Extrinsic Evidence

Your publication is high on my reading list. I enjoy the articles and the wealth of information shared. I do, however, have some feedback for you.

In reference to the article "Extrinsic Evidence" by Joel Leininger [Sept/Oct 2005], I was startled to see the example of a called for iron pipe monument as an "ambiguity" because it was (hypothetically) found 0.20 feet from the record position. To my interpretation this is an example of a comparison of measured to record distance rather than an ambiguity in the deed. I think the found, called for monument leaves little room for ambiguity. Ambiguity could only arise if the found monument were not called for in the deed (lending uncertainty as to its origin) or if more than one monument existed in close proximity or if the distance discrepancy were more significant. A found, called for monument 0.20 feet out of position is actually a much better situation than, for example, a found uncalled for monument 1.2 feet out of position. Also, a realistic consideration would be the field conditions and the date of the original survey. I would find it difficult to question a pipe set 60 years ago, found to be 0.20 feet from the record call on a steep, brush-covered slope. By the way, my apologies if the 100.20 was a misprint–I might agree if the pipe was found at 102.00 feet.

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Leininger Replies

The doctrine specifies that all parts of the description (both geometry and monuments, etc.) to be gratified if possible; only when that cannot happen are the "rules of construction" triggered.

No ambiguity would exist if the call and the measurement exactly agreed. Any disagreement, no matter how small, is an ambiguity. You are correct that in most locations 0.20 feet would

not be cause for concern and, of course, the call for the pipe would outweigh the called distance. But you have (perhaps subconsciously) invoked the rules of construction to choose the pipe over the measurement. In doing so, you reject the called distance in accordance with the rule – properly, I might add. *–J.L.*

More on Iraqi CORS

Thanks for the interesting article, "Development of the Iraqi Geospatial Reference System" [Nov. 2005]. My special interest is based on my personal challenging struggle with the similar task, which finally ended with my doctorate dissertation on this topic. I was responsible for the technical execution of the contract in Iraq in the 1970s. Although at that time the Iraqi Geospatial Reference System (IGRS) was simply named the Geodetic Control, the scope of work was more complex, and it included mean sea level determination, precise leveling, gravimetric surveys, astronomical observations, and uniform and countrywide horizontal and vertical network.

In my opinion, the establishment of six CORS is the best solution for modern GPS-based zero order network. The second stage of the project as 1st order GPS survey control network, done by high accuracy 200-300 passive GPS points is also the necessary component of new High Accuracy Reference Network (HARN). But, as mentioned in the article, GPS alone is not reliable enough to support the multitude of projects, which require so many surveying and mapping techniques. It is the enormous task to establish IGRS useful for all needs. Therefore my suggestion that all the rest of HARN components can be solved by tasks already done in the1970s.

Of course, the conversion and adaptation need some special approach, but as a result it will solve so many difficulties. I noticed from the article how little is known about tremendous and hard job done in the past, and how little is known about accuracy. This situation will probably change after the reestablishment of the federal Iraqi mapping and survey agency (called "Directorate General of Surveys" in the 70s).

Although more than 25 years passed from the final stage of our project, the high accuracy of surveys are at the level of the modern most precise GPS surveys. We established the horizontal network by continuous trilateration, using laser AGA 8 geodimeters (m.s.e.: 5mm +1ppm). The structure of the network was as shown in attached sheet of 1:250,000, *i.e.,* all the distances between neighboring points are measured (there was no deviation from this principle on the total area of Iraq). The 1st order network consists of 2778 points, with 8606 measured distances from 8 km to 40 km, with the average distance between points 15 km. The m.s.e. of the distance, after adjustment, is equal to 22 mm, so the relative error is better than 2 ppm (1:650,000) at any point of the net. It was possible to obtain such high accuracy only by using the laser distance-meters. In fact, each distance was measured with base-line accuracy. All horizontal control points are marked by prefabricated concrete marks and the pillar is additionally secured by concrete floor. For security (protective) reasons there is no attractive description on cast-iron cap of pillar. The total number of 404 points of the network, being at a distance not exceeding 2 km from precise leveling bench marks, were leveled and tied by geometric leveling; the rest of them received the heights by adjustment of trigonometric leveling (16 471 observations of vertical angles).

Besides, the geodetic control consisted of: two mareograph tide-gauge stations to determine mean sea level, primary precise leveling net (51 lines, 8,800 km, 1984 bench marks, final accuracy 1.81 mm/km), gravimetric surveys along all precise leveling lines.

In this specific situation, the reports that some survey markers along rebuilt roads had been destroyed (and probably many bench marks) have no influence on the use of the rest of them. This situation is typical, when so many infrastructure projects started after 1979. But, fortunately, for modern technology there is no need to have so many points as established in the 70s.

Having all processing related to the measurements finished, the accurate conversion into new reference system is possible with a few centimeters accuracy. Additionally, the geoid's model can be improved.

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Dave Doyle Replies

Thank you very much for taking the time to respond to the article about the work being performed in Iraq. I think we all agree that assisting the Iraqis' to build a modern, accurate and efficient geospatial reference frame will be an important part of their national reconstruction efforts. I am especially grateful for your detailed description of the density of the classical triangulation and leveling networks and the field procedures employed in this effort. It sounds like it was of the highest possible quality. I had been provided only the most limited information about the existence of these networks by the U.S. Army forces engaged in the survey work.

From the information provided by the Army survey team, it sounds as though many of the older marks have been either disturbed or destroyed. It is very possible however, that with their limited time and resources that they were not able to fully evaluate the condition of the networks. I will be meeting with several Iraqi engineers who have come to the States for training and I hope to get a better idea of the condition of the framework at that time.

If the older vertical bench marks can be recovered and positioned with GPS it will be very possible to build an improved geoid model for Iraq and would be vastly superior to the global EGM96 currently available to them. I would be especially hopeful that we could make high accuracy GPS ties to the mareograph tide-gauge stations. Our Army colleagues seemed to be only vaguely aware of the existence of these stations.

Again, please accept my thanks for taking time to contact us with this information. I will keep you informed as to the progress of this effort, and I hope that you won't mind if I contact you from time-to-time for your advice concerning this program.

Dave Doyle
NGS, Chief Geodetic Surveyor

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