

# COUNTY OF MONROE

## GEODETIC MONUMENT POSITIONING REQUIREMENTS

The County of Monroe requires this work to be performed by, or under the direction of and certified by a Professional Land Surveyor who is licensed and registered to practice in New York State.

### **MONUMENT GPS/GNSS POSITIONING REQUIREMENTS**

The horizontal datum shall be NAD 83 (2011), New York State Plane Coordinate System, Western Zone and the vertical datum shall be NAVD 88.

The NAD 83 (2011) geodetic position of the monument shall be determined by employing GPS/GNSS survey techniques.

GPS/GNSS surveys shall be static surveys performed by 15 minute minimum occupations with separate observations under differing satellite configurations. Adjustment shall be completed by a minimally constrained least squares adjustment. From the least squares adjustment the maximum allowable Network Horizontal Positional Accuracy (at two sigma, 95% confidence level) shall not exceed 0.02 feet or a precision of 1 part in 50,000 parts (1:50,000).

If site conditions at the monument location compromise the quality of direct GPS/GNSS observation of the monument position, conventional Theodolite or Total Station terrestrial (TPS) survey techniques shall be employed to position the monument from nearby locations that provide quality GPS/GNSS observation conditions. The alternate locations providing quality GPS/GNSS observation conditions shall be measured between and to the geodetic monument being positioned by fully traversing through all points, forming a closed loop traverse with an occupation of each point by the Theodolite or Total Station.

Conventional Theodolite or Total Station terrestrial (TPS) surveys shall be performed with either an Electronic Distance Measuring Instrument (EDM) (rated with an internal uncertainty of no more than 0.003 m and scale of no more than 2 parts-per-million (ppm)). The EDM distance measurements shall be corrected for both temperature and pressure as necessary. The angulation shall be performed with a directional theodolite or total station that has an internal least count of no more than 2 seconds. A minimum of two positions on the circle (both direct and reverse) and an EDM distance shall be taken along with each angle measurement. Any of the individual angles shall differ from the mean of all angles by no more than 5 seconds and individual distances shall differ from the mean of all distances by no more than 0.01 feet and 2 parts per million (ppm).

### **LEAST SQUARES ADJUSTMENT OF DATA**

Adjustment of the combined GPS/GNSS survey data, Conventional Theodolite or Total Station terrestrial (TPS) survey data shall be completed by a single minimally constrained least squares adjustment of the combined data. From the least squares adjustment the maximum allowable Network Horizontal Positional Accuracy (at two sigma, 95% confidence level) shall not exceed 0.02 feet or a precision of 1 part in 50,000 parts (1:50,000).

## **GEODETIC MONUMENT ORTHOMETRIC HEIGHT REQUIREMENTS**

The monument shall be elevated in accordance with one of following procedures.

Where existing geodetic monuments on NAVD 88 vertical datum are within reasonable proximity, the orthometric height, shall be established by employing conventional terrestrial differential leveling techniques and shall close within  $0.033 \text{ feet} \cdot \text{SQRT}(s)$  where  $s$  is equal to the length of the level run in miles.

Where there are no existing geodetic monuments on NAVD 88 vertical datum within reasonable proximity the orthometric height shall be derived from the GPS/GNSS survey of the direct observation of the monument. Where the geodetic monument position has been determined from nearby locations that provide quality GPS/GNSS observation conditions, the orthometric height shall be determined by employing conventional terrestrial differential leveling techniques from the location that achieved the highest quality GPS/GNSS least squares adjustment orthometric height. The orthometric height of the nearby GPS/GNSS location utilized shall have a vertical uncertainty relative to the geodetic monument of no more than 0.006 feet.

## **GEODETIC MONUMENT POSITIONING & HEIGHT REPORTING REQUIREMENTS**

The Licensed Land Surveyor shall submit copies of a certified, signed and sealed report to the Monroe County Surveyors Office for review and acceptance by the Monroe County Surveyors Office. The report shall contain the following and follow the format of an example report provided by the County Surveyors Office:

- A summary of survey field operations.
- GPS/GNSS post processing report when performed.
- GPS/GNSS OPUS Extended report when utilized.
- If TPS Survey techniques are employed provide an angle sets report (Rounds Report, Direct-Reverse Report), record of field notes, reduction of field data and raw data file.
- Least squares adjustment report with a final adjusted grid coordinate listing.
- Differential leveling summary report.
- Certified Monument Record Sheet.