

CORS Update

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Over 300 users a month are accessing the federal CORS data mentioned in an article I wrote for the March 1996 issue. Recent developments regarding the CORS network convinced me that an update was in order. Figure 1 shows the current coverage and overlap provided by the system. Certain differences between the CORS and HARN coordinates have been discovered. The reason for this is that while all coordinates provided are NAD 83 coordinates, the CORS coordinates are more accurate NAD 83 coordinates. To find out what the current status is, I spoke with Bill Strange, Chief Geodesist with the National Geodetic Survey.

Strange said the network now contains 84 stations, with 20-25 new stations expected over the next year. He said state DOTs are the primary driving force behind the new stations and that survey accuracies of 1 to 2 centimeters are easily being achieved. He said he expects a rush of new stations caused by new techniques for weather forecasting and earthquake prediction. Current estimates are that the FAA will establish up to 600 (for aviation), and NOAA (for weather forecasting) up to 1,000. He said a loss of accuracy of about one meter when using the real-time correctors broadcast by the Coast Guard stations had been detected, caused by differences between the way the Ashtech and Trimble equipment used by the Coast Guard CORS stations handled group delay. Resolution of the firmware difference has resulted in a dramatic improvement in the accuracy of handheld receivers. Work is continuing at NGS to improve multi-path errors at the CORS stations, which will further improve handheld accuracies. Other important research includes antenna phase-center modeling that will allow different antennas to be combined when making GPS observations without loss of vertical accuracy.

Differences Between CORS and NAD 83

When I asked about stories I had heard regarding discrepancies between CORS and NAD 83 HARN stations, Strange gave me a short primer on coordinate datums and said that the discrepancies depend on which coordinate system you are using as well as the accuracy of your position relative to that system. The original NAD 83 adjustment, HARN results, and CORS all provide NAD 83 coordinates. The changes in coordinates are due to the continuing increase in accuracy of coordinates relative to the NAD 83 coordinate system. The CORS stations—at $\pm 1-2$ centimeters—essentially have no error of position, whereas the original accuracy of NAD 83 was $\pm 0.5-1$ meter. The HARNs were established after the NAD 83 adjustment and they typically have five to ten centimeters of error. The Tennessee HARN was established using the early Macrometer equipment and it contained so much error that it has been re-observed. The Maine HARN appears to contain the most disagreement (at approximately 10 centimeters) and is the result of the fact that it held a 1987 point from the Eastern Strain Network. Even though recent HARNs are more accurate, the early HARNs used the best techniques available at the time, including orbit relaxation and VLBI. Fortunately, the shifts between CORS and

NAD 83 show a trend that should make it easy to develop correctors to apply for each HARN (*see Figure 2*). The discrepancies in the Maryland-Delaware HARN are only around the one-to-three centimeter level.

NAD 2000?

I asked about the rumored NAD 2000, and Strange commented that all the HARNs should eventually be re-adjusted and shifted into agreement with the most accurate geodetic control provided by CORS and ultimately with the ITRF reference system. (The International Terrestrial Reference Frame is becoming the *de facto* worldwide standard for GPS.) This will enable users to achieve the same answers no matter which CORS station they are using. One benefit from this capability would arise if a particular CORS station were down for some reason. The user could then download data from another nearby station and achieve the same accuracies. Some users will grumble about changing values, but as better information and techniques become available, surveyors will have more flexibility in their work. California surveyors are well acquainted with changing values because of tectonic plate movements in their region. NGS has announced that any decision on a national re-adjustment will be carefully considered. User input will be solicited. The solution will most likely provide easily transformable coordinates, in both ITRF and NAD 83.

Every State Will Have A HARN

Strange said that every state will have a HARN by the end of 1997. He also said that most of the existing HARNs will not provide expected geodetic accuracy in the vertical component, but will require re-observation and/or additional leveling connections to improve in that area. Strange said the NGS mission is one of standardization, simplification and education. I inquired about the feasibility of using GPS observations performed by private surveyors and Strange said some of the state geodetic advisors are starting to pull together these observations. He said the GIS users are happy with CORS. I asked if he had any advice for surveyors and he said they should be heavily involved in the establishment of coordinate systems and the conversion of coordinate values from one datum to another. n

Marc Cheves is the editor of the magazine.