. — making a difference of 1/4 of a degree, probably caused in part by a small disagreement in the different instruments, and in part by what is called the **diurnal variation of the needle**; — a variation arising from the heat of the solar rays, combined with the state of the atmosphere — In the late survey we had occasion to verify, by experiment, the existence of the diurnal variation of the needle. — On fixing a flag staff at each end of Bentz's 2nd line, as the same was located in 1817, and taking a station between the flags, from which each of them could be distinctly seen, the course, taken in the morning when the sun was about half an hour high, appeared by the compass to bear N. 17°10' E. — the same thing was afterwards done in the evening when the sun was about two hours high; — the bearing then appeared to be about N. 17° 20' E. — I have taken the difference between them, and stated the course at N. 17 1/4 E. — However there is reason to believe that the bearing taken in the morning is the most accurate (the needle being probably less affected) and that the true bearing at this time is something less than N. 17 1/4 E. — The course also of Patrick Street, stated at S. 85 1/4 E. and N. 85 1/4 W. seems to be at this time S. 85 1/2 E. and N. 85 1/2 W. — All the above lines however are exactly run on the ground as they were located in 1817. — These remarks respecting the above mentioned lines bearing S. 85 ½ E. and N. 85 ½ W. — will also apply to other lines of the town, that are intended to be parallel therewith. — All the side lines of the range of lots lying on the West side of Bentz's 2nd line and extending from 2nd Street to 4th Street, are stated at S. 85 ½ E. and N. 85 ½ W. in the foregoing field-notes; but it should be observed that they are exactly parallel on the ground with the line at the Northern boundary of the Town, as surveyed in 1817, and ought to be so laid down on the plan of the town.*

Thomas Woodrow
August 21st 1820