

**City of Houston**

**Design Manual**

**Chapter 2**

**SURVEY REQUIREMENTS**

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2.01 CHAPTER INCLUDES

- A. Suggested guidelines for use by engineers in development of construction drawings and right-of-way maps inside the Houston city limits and outside the Houston city limits within the ETJ. These guidelines are required for Capital Improvement Projects designed under professional services contracts with the City of Houston.

2.02 REFERENCES

- A. Article IV, Chapter 33, City Surveys, of the Code of Ordinances.
- B. Professional Land Surveying Practices Act, latest revision.

2.03 DEFINITIONS

- A. Survey Field Books - Bound standard engineer's field books for transit and level, 7-1/4 inch by 4-3/4 inch.
- B. Data Collection Base - A database printout file reflecting station occupied, backsight, point number, angle, distance, elevations, and identification code; or station and offset left and right from a centerline or control line (transit, baseline, traverse, survey, etc.).
- C. City Surveyor - An authorized representative of the City having approval authority for privately-funded projects or having authority for administration of contracts for the City.
- D. GPS – Global Positioning System operated by US Department of Defense. When it is used with proper observation procedures and equipment, it can provide survey quality locations in terrestrial space.
- E. Site Control Monuments - Monuments needed to augment existing City monuments, conforming to standards established by the City Surveyor.

2.04 DESIGN REQUIREMENTS

- A. Adhere to these guidelines for Capital Improvement Projects designed under professional services contracts with the City of Houston.

2.05 SUBMITTALS

- A. For work performed through a professional service contract with the City, deliver field books and an electronic file in standard ASCII format (Point Number, Northing, Easting, Elevation, Description) at completion of the design phase. Photocopies or carbon copies of field books are not acceptable. Field books and electronic files will be retained in the City's permanent files.
- B. For right-of-way drawings identifying or describing acquisition of new or additional rights-of-way, deliver field books and database printout files to the City Surveyor or a designee of the City Surveyor. Additional documents to be submitted are:
  - 1. Overall map of rights-of-way with individual drawings of parcels identified on overall maps. Map or drawing media shall be mylar.
  - 2. Computer printouts of coordinate computations.
  - 3. Abstract information, all recorded plats and copies of instruments used (i.e., deeds) in preparation of the right-of-way drawings.
- C. For projects requiring new Site Control Monuments, the surveyor responsible for setting the monuments shall submit sealed City of Houston monument sheets, with necessary supporting data, to the City Survey Office.

## 2.06 QUALITY ASSURANCE

- A. Field surveying used in the development of construction drawings, calculations and preparation of right-of-way maps, and field note descriptions shall be performed by or under the direct supervision of a Professional Surveyor.
- B. Field notes, metes and bounds descriptions and right-of-way maps shall have the imprinted or embossed seal of the responsible Professional Surveyor and shall be dated and signed by the Professional Surveyor.
- C. When establishing Horizontal Control, surveyors shall transcribe onto the pages of a standard Survey Field Book, as described in Paragraph 2.03.A, all angles and distances, at the time of measurement, with an accompanying sketch. When establishing Vertical Control, the surveyor shall use differential leveling, or GPS methods, and transcribe the vertical data onto the pages of a standard Survey Field Book, with an accompanying sketch.
- D. For projects in which the Horizontal Control exceeds a distance of 2,000 feet from a found City of Houston monument, a Site Control Monument shall be set. Additional Site Control Monuments shall be set should the Horizontal Control exceed a radial distance of 2,000 feet from an existing City of Houston monument or newly set Site Control Monument. Obtain City monument designation numbers from the City Survey Office. If an existing Site Control Monument is used to reference the project, said Site Control monument must be re-observed

and re-submitted with the resultant horizontal and vertical coordinates. All recovery ties must be re-observed and present on the new recovery sheets.

## 2.07 FIELD WORK

- A. For engineering contracts with the City, field work shall be recorded in field books or electronic field books. Obtain a field book number from the Survey Section and record this identification in the title block on drawing sheets.
- B. The control line must be monumented at its beginning, end, and at angle points with markers of a permanent nature, such as iron rods, spikes, or other lasting identification. Make reference drawings for each control monument showing ties to planimetric features to allow easy recovery. Set markers at a maximum of 1000 feet on long lines. (Wherever practical, all Horizontal and Vertical Control monuments must be marked in such a way as to identify the surveyor in responsible charge.)
- C. Locate any found monuments and/or property corners and reference them to the design baseline according to the existing City of Houston survey system, as required by Article IV, Chapter 33, City Surveys, of the Code of Ordinances.
- D. Use the City datum (Code of Ordinances section 33, article 4) as a basis for all elevations. Set temporary bench marks (TBMs) within 200 feet of the beginning and end of each project baseline and at intervals not to exceed 1000 feet throughout the project.
- E. Show the stations of all side street construction centerlines with angular relationships or bearings of said centerlines of side streets with the main roadway centerline station.
- F. Record topographic features within the public right-of-way, proposed right-of-way, any contiguous easements to the right-of-way, and any construction right-of-way of the project and on intersecting streets for a distance of 20 feet beyond the intersection of the right-of-way lines. Identify all visible underground structures, such as inlets, manholes, and junction boxes, with size, depth, and type.
- G. Cross sections shall be taken at intervals of 100 feet for projects outside of the CBD. For projects within the CBD, take cross sections at 25 or 50 foot intervals. For levels recorded in field books, record rod readings or elevations as numerator and distance right or left of the base or centerline as the denominator. Data collector of a total station can be used to acquire necessary elevations at required intervals. Record elevation of driveways at intersection of driveway centerline with existing or proposed right-of-way line. Cross sections shall include a reading at the following points: street centerline, flow-line of ditch or gutter, curb or pavement edge, sidewalk, the existing or proposed right-of-way line, 20 feet beyond the right of way line if possible, and on intersecting streets for a distance of 100 feet beyond proposed pavement. See Figure 2.1 Perimeter of Standard Topographical Survey.
- H. For acquisition of new or additional rights-of-way:

1. Tie points of commencing (POCs) or points of beginning (POBs) for each parcel to the NSRS datum (CORS monuments).
2. Set iron rods or permanent markers at the intersections of the proposed right-of-way and property lines of parcels to be acquired.
3. Identify monuments, corners, angle points, points of curve (PCs), points of intersection (PIs), points of tangency (PTs), and other points as either "found" or "set." Describe each monument in such a way as to clearly define size, type of material and the nature of the monument, i.e., 3/4-inch iron pipe, 5/8-inch iron rod, cotton spindle, mag nail, etc.
4. Locate visible improvements, buildings, fences, permanent signs, utilities and other structures within 10 feet of the proposed right-of-way line.

## 2.08 CALCULATIONS

- A. Calculate coordinates of proposed right-of-way parcels, control points, found or set monuments, curve data, lengths, stations and offsets to monuments, and proposed improvement features.
- B. Computer printouts of the coordinate calculations should be submitted to the City with field books and database printout files.

## 2.09 CONSTRUCTION DRAWINGS

- A. Found monuments must be plainly shown on the drawings and located by station and distance, right or left from the control line, or construction centerline. Monuments used to establish the control line must be identified as Control Points, and their relationship to the construction centerline and to the proposed right-of-way lines must be shown. If the project is dimensioned from a control line, such as construction or design baseline, which is different than the control line referenced in Paragraph 2.07, it must be established and monumented in accordance with the requirements of Paragraph 2.07. Coordinates for transverse control points and all points of curve, points of tangency, and points of intersection along the design baseline shall be shown.
- B. Show location and identification of existing City survey monuments and found monument, by station and distance and whether right or left of control line or centerline. Show swing ties set for control or centerline control points using the City of Houston Recovery sheet format.
- C. Show and identify location of the City datum monuments and temporary bench marks used for elevation control. List the TBM located closest to that particular sheet in a station/offset, description and elevation format.

- D. Show centerline angles of intersection of side streets with main roadway centerline. Where bearings are used, identify source of bearings and show bearings on both control line and project centerline when they are not the same line.
- E. Identify locations of manholes, angle points, bends, etc., for proposed wastewater, storm sewers, water lines, and pavement features such as radius returns and centerlines of boulevard openings. Show relationship of proposed improvements to the right-of-way line.
- F. For bridges, overpasses and underpasses show top of pavement elevations at gutter line and centerline for the following locations:
  - 1. Construction joints
  - 2. Armor or expansion joints
  - 3. Intervals between bents that correspond to the increments used for dead load deflection calculations.
- G. For bridges and grade separations, drawings must incorporate layout sheets which identify proposed centerline and curve information plus:
  - 1. Surface coordinates for control points so that an inverse between coordinates reflects a surface distance. Identify origin of coordinate system used.
  - 2. Show coordinates of centerline or control line at PIs.
  - 3. Show coordinates of curb lines at their intersection with the centerline of bents and abutments for irregular structures.
- H. For all horizontal and vertical control monuments, show published coordinates expressed in units of U.S. Survey Feet and as a part of the Texas Coordinate System of 1983. Proper metadata for GPS – derived points should include the vertical adjustment, the Geoid used, the ITRF used and the current published coordinates of the base stations at the time of calculation.

## 2.10 RIGHT-OF-WAY MAPS

- A. Show "x," "y" values on monuments based on the City survey control and the scale factor used to convert grid coordinates to “surface” coordinates. All Distances shall be shown as “surface” distances and plainly marked as such. All bearings shall be based on the Texas Coordinate System of 1983.
- B. Distances on proposed right-of-way lines shall be continuous from beginning to end of the job. Show either straight line or arc distance across intersecting streets.

- C. Where a parcel is taken from a larger tract, show dimensions, distances, and area of the remainder of the tract based on recorded information.
- D. Identify the evidence used to decide the final placement or establishment of the proposed right-of-way line, such as angle points, or corner monuments, as either "set" or "found." The description of each point used shall be shown on the drawing as identified in the field survey.
- E. Grid Coordinate values of "x," "y" shall be shown for PCs, PTs, and PIs of curves on the proposed right-of-way lines. Curve data must include the following: delta, radius, arc length, chord length, and chord bearing.
- F. Grid Coordinate values of "x," "y" must be given on the POB of at least one tract in each block. Where the proposed right-of-way is to be acquired from a large tract of land, coordinate values should be given for the POB of field note description of the large tract.
- G. Other information to be shown on right-of-way maps:
  - 1. All visible improvements such as buildings, fences, permanent signs, utilities, and other structures located on the property or within 10 feet outside the right-of-way line, if accessible.
  - 2. Abstract information used in preparation of the right-of-way map.
  - 3. Field book numbers obtained from the City Surveyor.
  - 4. Real estate numbers obtained from the City Surveyor, right-of-way engineer, or Real Estate Division.

## 2.11 DOCUMENTS

- A. Where new construction will damage, destroy, or alter existing survey markers, include in specifications a requirement for installation of survey marker boxes by construction contractor at a unit price per box. The City Surveyor will determine the number and location of boxes to be furnished and installed by the contractor.
- B. Plats, metes and bounds description and field books shall have the Professional Surveyor's seal, signature and date affixed to the instrument.

END OF CHAPTER

FIGURE 2.1  
PERIMETER OF STANDARD  
TOPOGRAPHICAL SURVEY

