Attachment No. 2

Topographic/Site Survey Map Requirements

Topographic/Site survey maps shall include the following:

1. Map scale of 1" =20' shall be used on this project unless otherwise agreed upon by the Project Manager
2. Contour lines indicating the shape and elevation of the land over the area being surveyed at the 1-foot contour interval.
3. Spot elevations used to create the contours
4. Reference to the Los Angeles City Engineer Field Book for horizontal and vertical control and tied to Los Angeles Department of Water and Power horizontal control.
5. Ties to street control lines, intersections, monumentation, and established Right-of-Way line
6. Location of natural and manmade features including the surface expression of utilities
7. Survey control including elevation benchmarks established specifically for the project.
8. Subsurface utility scanning and mapping
9. Subsurface basement and structure scanning and 3D mapping.
10. Invert elevation of storm drain maintenance holes and catch basins
11. Additional details that need to be included are:
    a. North Arrow
    b. Scale, both graphic and descriptive
    c. Legend depicting symbols and abbreviations used in the drawing
    d. Title limits (legal description of survey)
    e. Surveyor, Professional Land Surveyor's Seal
    f. Date Survey
    g. Street names
    h. Street widths
    i. Street Control line information, (bearing and distances, curve data)
    j. A Basis of Bearings
    k. Delineation and labeling of surface materials, i.e., concrete, dirt, asphalt, brick, ceramic tiles, etc.
    l. Delineation and labeling and location of surface features, e.g. driveways, access ramps, curbs, gutters, drains, valves, meters, vaults, maintenance holes, power/communication poles, traffic signals, streetlights, street furniture's, etc.
    m. Location of all permanent and fixed structures including retaining walls, bridges, culverts, buildings, transmission towers, maintenance holes, fences, gates, etc.
    n. Plotting of record substructure information obtained from City substructure, Storm Drain, and Sewer Maps in the public right-of-way.
    o. Delineation and elevations of changes in surface grades, e.g., curbs, flow lines, swales, etc.
    p. Location and elevation of lakes, rivers, streams, or drainage courses on or near the survey limits
    q. Entry way elevation and doors (finished floor) if applicable
    r. Walls-heights, widths, and material
    s. Fences- height and material
    t. Trees over 4" in diameter. Trees need to be identified by the following broad categories: oak, palm, coniferous and all others.
    u. Work Order Number

v. Public easements as shown on the City of Los Angeles Cadastral Maps.
w. Permanent features and structures such as billboards, bus shelters, utility cabinets, benches, newspaper racks, parking signs and meters, traffic signs, etc.
x. Sewer maintenance hole inverts, if sewer relocation is needed for the project.

12. All deliverables shall be reviewed and approved by the BOE Survey Division.
13. All deliverables shall comply with the attached ***Exhibit 2A: BOE Survey Division Preliminary / Topographic Survey Guidelines for Sub-Consultant Engineers***

Survey General Requirement (GR1722)

The Consultant shall be responsible for all project survey services. The Consultant shall include the cost of all survey work in their bid. The Consultant shall have all surveying performed by a licensed land surveyor or a civil engineer registered by the State of California to perform such work. As a matter of distinction, the licensed land surveyor or professional engineer performing this work shall be referred to as "the project surveyor". the City Engineer reserves the right to verify all survey work performed by the contractor/project surveyor.

Consultant-supplied surveying services shall be in conformance with the California business and professions code, §§ 8700-8805 Chapter 15 "Professional Land Surveyors Act," whereby the contractor shall partner with / procure the services of a licensed land surveyor or professional civil engineer registered by the state of California to perform such work.

All survey monumentation shall be in place and all required accessory tie pages shall be filed with the city engineer prior to project close-out and the release of improvement bonds. After setting the final monuments, the "project surveyor" shall notify the Bureau of Engineering's survey division of the placement of the final monuments within five days of the monuments being set.

Valley District Survey Office (818) 374-4660
6262 Van Nuys Blvd. Suite 350
Van Nuys 91401
Email Address: Eng.surdivisionwr@lacity.org

Central District Survey Office (213) 473-0608
555 Ramirez St, Space 250
Los Angeles 90012
Email Address: Eng.surdivisionwr@lacity.org

A. Permanent Survey Control Network Markers

1. All Land Survey work within the City of Los Angeles shall be constrained to the City's Horizontal and Vertical Control Networks. The horizontal control shall be based upon the City's Centerline / Control Lines as noted in the City Engineer Field Books (C.E.F.B). In accordance with the California Business and Professions Code Section 8771 (b), City Municipal Code and Bureau of Engineering Land Development Standards, all survey monuments within or in near proximity to the project sites, are

to be diligently searched for, recovered or re-established and preserved for the duration of the project. Survey monuments, whether horizontal control or benchmarks shall be preserved by the project's Licensed Land Surveyor or Professional Civil Engineer registered by the State of California to perform such work. Preconstruction and post-construction tie notes must be furnished to the Bureau of Engineering's Survey Division for review and approval. The tie notes shall note the character of the monuments recovered or re-established, all recovered centerline ties, method of establishment, measure to at least four centerline ties and centerline data / measure to survey monumentation at adjacent intersections. The vast majority of City survey monuments were originally established by the intersection of best fit alignments of the recovered original monumentation and lines of occupation that were captured by the City's Survey Division shortly after the recordation of the original subdivisions (protraction). City survey monuments are to be established by retracing the survey lines run as shown on the City Engineer Field Books. City survey monuments may not be established solely by local evidence (local accessory ties) nor by Global Navigation Satellite System measure. The tie notes shall be of such quality, form and completeness, and shall be on paper of such quality and size as may be necessary to conform to the standardized office records of the City Engineer. All such notes shall be indexed by the City Engineer as part of the permanent public records of his office. A post-construction set of tie notes shall be required to memorialize the resetting of any survey monuments (centerline survey monument or accessory curb ties) that has been destroyed during the construction process. The post-construction tie notes shall conform to the same standards and be processed in the same manner as the pre-construction tie notes.

B. Layout of Contracted Work:

1. The CONTRACTOR shall be responsible for accuracy of all survey work for construction. The CITY ENGINEER reserves the right to verify all survey work done by the CONTRACTOR.

C. Construction Surveying Services

1. Construction Surveys shall conform to Chapter J 600 of the Bureau of Engineering Survey Manual, Part J. This manual may be purchased through the Bureau of Engineering Public Reference Center.

2. The CONTRACTOR shall provide all reference stakes and form checks necessary for construction and inspection of improvements. All construction staking shall be documented in survey field notes. This staking may include but is not limited to: removals, joins, rough grade, slope, utilities, storm drains, sewers, curbs, walks, paving, wall and building stakes; and any other staking necessary for construction and inspection.

D. Reference or Grade Stakes

1. A reference or grade stake shall be set for each grade change or angle point shown on the plan, standard plan, and shop drawing, in addition to the normal staking interval.

E. Form Checks

1. Forms shall be checked when durable points may be disturbed, removed, or are impractical to be used to verify the design location. The measured location shall be recorded in the survey field notes. All variations from the plan location shall be brought to the attention of the ENGINEER.

F. Staking Intervals and Offset Stake Lines

1. All staking intervals shall be in accordance with the Survey Manual, Figures J 615.224A&Am, J 615.225A, and J615.225Am. Stake lines shall be set at an offset distance from the improvement to ensure proper grade, station, and alignment.

G. Utility Stakes

1. The CONTRACTOR shall provide stakes for all utilities, public or private, that require location or relocation, unless otherwise stated.

H. Additional Survey Work

1. The CONTRACTOR may be required to furnish additional survey work, such as profiles, restakes, Change Orders, etc., at the request of the ENGINEER or the INSPECTOR.

I. Accuracy

1. The CONTRACTOR shall use appropriate surveying methods to obtain the following standards: For fixed works (i.e. cast-in-place concrete; asphalt pavement, pipes and drains; and other items determined by the ENGINEER) the following survey standards shall be used. The absolute horizontal accuracy, in relationship to the Engineer's control, shall be such that the semimajor axis of its 95% error ellipse is ±0.015 foot or less. The absolute vertical accuracy, in relationship to the Engineer's control, shall be such that its standard deviation is ±0.015 foot or less. The relative horizontal accuracy of survey points within the Project shall be such that the semimajor axis of its 95% error ellipse is ±0.015 foot or less. The relative vertical accuracy of survey points within the Project shall be such that its standard deviation is ±0.015 foot or less.

2. For excavation purposes, the following survey standards shall be used. The absolute horizontal accuracy, in relationship to the Engineer's control, shall be such that the semimajor axis of its 95% error ellipse is ±0.1 foot or less. The absolute vertical accuracy, in relationship to the Engineer's control, shall be such that its standard deviation is ±0.1 foot or less. The relative horizontal accuracy of survey points within the Project shall be such that semimajor axis of the 95% error ellipse is ±0.1 foot or less. The relative vertical accuracy of survey points within the Project shall be such that its standard deviation is ±0.1 foot or less.

J. Survey/Inspector

1. The CONTRACTOR shall provide to the INSPECTOR those measurements and control points necessary to determine the location and conformance to the plan, line, and grade of the improvements necessary for inspection purposes.

K. Survey/Engineer

1. The CONTRACTOR shall provide to the ENGINEER those measurements necessary for the expedient completion of the design of the project.

L. Survey Plan of Operations

1. Prior to design the CONTRACTOR shall submit to the ENGINEER for approval a survey plan describing methods and instrumentation to be used on the Project. The survey plan must be approved prior to any construction.

M. Survey Notes

1. The CONTRACTOR shall supply and keep notes on CITY standard format note sheets in conformance with Chapter J 600 of the Bureau of Engineering Survey Manual, Part J. The ENGINEER may request copies of, and otherwise review, survey notes at any time during the construction phase of the Project. Upon completion of the design of the project, the original survey notes shall become the property of the CITY and shall be delivered to the ENGINEER.

EXHIBIT 2A

ENGINEERING

CITY OF LOS ANGELES

SURVEY DIVISION

PRELIMINARY / TOPOGRAPHIC SURVEY GUIDELINES

(FOR SUB-CONSULTANT ENGINEERS)

DATE: 06/27/23

Preliminary / Topographic Surveys

To ensure conformity in workings and quality and accuracy of product, the following elements must be adhered to when performing “Preliminary / Pre-Design / Topographic Surveys” for the City of Los Angeles’s Bureau of Engineering (BOE).

Horizontal Control Points:

The horizontal control points for preliminary surveys are control line survey monuments, generally centerline survey monuments lying within the public roadways. These survey monuments comprise the City’s dense horizontal control network of over 100,000 control monuments. The survey monuments are memorialized within City Engineer Field Books, most available online via the Bureau of Engineer’s NavigateLA website. Those Field Books not found on the NavigateLA website can be obtained via the Bureau of Engineer’s Vault.

All Land Survey work within the City of Los Angeles shall be constrained to the City’s Horizontal and Vertical Control Networks. The horizontal control shall be based upon the City’s Centerline / Control Lines as noted in the City Engineer Field Books (C.E.F.B). In accordance with the California Business and Professions Code Section 8771 (b), City Municipal Code and Bureau of Engineering Land Development Standards, all survey monuments within or in near proximity to the project sites, are to be diligently searched for, recovered or re-established and preserved for the duration of the project. Survey monuments, whether horizontal control or benchmarks shall be preserved by the projects Licensed Land Surveyor or Professional Civil Engineer registered by the State of California to perform such work. Bench circuit level notes and tie page notes must be furnished to the Bureau of Engineering’s Survey Division for review and approval. The tie notes shall note the character of the monuments recovered or re-established, all recovered centerline ties, method of establishment, measure to at least four centerline ties and centerline data / measure to survey monumentation at adjacent intersections. As the vast majority of City survey monuments were originally established by the intersection of best fit alignments of the recovered original monumentation and lines of occupation that were captured by the City’s Survey Division shortly after the recordation of the original subdivisions (protraction). City survey monuments are to be established by retracing the survey lines run as shown on the City Engineer Field Books. City survey monuments may not be established solely by local evidence (local accessory ties) nor by Global Navigation Satellite System measure. The tie notes

shall be of such quality, form and completeness, and shall be on paper of such quality and size as may be necessary to conform to the standardized office records of the City Engineer. All such notes shall be indexed by the City Engineer as part of the permanent public records of his office.

Primary horizontal control monuments must be shown on the preliminary survey map. Project deliverables must include centerlines, right-of-ways and project boundaries established by the recovered or re-established survey monuments. Mapped distances shall note both record City Field Book measure and the field measure made by the project Surveyor or Engineer of Record.

The basis of the coordinate origin for all projects shall be based upon the City's NAD83 pseudo coordinate system. This is to say that a local coordinate obtained through the NavigateLA website shall be held at a single recovered or re-set survey monument nearest the project (The Origin Point or Origin Monument). Multiple coordinates cannot be held simultaneously as the City's pseudo coordinate system is a patchwork of precise historic field measure, once tied to NAD27, later approximated to NAD83 through algorithms.
These City Field Books and pseudo NAD83 coordinates can be obtained from the Survey Layer of the NavigateLA website.

Basis Of Bearings:

The NavigateLA coordinates of the "Origin Monument" shall be held at one end of a recovered or re-established City control line or City Centerline.

The NavigateLA bearing of said recovered or re-established control line or centerline shall serve as the "Basis of Bearings", (B.O.B.). The origin coordinate is to be held, field measure shall not altered.

A Survey Plat shall be prepared noting the horizontal control used for the preliminary survey.

Vertical Control Points:

The project shall be tied to two City of Los Angeles precise benchmarks (PBM's) near the project site. The most recent adjustment of the NAVD 1988 datum shall be held unless otherwise agreed upon. A BM level circuit shall be run from one precise benchmark to the other, utilizing all the previously established horizontal control points as turning points (TP). Side shots are not permitted in this level circuit. BM's (Spikes) will be set on top of curb at every intersection for construction purposes. If spikes are recovered at street intersection curb returns, they shall be utilized. If the block is relatively long (660 feet +/-) an additional BM will be set somewhere mid-block. This procedure essentially determines the elevations at all horizontal control points. The level circuit shall be included in the final "Survey Plat"

Field Survey Work:

For the purpose of brevity, this discussion will be limited to the salient aspects of the Survey Division's field procedure that may differ from other agencies or companies. Said work shall adhere to City description coding for symbols and linework.

When establishing primary horizontal control points, it is important to also establish the street C/L intersection survey monuments, one block away from the subject street on both sides, at every side street, as the observed street angles will be reflected in the map.

If stationing is shown on the map, it will be based on the measured lengths (never record, or reference) of the street C/L's. As a general guide, stationing will increase from north to south, and east to west.

The following topographic features shall be included in the preliminary survey:

Hardscape features including but not limited to curb & gutter, access ramps, driveways, sidewalks, concrete, asphalt concrete, walls, retaining walls, stairs, decorative concrete, parking meters, guard rails, mailboxes, fencing i.e., chain link, wood, wrought iron, etc. The condition of all hardscapes shall be noted (i.e., good condition, damaged, etc.)

Utilities including but not limited to sewer, storm drain, telephone maintenance holes, catch basins, drop in-lets, parkway culverts, CMP risers, power poles, telephone poles, guy wires, various pull boxes, traffic control panels, traffic signal poles, street light poles, irrigation control panels, water valves, water meters, fire detector checks, post indicator valves, fire hydrants, blow-offs, gas valves, gas meters, etc.

Vegetation including but not limited to trees (to include type of tree, trunk diameter in inches and dripline in feet), shrubs, planter areas, etc.

Office, processing of the field work:

The processing of the field work shall be performed using “Carlson Survey Version 2022” software. The BOE Survey Division shall provide a template drawing and the symbol library for the clients use.
Said drawing shall include both 3 dimensional and 2 dimensional linework. All points shall be processed, and symbols shall also be processed in accord with the provided AutoCAD template drawing and pdf samples drawings.
Said drawing shall provide a design level 3-dimensional surface, that shall also include contours and labels for the major contour indexes. This 3-dimensional surface will be relied upon by the BOE design teams.
Said drawing shall also include the control used, to include a point number, description, and City Field Book reference data. Record and measured angles shall also be noted if necessary. Right of ways shall be included, string dimensions shall note street widths.
Said drawing shall also include a north arrow, bar scale, BOE line type legend, BOE symbol legend, BOE abbreviations legend and note right of way.
Said drawing shall also refer to the “Survey Plat” created from the establishment of the horizontal and vertical control.

Product delivery:

A completed copy of the Survey Plat which notes a Basis of Bearings, the City Field Book pages used (copies of those pages shall also be included), and note of City Bench Marks used and the accompanying level notes.
A Completed AutoCAD rendering in Version 2020 drawing format, and a design level 3-dimensional XML file. The AutoCAD rendering shall be delivered in digital and pdf format.

Drawing Examples and Support Files:

Sample tie page form (PDF format)
Sample tie page (PDF format)
Sample Survey Plat (PDF format)
AutoCAD template drawing (Digital format)
Symbols and linetype library (contained in AutoCAD template drawing and PDF format)