Version 3.1

NGS **PROPOSAL** for an Addendum to Current FGCS Specifications and Procedures to Incorporate Electronic Digital/Bar-Code Leveling Systems

The current FGCS Specifications contain a 10 arc-second collimation tolerance limit for electronic digital/bar-code leveling systems. If this tolerance limit is exceeded, the observations are to be reobserved, and if the tolerance limit is routinely exceeded, it is recommended the instrument be returned to the manufacturer for repair/calibration. Instrument manufacturers have stated that their new, improved digital/bar-code leveling instruments can exceed the 10 arc-second limit and still produce results within their stated accuracy. In order to determine if the 10 arc-second specification should be revised, additional tests and evaluations are necessary to validate the manufacturers' statements. In the interim, NGS is issuing this proposal for an addendum to the existing FGCS specifications. The following are guidelines/requirements for digital bar-code leveling systems that exceed the 10 arc-second collimation tolerance limit. This proposal is consistent with manufacturers' recommended procedures.

Note: Since bar-code leveling rods are not calibrated at every increment (i.e., there are no "detailed" calibrations), first- and second-order leveling must always have an even number of setups.

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First-Order (Precise) Geodetic Leveling

- Check that the instrument, tripod, and Invar staff are in good mechanical order (i.e., they must adhere to digital level manual guidelines),
- Allow digital levels sufficient time to adjust to the ambient temperature,
  (Manufacturer recommends: temperature difference in Centigrade x 2 = time in minutes required for instrument to adjust to a new temperature.),
- BFFB (Backsight-Foresight-Foresight-Backsight) sighting method (alternating),
- Sight lengths cannot exceed 35 meters,
- Setup sight-length imbalances cannot exceed 1 meter,

- Section sight-length imbalances cannot exceed 1 meter for first-order, class I; and cannot exceed 2 meters for first-order, class II.

- Collimation ("c") checks:
  - Maximum collimation value not to exceed 50 arc-seconds,
  - Collimation must be checked at the beginning and end of each day's observations (typically in the morning and afternoon),
  - During the day, collimation values must not vary by more than 2 arc-seconds, and
  - Day-to-day collimation values must not vary by more than 5 arc-seconds,

- Tripod and instrument must be shaded,

- Avoid sighting across areas with intense solar radiation,

- Do not measure when there is excessive vibration,

- Accurately focus the instrument cross-hairs on the rod,

- Do not measure when a staff section is interrupted (e.g., by branches of a tree),

- Do not measure beyond the base or top of the staff,

- Read, understand, and implement the advice and information given in the instrument's user manual, and

- Report a summary of section misclosures to the National Geodetic Survey for validation purposes.

<u>Second- and Third-Order Geodetic Leveling</u>

- Check that the instrument, tripod, and staff are in good mechanical order (i.e., they must adhere to digital level manual guidelines),

- Allow digital levels sufficient time to adjust to the ambient temperature, (Manufacturer recommends: temperature difference in Centigrade x 2 = time in minutes required for instrument to adjust to a new temperature.),

- BF (Backsight-Foresight) sighting method (alternating),

- Sight lengths cannot exceed 50 meters,

- Setup sight-length imbalances cannot exceed:
  - 1 meter for second-order, classes I and II,
  - 2 meters for third-order, and

- Section sight-length imbalances cannot exceed 2 meters.

- Collimation ("c") checks:
  - Maximum collimation value must not exceed 50 arc-seconds,
  - Collimation must be checked at the beginning and end of each day's observations (typically in the morning and afternoon),
  - During the day collimation values must not vary by more than 2 arc-seconds,
  - Day-to-day collimation values must not vary by more than 5 arc-seconds,

- Tripod and instrument should be shaded in bright sunlight; avoid "one-sided" sunlight on the tripod and instrument,

- Avoid sighting across areas with intense solar radiation,

- Do not measure when there is excessive vibration,

- Read, understand, and implement the advice and information given in the instrument's user manual, and

- Report a summary of section misclosures to the National Geodetic Survey for validation purposes.

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