

Assumptions Underlying Article on Basis-of-Bearing

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May 13, 2013

The following items reflect feedback from two primary sources – those responding to the Basis-of-Bearing article published in the May 2013 issue of the NMPS Benchmarks and from persons responding to the SurveyorConnect (<http://surveyorconnect.com/index.php?mode=thread&id=203562>) bulletin board. Comments also appear in other threads on SurveyorConnect that can be found by searching “basis of bearing” on that site. The thoughtful suggestions of many are sincerely appreciated.

- I. In developing the proposed basis-of-bearing article, our goal was to remain true to simple basics. “North” is a physical concept defined by the Earth’s spin axis. Meridians converge at the poles and are not parallel. “True” north is often taken to be either geodetic or astronomic. The difference is generally small and seldom exceeds 10-15 seconds of arc. If and when that difference matters, it should be discussed between the professional surveyor and his/her client or recording office.
 - A. Astronomic north is determined by astronomical observation and is affected by the deflection-of-vertical at the point of observation.
 - B. Geodetic north is referenced to the mathematical Conventional Terrestrial Pole (CTP).
- II. Licensed surveyors are expected to be responsible to the public, to the profession, and to themselves. That means professionals enjoy a great deal of latitude in deciding appropriate methods and procedures for determining and meeting the needs of their clients. In addition, professionals and technicians alike are expected to understand basic concepts and to be responsible for maintaining a level of competence commensurate with the services performed. We all participate in life-long learning but no one enjoys a monopoly on the “truth.” Respectful discussion of ideas (even differing opinions) is essential for maintaining individual competence and for collective enhancement of our professional image/reputation.
- III. Some respondents opined that angles are more important than directions. That point is valid and conceded within the context of “absolute” and “relative.” Briefly, relative is viewed as being associated with measurements and absolute is viewed as associated with a reference. Many are comfortable with the practice of measuring angles and computing directions. In that case, directions are dependent on measured angles and both are essential. But, the process of identifying a common basis-of-bearing that is most appropriate for professional practice needs to recognize other methods as well. A compass determines an independent direction, an astronomical observation (solar or star-shot) determines a direction that is independent of other lines on the ground, and GPS provides independent directions. A basis-of-bearing needs to be an absolute reference.
- IV. Some who responded were quick to offer, “This is how I do it.” with the implication that the public and the profession are accordingly well served. For the most part, those points are valid and such practice exceeds the “minimum” level being identified. The question for those persons is, “Should everyone be expected to do it your way?” Typically, the answer is “no” because there are other legitimate methods that could be used. The proposed basis-of-bearing is simple, elegant, and offers many benefits. One particular response implied that “elegant” and “practical” are mutually exclusive. We disagree.

- V. Under the “This is how I do it.” scenario, those who provide more technical detail than the minimum required are to be commended for their diligence and for providing future users the information needed to duplicate or to follow their work. In some cases, the pendulum may swing too far. What is the benefit of requiring subsequent users to sort through details of datums, ellipsoids, projections, brands of equipment, or computational methodology in order to establish compatibility between one “flavor” of reference or another? Technicians have every right to be proud of doing a good job and being able to justify all the details. Those talents are viewed as prerequisites to becoming a professional. On the other hand, professionals have the prerogative and larger responsibility to make decisions in a broader context; that is, understanding implications of the difference between standards and specifications. The proposed basis-of-bearing is a simple standard while specifications are left to the surveyor’s professional judgment.
- VI. Various respondents expressed a preference for using a grid bearing as the basis-of-bearing. Given the current preponderance of use, that preference has merit. However, true north is “closer” to physical reality while a grid bearing depends upon knowing which map projection is being used (UTM, state plane, low distortion projection, etc) and parameters associated therewith. The public is well-served by using true north as the common basis-of-bearing and it is easier for users of other methods to compute and use true north than the converse.
- VII. The proposed basis-of-bearing contains a subjective difference between “routine” and “higher-order” applications. Control surveys, some engineering surveys, and deformation monitoring surveys are examples in which the “higher-order” criteria should be applied. Of various factors that can be considered as discriminating between routine and higher-order, the most reliable discriminator is probably the proven standard deviation of the reference. All higher-order surveys should certainly have a (2 sigma) standard deviation less than 10 seconds of arc. Understandably, a standard deviation less than 10 seconds of arc does not, in itself, qualify a reference as “higher-order.” For example, stating that GPS equipment was used, that a 1 second theodolite was used, that the distance to the backsight is more than 100 meters (~330 feet), or that the reference is based on a particular ellipsoid, datum or projection does not qualify a reference as being “higher-order.” Numerous specifications need to be met for a reference to be “higher-order.”