NMSU Supplemental Control
Chapter 15, Example 1
2nd Edition "The Global Spatial Data Model"
Earl F. Burkholder, PS, PE, F.ASCE – May 30, 2020

GPS control on the NMSU campus dates back to 1992 when station REILLY was established in the central "horseshoe" of the NMSU campus. Station REILLY was part of a "local" horizontal GPS network which included station CRUCESAIR and other existing geodetic control. That early GPS project was surveyed as a horizontal network with excellent results. Results for the vertical component were not impressive.

Additional GPS data were collected on station REILLY in 1999 which NGS subsequently elevated to HARN station status. The NAD 83 (2011) positions of stations CRUCESAIR and REILLY are both published as A-Order HARN stations and their relative position of one with respect to the other is 1:10,000,000.

A GPS survey based on NAD 83 (1992) values for stations CRUCESAIR and REILLY was computed in 2005. Those results are posted at http://www.globalcogo.com/nmsunet1.pdf and the network is described in Chapter 11 of the 2008 (1st) Edition of "The 3-D Global Spatial Data Model (GSDM)." Enhancements and additions since then include:

- The 2005 NMSU Network was re-computed using the NAD 83 (2011) control point values. Those results are included in Chapter 12 of the 2nd Edition of "The 3-D Global Spatial Data Model" published by CRC Press in 2018. There is a noticeable difference in the X/Y/Z coordinate values of all points but the relative positions of the points in the NMSU Network are remarkably stable.

- Station BROMILOW is part of the NMSU Network and is embedded in the sidewalk between NMSU Engineering buildings, Goddard Hall and Jett Hall. Regretfully, on April 1, 2008, that portion of the sidewalk was rebuilt – meaning the aluminum tablet for station BROMILOW was removed and replaced in the newly poured concrete. Was the tablet really replaced where it was?

- Sometime later, additional GPS vectors were observed to add more points to the NMSU Network and to survey the "reset" location of station BROMILOW. Example 2 in Chapter 15 of the 2nd Edition uses the NAD 83 (2011) values of station BROMILOW, both before being disturbed and after being reset, for an exercise in Hypothesis Testing.

- The NMSU Supplemental Control Network is based on the previously published values for stations REILLY and PSEUDO. New control points in the Supplemental Network include stations WAKEMAN and EFB. Station BROMILOW is included as a "reset" station. See accompanying diagram.

- Stations REILLY, EFB, WAKEMAN, and BROMILOW as shown in the diagram were used as control points from which to observe horizontal and vertical angles to the Finial on Skeen Hall. Example 3 in the 2nd Edition shows how terrestrial observations (no GPS) were incorporated into a linear least squares adjustment to compute the position of the finial (which could not be physically occupied).
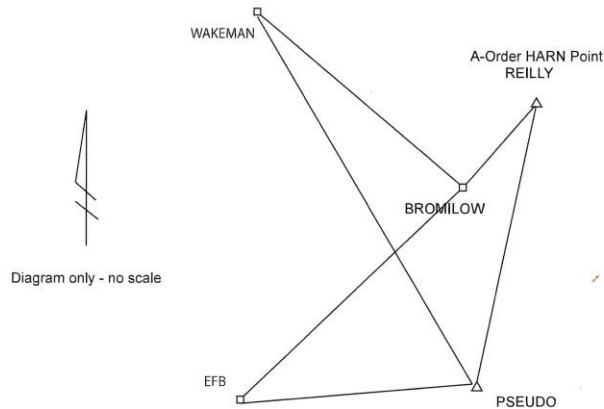
Diagram of Supplemental Control Points on the NMSU Campus

<u>Geocentric & ECEF sigma</u>   <u>Geodetic & local sigma</u>

Station REILLY - NAD 83 (2011)

    X =   -1,556,177.595 m +/- 0.0022 m   φ = 32° 16' 55."93002 N +/- 0.0024 m (N)
    Y =   -5,169,235.284 m +/- 0.0042 m   λ = 106° 45' 15."16035 W +/- 0.0018 m (E)
    Z =   3,387,551.720 m +/- 0.0038 m   h = 1,166.543 m   +/- 0.0052 m (U)

Station WAKEMAN - NAD 83 (2011)

    X =   -1,556,515.423 m +/- 0.0018 m   φ = 32° 17' 00."09689 N +/- 0.0016 m (N)
    Y =   -5,169,056.109 m +/- 0.0040 m   λ = 106° 45' 29."49401 W +/- 0.0018 m (E)
    Z =   3,387,656.711 m +/- 0.0024 m   h = 1,159.912 m   +/- 0.0043 m (U)

Station EFB - NAD 83 (2011)

    X =   -1,556,489.931 m +/- 0.0016 m   φ = 32° 16' 42."99414 N +/- 0.0015 m (N)
    Y =   -5,169,358.655 m +/- 0.0037 m   λ = 106° 45' 25."22846 W +/- 0.0017 m (E)
    Z =   3,387,211.826 m +/- 0.0023 m   h = 1,161.020 m   +/- 0.0041 m (U)

Station PSEUDO - NAD 83 (2011)

    X =   -1,556,206.595 m +/- 0.0017 m   φ = 32° 16' 45."74754 N +/- 0.0020 m (N)
    Y =   -5,169,400.704 m +/- 0.0031 m   λ = 106° 45' 14."39942 W +/- 0.0014 m (E)
    Z =   3,387,285.999 m +/- 0.0030 m   h = 1,165.614 m   +/- 0.0039 m (U)

Station Bromilow – NAD 83 (2011)

    X =   -1,556,209.724 m +/- 0.0014 m   φ = 32° 16' 52."33538 N +/- 0.0014 m (N)
    Y =   -5,169,286.462 m +/- 0.0034 m   λ = 106° 45' 15."77216 W +/- 0.0014 m (E)
    Z =   3,387,457.534 m +/- 0.0017 m   h = 1,165.501 m   +/- 0.0036 m (U)

Geocentric X/Y/Z and Geodetic Coordinates for Control Stations with Associated Standard Deviations