

DIVISION 01000- GENERAL REQUIREMENTS

**SECTION 01300 SURVEY INFORMATION - PROCUREMENT AND CONTRACTING
REQUIREMENT**

PRECISION MEASUREMENTS (conventional closed traverse)

Unadjusted Linear Misclosure 1:30,000

Min. Scale Graduation
of Instrument 20 sec.

Distance Measurement EDM/Steel
tape

ACCURACY MEASUREMENTS (GPS survey or survey adjusted using least squares)

Minimum positional tolerances of land property corners computed least squares adjustment at the 95% confidence level as set forth in appendix b of the Geometric Geodetic Accuracy Standards and Specifications for Using GPS Relative Positioning Techniques, Federal Geodetic Control Committee.

Local Accuracy of
directly occupied
corners 0.05 ft (1.7cm) + 1:30000

Local Accuracy of
control supporting
the survey 0.03 ft (1cm) + 1:30000

APPLICABLE SPECIFICATIONS;

- 1) All survey field work, including GPS work, shall be performed with methods of practice and equipment capable of attaining the tolerances as specified, including the following:
 - a) Elimination and reduction of known systematic errors and mistakes;
 - b) Sufficient redundancy to clearly state that the accuracy requirements have been achieved;
 - c) Analysis of field procedures and data processing to achieve the accuracy and precisions;
and
 - d) Documentation verifying compliance with these standards.

UNIVERSITY OF NEW HAMPSHIRE
CONSTRUCTION AND RENOVATION STANDARDS

- 2) All survey instruments shall be kept in good repair, close adjustment, and operated according to manufacturers' specifications.
- 3) All steel tapes and electronic distance measuring devices shall be routinely compared to a distance traceable to the National Bureau of Standards. A record of these comparisons shall be maintained by the surveyor.
- 4) All pertinent information, measurements, and observations made in the field during the course of the survey shall be recorded as field notes in (5) below. Computer printouts of raw data downloaded from an electronic data collection device shall be considered a form of field notes.
- 5) All field notes shall indicate:
 - a) Location;
 - b) Street names;
 - c) Client;
 - d) Instruments;
 - e) Date;
 - f) Field crew;
 - g) Weather conditions; and
 - h) Purpose of field work.
- 6) Searches for evidence believed to be ferrous or magnetic in nature shall be conducted with a magnetic or metal detector when evidence is possibly buried or not visible.
- 7) Survey traverses shall be based on a bearing system determined from astronomic observations, GPS observations, or from geodetic monuments incorporated into the traverse. If neither method is practical the survey shall be based on a magnetic bearing observed with a compass having a scale permitting interpolations to one-half of a degree. An alternate method shall be orientation of the survey to an existing survey. Angular measurements of the field traverse shall be repeated 2 or more times and each set of angular measurements shall be made with the telescope both in the direct and inverted by 180 degree position.
- 8) Sideshots from the traverse to monumentation or other physical features controlling the position of a property line shall be minimized. Angle measurements to those points shall be repeated 2 or more times. Distance measurements to those points shall not be greater than 100 feet when measured with a steel tape. Precision of measurements from the control points to sideshot points shall be a minimum of half the horizontal angle scale reading with distance measured to the hundredth of a foot. The exceptions to this shall be stone walls and fence posts which may be measured to the nearest tenth of a foot, and centerline and edges of water bodies which may be measured to the nearest foot.
- 9) Vertical data shall be referenced to the North American Vertical Datum of 1988, Horizontal data shall be referenced to New Hampshire State Plane Coordinates System North American Datum 1983/1986.
- 10) A minimum of 2 benchmarks shall be established on the subject tract. Benchmarks shall be 3-4" brass disks set in at least 4' of concrete with a minimum 12" diameter (identified and numbered per UNH), all benchmarks shall be enabled to be located with a magnetic location device. Benchmarks shall be referenced to the datum identified in above paragraph # 9.
- 11) The establishment of benchmarks shall be done with care and sufficient redundancy to ensure that the elevations are accurate and reproducible. Whenever possible and practical, a

UNIVERSITY OF NEW HAMPSHIRE
CONSTRUCTION AND RENOVATION STANDARDS

minimum of 2 known benchmarks shall be included in all level runs. All level runs shall either begin and close on separate known marks, or shall be a closed loop beginning and ending on the same known mark. Benchmarks shall be established by differential leveling using an instrument equipped with an automatic compensator or spirit level vials. The misclosure tolerance between benchmarks shall be $0.05' \div \sqrt{M}$ where M is the one-way distance in miles. The misclosure tolerance of a closed loop shall be $0.04' \div \sqrt{M}$ where M is the distance of the loop in miles.

- 12) All topographic surveys shall be referenced to a vertical control system comprised of closed level loops.
- 13) All site surveys shall include the location of all trees 6" and greater, shrubs and other landscaped features.
- 14) Grid lines for detailed cross-section work shall be closed and tied to the control system.
- 15) If any method of accumulating field data shall include running secondary traverses or level loops they shall begin and end at points on the control system.
- 16) When aerial photogrammetry is to be used to compile a topographic map the horizontal and vertical photo control points shall be incorporated into the control traverse and level loop.
- 17) Measurements to physical features or improvements shall be taken with a precision compatible with the detail being located as follows:
 - a) Linear measurements shall be taken to the nearest foot when locating feature such as but not limited to: streams, ditches, ledge outcrops, boulders and wetlands. All other physical features shall be located to 0.1' to include but not limited to: poles, pavements, curbing, sidewalks, manholes, catch basins, culverts and signs.
 - b) Horizontal and vertical angles to the features shall be taken to a minimum of 20 seconds.
 - c) Elevations shall be taken to the nearest hundredth of a foot on building floors, manhole rims, curbing, pipe inverts, pavements; and
 - d) Natural ground elevations and water levels shall be taken to the nearest tenth of a foot.
- 18) Measurements shall be taken to a precision compatible with the construction tolerances for the project.
- 19) Construction layout monuments shall be of a type and character and set in a manner so as to provide a degree of permanency consistent with the terrain, physical features and intended use. Sufficient monuments and offset information shall be provided to enable the user to check the accuracy of any points or lines established there from. Any stakes that show offsets and/or cut and fill data shall also show sufficient information to identify the horizontal position of the points to which they refer.
- 20) All buildings, structures, or foundation layouts shall have the perimeter closed, or in the case of a rectangle, the diagonals measured.

PLATS

- 1) For results of a surveys where a plat is prepared, the plat shall be drawn on reproducible medium. The plat shall identify the tract or parcel and contain enough information so that the boundaries of the parcel of interest can be located with certainty in the future by a competent land surveyor.

UNIVERSITY OF NEW HAMPSHIRE
CONSTRUCTION AND RENOVATION STANDARDS

- 2) As appropriate to the purpose of the survey, a survey plat shall contain but not be limited to containing the following:
- A. The municipality, date, scale, bar scale;
 - B. The name and address of the company and or individual which prepared the plat, or both, and the name and seal of the licensed land surveyor;
 - C. Owner of record with mailing address, and title reference;
 - D. Meridian arrow and origin with the date of observation or reference plat;
 - E. Vicinity map;
 - F. Bearing and horizontal distances on all pertinent property lines;
 - G. Curved boundary lines showing radius, delta, and length;
 - H. On non-tangent curves, a course and distance of the long chord shall be shown;
 - I. Irregular boundaries without curves, such as rivers or streams, or with curves which have no definable geometry, shall have sufficient information to mathematically close the plat;
 - J. Tie lines, when used, shall be noted that they are not property lines;
 - K. All monuments set or found, including monuments with tie lines on which establishment of the corners of the surveyed premises are dependent;
 - L. Monuments shall be described as to material, the date the monument was set, and the relation of the monument to the surveyed lines and/or corner;
 - M. Lines of possession where they affect the surveyed boundaries;
 - N. Abutters with title reference and assessor's parcel number;
 - O. Easement and right-of-way limits, protective covenants, references to easements and encumbrances of record, whether private or public, and evidence of any unwritten interests observed.
 - P. Revision dates and purposes;
 - Q. Legend, unless symbols are clearly identified within the plat;
 - R. Man-made structures pertinent to the purpose of the surveyed project;
 - S. Natural features i.e. trees, shrubs and landscaped elements. To include a table identifying species.
 - T. List of documents, plats and data relevant to the survey;
 - U. Any record evidence of a cemetery or burial ground shall be duly noted on the plat unless such cemetery or burial ground is located on the plat;
 - V. The area of the subject tract or parcel, expressed in acres, unless the area is less than 2 acres, in which case the area may be expressed in square feet;
 - W. All benchmarks shall be adequately described on topographic surveys or boundary surveys when property lines are defined by an elevation to enable it to be recovered at a later date;
 - X. A certification by the land surveyor stating the method and classification of the survey and the precision and accuracy attained.
 - Y. If coordinates of positions are shown the following shall also be included:
 - i. The units of reported coordinates;
 - ii. The horizontal datum and coordinate system of the horizontal coordinates;
 - iii. Vertical datum of the vertical coordinates; and
 - iv. Basis of bearings.
 - Z. Deliverable Products.

UNIVERSITY OF NEW HAMPSHIRE
CONSTRUCTION AND RENOVATION STANDARDS

- i. 3 sets of D size paper copies.
 - ii. 1 set of D size Mylar reproducible drawings.
 - iii. CD or DVD with digital files of formatted drawing and computer modeling files (AutoCAD 2000 or newer - .dwg format or ESRI shapefiles).
 - iv. Drawing layers shall be feature driven.
- AA.** If the survey is a boundary or property survey a plan shall be recorded in the county registry of deeds. The plan recording number should be noted in all plans specified in Y above.