



BROWN

April 13, 2006

***Brown University Survey Control Standards***

***Survey Requirements***

**Intent:**

The *Survey Procedures* will ensure that work produced for the Owner will integrate into the existing Brown University Survey Control Network and build upon the CAD base map of Brown University.

**Survey Procedure Coordination Meeting:**

At the start of field work requiring survey support, a Survey coordination meeting will be held between the Owner and the Surveyor. We will review these Survey procedures, point numbering, identify any specific concerns, and deliver information regarding the Brown University Survey Control Network.

**CAD and Drawing Requirements:**

Refer to the *Brown CAD Deliverable Guidelines* for specifics on electronic file deliverables, CAD standards and formats, required support files and documentation, and drawing sheet and title block requirements.

**Brown Survey Control Network:**

Brown University maintains a Survey Control Network comprised of Primary and Secondary control points. The Survey Control Network references the Rhode Island State Plane coordinate system, North American Datum of 1983 (NAD83/96). The vertical datum is the North American Vertical Datum of 1988 (NAVD 88). All survey work shall adhere to these datums.

**Provisioning of Brown University Survey Control information:**

CAD files of the Brown University base map and Survey Control Network Points are available for use from the Owner. In addition, Control Point coordinates, elevations, and reference tie sheets will be provided.

**Reference Points:**

At least two Control Points (1st pair) are to be incorporated into the start of each survey and two additional Control Points (2<sup>nd</sup> pair) to close the traverse. The points selected are to be shown and dimensioned on a plan. Other landmarks and/or property stakes may also be used in combination with the Brown University Control Points. A description of said landmarks or property stakes, and recovery notes is to accompany each survey plan.

#### Accuracy:

The field traverse will be performed in accordance with the accuracies of a Class I survey as defined in: "Procedural and Technical Standards for the Practice of Land Surveying in the State of Rhode Island and Providence Plantations", prepared by The Rhode Island Society of Professional Land Surveyors, Adopted by The Rhode Island Board of Registration for Professional Land Surveyors, Effective April 1, 1994, and "Technical Manual to Accompany Procedural & Technical Standards for the Practice of Land Surveyors in the State of Rhode Island and Providence Plantations", Rhode Island Society of Professional Land Surveyors.

#### Point Numbering:

Point numbers 001-999 are reserved for the Owner. Brown University will provide point numbers for new Survey Control Points that are to be added. (See ***Survey Control Network*** below for information on adding Control Points) All new traverse layouts shall begin with point number 1000 or higher.

### ***Survey Specific Elements***

#### Boundaries:

- Show on the survey map boundary lines giving lengths and bearings of lines, and radius, delta, and lengths of curves. The Surveyor shall verify this information with the Record Title. If the record boundary varies from the surveyed boundary, show the surveyed information and show in parentheses the record boundary thusly (100.23' by deed) for distance on (N32 -21' -24"E by deed) for bearing.
- Show boundaries of properties as indicated by existing landmarks. The Surveyor shall indicate the names of owners of abutting properties.
- Show boundaries as called for by recorded deeds. Wherever these boundaries do not agree, the surveyor is to stake and show on the map the boundary which he/she advises should be adopted.
- Install steel pins at lot corners if no monuments exist.
- State on the drawings whether monuments were found or set, and describe the relationship of all monuments to the boundaries.
- Identify four permanent bench marks on site.

#### Boundary and other roads:

- Show by full lines all existing railroads, roads and private right-of-way bounding upon, leading to, or within the property. Indicate traveled way, and trees, turf planting strips, curbs walks, and street railways, lamp posts and utility poles, fire hydrants, manhole covers, and catch basins, if any, in these roads. Label way "public" or "private". If public indicate when taken by city, and if taken on fee or only an easement.
- Indicate width of traveled ways, sidewalks, and planting strips, adding figures showing width in feet if established by public authorities.

#### Interior Features - Survey and indicate on the map:

- All interior roads, drives, walks, trails, cultivated areas, fences, walls, ledges, ditches, culverts, catch-basins, water courses, hydrants, lamp posts, and utility poles.
- Outlines of all structures, both on the premises and within 30 feet of the property line, showing outside doors, steps, cellar-bulkheads, verandas, terraces, etc. State type of construction and number of stories.
- Measure and label the distance from corners of structure to property lines, reference points and other buildings.
- Give minimum dimensions of all culverts.
- For all buildings occurring in the surveyed area, indicate the locations of the following items and record elevations thereof to the nearest 0.01 feet:
  - Porches and landings, at top and at grade, including steps from grade.
  - Spot elevations at all corners.
  - Window wells and areaways.
- Locate and label recorded easements and rights-of-way; state owner of right, and give title reference of instrument (if any) creating the right.
- Show zoning district of property; if more than one zone, show the extent of each. Show zoning districts of adjacent property and property across the street(s) or highway(s) or railway(s).
- Show building line and setback requirements, if any.
- Indicate every doorway opening with proper dimensions and locations, and include spot grades inside and outside building at each.

#### Trees and Foliage:

- Indicate on the map the approximate extent of overhang of branches of isolated trees, of masses of trees, and of high bushes.
- Locate accurately and show on map by strong dots all isolated trees over three inches in diameter.
- Unless otherwise directed, the kind of every tree so located is to be indicated on the map by letters forming abbreviations of their common names.
- The diameter of the trunk of each surveyed tree four feet above the ground is to be indicated.

#### Existing Utilities:

Locate and size all utilities in the street and on site, including gas, electric, water, telephone, cable television, high temperature hot water, steam and chilled water. Indicate size, depth and pressure of water mains. Indicate location of nearest fire hydrant and size of main. Indicate invert elevation of sewers, storm drains and catch basins. Indicate location and characteristics of power and communications systems above and below grade. For all subsurface utility lines on the site, indicate and locate intersection and manholes for the first connection to the off-site system

#### New Utility Installations:

All new utility installations shall be as-built prior to backfilling. Survey points shall be centered on the top of each utility line and provided at each bend, elbow, juncture, curve,

branch, elevation change or other direction change along the utility route. In the event a survey point cannot be attained, three (3) reference dimensions must be provided from the point on the utility line to three (3) separate surrounding fixed points and the elevation change will be measured from top of grade. For each point along the utility line that is not surveyed, a Recovery Tie Sheet diagram must be provided, as defined under *Survey Control Network*.

Topography:

- Maximum error shall be 0.5 feet.
- Show contours at 1 foot intervals, with spot elevations at curbs, sidewalks, building entries, and at edge of property.
- Spot elevations of pavements, rims, and inverts of utility structures, sill height for every window or masonry opening at ground level or opening to basement, building floors, bench marks, stairs (top and bottom elevations at each), and other fixed artifacts shall be to the nearest hundredth foot.
- Indicate every door opening with proper dimensions and location, and include spot grades inside and outside building at each.
- Contour error shall not exceed one-half contour interval.
- Provide spot elevations at street intersections and at 20 foot intervals along the edges of walkways and at top and bottom of curbs.

***Survey Control Network***

Adding new Control Points:

Prior to the start of any survey work the Surveyor shall review the area to be surveyed with Brown University staff. Locations for setting Secondary Survey Control points, either to replace points which no longer exist, or to increase the density of the secondary survey control network will be identified. Follow the guidelines below for installation.

Control Point Numbering:

Secondary Survey Control Points shall be installed on Brown University property whenever possible. The monument's cap will be stamped with the appropriate point number. If a Secondary Survey Control Point has to be set within the City of Providence road right-of-ways, coordination with the City of Providence will be required.

When Secondary Survey Control needs to be replaced or added, the following procedure will be followed. A new traverse will be established based on the previous intervisible pair of control points. New Secondary Survey Control points will be set and the traverse will close into an intervisible pair of Secondary Survey Control points beyond the area where the Secondary Survey Control had been destroyed or non-existent. The traverse will be adjusted in the same manner as defined below. Copies of the traverse adjustments, reference ties and field notes will be supplied to Brown University to be incorporated into the existing Survey Control Report.

Secondary Survey Control points will be set by driving a 36" long, 3/4" rebar in at the appropriate location and attaching a cap to the top of the rebar. Caps for use on rebar will be provided by Brown University. Surveyors will stamp the appropriate point numbers on the caps. Where possible, the survey control points will be set one (1) to two (2) inches below the existing ground. If a rebar with cap cannot be set, existing monuments may be used. It may be necessary in certain cases to use a drill hole in a side walk as a Secondary Survey Control point. If this is the case, a 3/8" drill hole filled with lead and a survey tack, will be set in the walk.

**Traverse Adjustment:**

The field traverse will be adjusted using a least squares adjustment software. A printout of the traverse adjustment will be provided along with reference ties to each newly created Secondary Control point. Reference ties, to the nearest 0.01', to aid in the recovery of the control point will be obtained to a minimum of three (3) predominant physical objects (see Recovery Tie Sheets section). A sketch of this information will be drawn in a bound hardcover field notebook and provided to Brown University along with the Control Report.

**Control Report:**

A Control Report and the following information will be provided:

- Field Notebooks
- Computations
- Original Source Documents
- Control Diagram, at a scale of 1"=1000'.
- Control Data
- The traverse adjustment information, traverse ties and copies of field notes will be incorporated into the Control Report.

In a neat, legible, typed format the following data will be supplied to Brown University: All original field notes, records, books, logs, CD's, disc's, or field data recording media of any form, hard-copy, or digital, will be delivered to Brown University.

**Recovery Tie Sheets:**

A minimum of three (3) recovery ties will be obtained for each survey control point. The length of the tie should be less than 100 feet, if possible. Acceptable points to be used as reference points may include but are not limited to the following, monuments with a defined point, drill holes, cross cuts in steps, "x" cuts on flange bolts of fire hydrants, etc. A tie sheet will be prepared similar to the attached samples.

***Final Deliverables***

**Design:**

Deliver all CAD DWG files as defined in the *Brown CAD Deliverable Guidelines*. Provide PDF files, 2 sets of prints, and 1 stamped and signed set of mylar drawings of the final Survey Control Network, Recovery Tie Sheets, Survey Control Report and all supporting documentation as defined herein. Deliverables shall include a Recordable Plan

showing, but not limited to, the following: Vicinity of baselines, Recovery Tie Sheets, Coordinate tables, Methodology with coordinates of and names of NGS stations used, and Certified to the applicable standards

**As-Builts:**

Deliver all CAD DWG files as defined in the *Brown CAD Deliverable Guidelines*. CAD file survey points shall be located on the RI State Plane Coordinate System and shall align with Brown University's base files. The surveyed traverse shall be shown with each point along the as-built utility alignment clearly delineated with a unique point number, elevation and description. An accompanying ASCII text file or Excel spreadsheet shall be provided which lists each point number, northern, eastern, elevation, and description along the as-built survey alignment. Test files will be required early in the project to ensure compliance and seamless integration into Brown University's existing base files.