HIGH ACCURACY REFERENCE NETWORK FOR NORTH DAKOTA

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The National Geodetic Survey (NGS) has recently completed the final adjustment of the Federal Base Network (FBN) and Area Navigation Approach (ANA) airports survey programs for North Dakota. Consisting of 68 stations, 24 new and 44 existing National Spatial Reference System (NSRS) control stations spaced at approximately 70 kilometer (44 mile) intervals, the network was observed to A and B-Order accuracy standards (5 mm + 1:10,000,000 and 8 mm + 1:1,000,000) as defined by the Federal Geodetic Control Subcommittee. This network is often referred to as the High Accuracy Reference Network (HARN).

Field operations were conducted between October and November, 1996, by NGS surveyors, using Trimble 4000SSE and 4000SSI, dual frequency Global Positioning System (GPS) receivers. Most observations far exceeded the 1:1,000,000 proportional accuracy required for the B-Order adjustment.

Fiducial stations used in the GPS adjustment included existing FBN stations in Minnesota, Montana and South Dakota. To ensure the integrity of the NSRS, all existing horizontal control in the State will be readjusted to provide consistency between the HARN and the existing horizontal network. The readjustment will extend into the bordering states to the extent necessary to maintain consistency of the NSRS. Until the completion of the state-wide readjustment, HARN stations will be designated as "SPECIAL STATUS" on NGS data sheets to indicate their positional differences with the existing lower order NSRS stations. Given the current back log of other HARN state-wide readjustments, the North Dakota readjustment could require as much as 2 years to complete. The new coordinate values are referred to as North American Datum of 1983 (NAD 83), Adjustment of 1996, and are designated NAD 83 (1996). This designation is necessary to distinguish between the original NAD 83 Adjustment of 1986, or NAD 83 (1986). Coordinate values should be properly labeled to eliminate confusion. Positional changes due to the network improvement vary across the State, but are generally less than 0.5 meter (1.6 feet). Positions and velocities relative to the International Earth Rotation Service (IERS) Terrestrial Reference Frame (ITRF) will also be published for all HARN stations.

Orthometric heights for the HARN were determined by occupying 28 bench marks and 1 station with previously determined height by GPS, referenced to the North American Vertical Datum of 1988

(NAVD 88). NAD 83 ellipsoidal heights were determined by holding the values published for 7 existing A-Order quality stations in and around the State. Accuracy of ellipsoidal heights determined by these observations vary, and are sometimes less than third-order. Orthometric heights are generally considered to be equivalent to those obtained by conventional vertical angle observations (0.1 meter/0.3 feet).

All GPS surveys performed prior to the HARN, and not submitted to NGS ("Blue Booked") for inclusion in NSRS, should be readjusted from original observations to maintain consistency with NSRS. Lower order coordinate information (e.g. cadastral surveys, photogrammetry, geographic information systems) can be transformed from NAD 83 (1986) to NAD 83 (1996) using version 2.10 of the NADCON software supplied by NGS, with special transformation grids for the North Dakota adjustment (i.e. NDHPGN.LAS and NDHPGN.LOS). The transformation grids will be developed by NGS following the state-wide readjustment, and should provide transformation values accurate to an average of 0.06 meter +/- 0.02 meter (0.20 +/- 0.06 feet) across the State. Updated coordinate information, and the NADCON software can be obtained from the NGS Information Services Section at (301) 713-3242 and the NGS Internet Home Page at http://www.ngs.noaa.gov.

Questions concerning the HARN and state-wide readjustment or coordinate transformations should be directed to Dave Doyle, NGS Observation and Analysis Division, telephone (301) 713-3178, or email daved@ngs.noaa.gov.