

**CITY OF LOS ANGELES
DEPARTMENT
OF PUBLIC WORKS
BUREAU OF ENGINEERING
SURVEY DIVISION**

CONSTRUCTION

**STAKING
GUIDELINES**

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PURPOSE OF THIS MANUAL

The purpose of this manual is to provide Contractors, Project Engineers, Inspectors and other interested parties, with the Survey Division’s staking policies and standards for public works construction projects.

POLICY

The Survey Division will establish sufficient survey marks and/or stakes for the contractor to lay out the necessary work and for the Contract Administration Inspector to check the contractor’s work. Special circumstances that are not covered in this manual must be discussed with the assigned Survey Party Chief and a Survey Supervisor for approved method of staking.

All cuts, fills and offsets will refer to plan lines and grades. Changes from this policy must be approved by the Party Chief, Contractor, and Inspector. The approval must be shown by a note describing the change with all three signatures on the title page of the staking grade sheet.

The Survey Division will only survey those projects whose awarded contract documents specify that the City Engineer will provide survey services.

PROCEDURES

The information beginning on page 6 describes the Survey Division’s procedures for the various types of Public Works construction surveying.

STAKING POLICY

These standards are intended to be guidelines. They are not designed to cover every situation where stakes are required. The Project Engineer and the Party Chief will discuss the general staking policy with the Contractor at the pre-construction meeting.

Generally, all staking should be offset from the work it is intended to control and in such a manner that the construction work can be completed using common hand tools. Staking should remain undisturbed during construction so that continual control of the work can be maintained.

The Contractor shall be responsible for protecting stakes throughout the time they are needed. Should it become necessary to destroy stakes or monuments, the Project Engineer or Party Chief will be notified and given lead time to allow referencing the stakes for later use.

NOTE: In the following specifications “ENGINEER” refers to the City Engineer or his representative.

“Permanent Survey Markers” Standard Specification for Public Works Construction, 1997 Ed., Section 2, SCOPE AND CONTROL OF THE WORK, 2-9.1 states in part:

“The Contractor shall notify the Engineer at least 7 days before starting work to allow for the preservation of survey monuments, lot stakes (tagged), and bench marks.... The Contractor shall not disturb survey monuments, lot stakes (tagged), or bench marks without the consent of the Engineer.... The Contractor shall bear the expense of replacing any that may be disturbed without permission. Replacement shall be done only under the direction of the Engineer by a Registered (licensed) Land Surveyor or a Registered Civil Engineer authorized to practice land surveying within the state.”

“When a change is made in the finished elevation of the pavement of any roadway in which a permanent survey monument is located, the Contractor shall adjust the monument cover to the new grade within seven days of finished paving unless otherwise specified.”

Existing monuments including private property markers in the curb or sidewalk on the project must be located and referenced by the Survey Division prior to any construction or demolition, as per Section 8771 of the Business and Professions Code.

“Survey Service” Standard Specification for Public Works Construction, 1997 Ed., Section 2, SCOPE AND CONTROL OF THE WORK, 2-9.2 states in part:

“The Contractor shall notify the Engineer in writing at least 2 working days before survey services will be required in connection with the laying out of any portion of the Work. The Contractor shall dig all holes necessary for line and grade stakes.”

“Unless otherwise specified, stakes will be set and stationed by the Engineer for curbs, headers, sewers, storm drains, structures, and rough grade. A corresponding cut/ fill to finish grade (or flow line) will be indicated on a grade sheet.”

“Line and Grade” Standard Specification for Public Works Construction, 1997 Ed., Section 2, SCOPE AND CONTROL OF THE WORK, 2-9.4 states:

“All work shall conform to the lines, elevations, and grades shown on the Plans.”

“Three consecutive points set on the same slope shall be used together so that any variation from a straight grade can be detected. Any such variation shall be reported to the Engineer. In the absence of such report, the Contractor shall be responsible for any error in the grade of the finished work.” Grades for underground conduits will be set at the surface of the ground. The Contractor shall transfer them to the bottom of the trench.”

Staking Requests

Staking requests (see page 7 for form) are to be submitted by the General Contractor. Subcontractors will submit their requests through the General Contractor who will prioritize the requests. The Survey Party Chief will set stakes as soon as practicable, and in the order requested, noting the time of completion of each request and the date and time the grade sheets were delivered to the Contractor.

Reasonable notice is required so that the survey work can be intelligently planned and coordinated in accordance with the schedules established by the Contractor. The expression “reasonable notice” is not the same for all requests. Per the Standard Specifications for Public Works Construction, Section 2-9.3, ... “The Contractor shall notify the Engineer in writing at least 2 working days before survey services will be required in connection with the laying out of any portion of the Work.”

Staking requests should indicate when stakes are required and when the area is ready for staking. Calendar dates are necessary so that the Survey Party Chief can properly plan and expedite the work. On large projects the requests will be numbered sequentially. General staking requests, e.g. “Stake the Job” are not acceptable. The Project Engineer is responsible for settling disputes regarding staking priority. He/she should change the priority of staking when, in his/her opinion the Contractor has requested more staking than necessary or reasonable in a given period of time.

The Survey Division will provide the necessary line and grade as needed by the Contractor to do basic layout work. Stakes will be set so that the work being referenced can be completed by the Contractor using the ordinary tools of construction. Offsets will usually be in whole feet unless another offset is agreed upon by the Survey Party Chief and the Contractor.

Grade Sheets are available one working day after the field work is completed. Grade Sheets may be picked up at the appropriate survey office or arrangements can be made to FAX them to the Contractor. We can not hand deliver Grade Sheets.

The Survey Division may assist the Contract Administration Inspector in checking the Contractor’s work for compliance with the plans and specifications where the normal hand tools of the Inspector are not capable of doing the checking work. Normal hand tools are: pocket tape, plumb bob, carpenter’s level, hand level, string line/chalk line.

RESTAKING CHARGES

Construction stakes that are susceptible to being disturbed and/or destroyed by tractors, diggers or vandals should be requested in a timely manner to reduce exposure to these and other hazards.

“**Survey Service**” Standard Specifications for Public Works Construction, 1997 Ed., Section 2, SCOPE AND CONTROL OF THE WORK, 2-9.2 states in part:

“Except for private contracts, the Engineer will perform and be responsible for the accuracy of surveying adequate for construction. The Contractor shall preserve construction survey stakes and marks for the duration of their usefulness. If any construction survey stakes are lost or disturbed and need to be replaced, such replacement shall be by the Engineer at the expense of the Contractor.”

Based on the standard Specifications for Public Works Construction, the Contractor is responsible for protecting the stakes requested. The Contractor is also responsible for the replacement of stakes when they are lost or disturbed and need to be replaced. The Contractor will be charged for restakes. SEE RESTAKING REQUEST FORM ON PAGE SEVEN.

Re-staking charges will be based on the current costs for survey personnel plus overhead.

NOTE: AS STATED ABOVE ALL STAKING WILL BE TO PLAN LINES AND GRADES. STAKES WILL BE SET AT GRADE CHANGES, B.C.'S AND E.C.'S., ANGLE POINTS AND VERTICAL CURVE B.C.'S, E.C.'S AND G.C.'S AND THE STANDARD STAKING INTERVALS AS SHOWN ON PAGE 8.

A. ROAD PROJECTS

1. Clearing and Grubbing Stakes/Limits of Grading

- a. Stakes are generally set at sufficient intervals to provide line of sight between points, but not greater than 100 ft.
- b. Stakes are set for horizontal control only.
 - 1) On open ground without encroachment problems, a staking tolerance of 1 ft. will be employed.
 - 2) In urban areas where possible encroachments exist, staking tolerance will be \pm 0.1'

2. Rough Grade Stakes

- a. Rough grade stakes will be set after clearing and grubbing activities are completed by the Contractor.
- b. Two lines of rough grade will usually be set, one on each side of the road with the location to be determined in the field after discussion between the Survey Party Chief and the Contractor.
- c. See page 8 for staking intervals and page 9 for tolerances
- d. It should **not** be considered standard practice to use rough grade stakes for other construction purposes where a closer staking tolerance is necessary.

3. Slope Stakes

- a. Slope stakes are set at the daylight point with reference stakes typically at 10' offsets with cut or fill to the slope stake.
- b. See page 8 for staking intervals and page 9 for tolerances.

4. Pavement Stakes

Note: Paving stake cuts and fills are always referenced to or set to the plan finished grade unless otherwise agreed upon by the Survey Party Chief, Contractor, and Inspector, and noted by their signatures on the Grade Sheet Title Page.

- a. For roadways 44 feet wide or less, only plan elevations shall be staked. If the crown section varies between the plan C/L grade changes, then additional stakes will be referenced to, or set to, plan grade on the center line of roadway at intervals noted on page 8 of this document.
- b. Roadways more than 44 feet wide shall have PAVING STAKES set on all plan elevations. In addition the roadway crown shall be defined by lines of stakes set at prescribed intervals between plan grade changes.
- c. No stakes will be set for crowns defined by "T" sections.
- d. In intersections stakes are usually set-to-grade per plan elevations.
- e. See page 8 for staking intervals and page 9 for tolerances.
- f. Freeway staking will be set for join purposes only. ENCROACHMENT PERMITS will be required on all State Highways.

5. Curb Stakes

- a. Cuts and/or Fills will typically be given to top of curb at street face. If it is a variable curb face cuts and fills will be given to both top of curb and flow line.
- b. Stakes will be set after clearing and grubbing activities are completed by the Contractor.
- c. See page 8 for staking intervals and page 9 for tolerances.
- d. The offset will be determined by discussion with the Party chief and Contractor.

6. Sidewalks

Generally sidewalks are not staked.

B. WALL STAKES AND RETAINING WALL STAKES

1. Stakes will be referenced to the plan lines and grades.
2. At vertical breaks cuts or fills will be given to both grades.
3. See page 8 for staking intervals and page 9 for tolerances.

C. STORM DRAINS AND SEWERS

1. One line of stakes will be set prior to excavation **after** staking areas are ready for stakes, i.e. cleared and necessary grubbing completed.
2. The offset and side will be determined by discussion with Party Chief and contractor.
3. Cuts and fills will be to pipe flow line at plan grades
4. See page 8 for staking intervals and page 9 for tolerances

D. JUNCTION STRUCTURES, CHAMBERS AND MAINTENANCE HOLES

1. One stake will be provided to control the location of the beginning of pipe and one will be set to control the end of pipe.
2. Stub outs will have one stake for direction.
3. These stakes may be set at the same time as stakes for the main line of the storm drain or sewer.
4. Cuts and fills will be shown to flow line of referenced points.
5. The offset line for staking will be determined in the field by discussion between the Party Chief and the Contractor.

E. CATCH BASINS

1. Two stakes will be set to control the location of catch basins (3 if the CB is fourteen feet or longer).
2. Catch Basin stakes will typically be set at the same time as lateral stakes.
3. Cuts and fills will be given to the flow line and top of curb and offsets will be to curb face.
4. The offset line will be determined in field by discussions between the Party Chief, Construction Inspector and the Contractor.

F. DROP INLETS FOR SEWERS

1. One stake will be set to control the location of drop inlets.
2. Inlets and outlets will typically be staked at the same time as stakes for the main line of the storm drain.

G. DRY UTILITIES/NON GRAVITY FLOW UTILITIES

The Survey Division will not normally stake utilities unless specified in the bid documents. Utilities can usually be built from rough grade stakes or curb stakes.

H. PARKING LOTS

1. Set or recover boundary corner points and set a benchmark for future reference.
2. The Survey Division will set stakes necessary for construction for:
 - a. Planter and island curbs.
 - b. Longitudinal concrete gutters.
 - c. Paving stakes where there is more than 40 feet between curbs, gutters, alleys, driveways and walks.
 - d. Paving stakes will be set no closer than a 25' grid.
 - e. Stakes will not be set for items that have to be scaled off the plan for location.

**DEPARTMENT OF PUBLIC WORKS, BUREAU OF ENGINEERING
SURVEY DIVISION
SURVEY STAKING REQUEST**

PROJECT: _____

LIST IN ORDER OF PRIORITY	TYPE OF STAKING REQUESTED	LOCATION & DESCRIPTION INCLUDING CHANGE ORDERS, PLAN CLARIFICATIONS, RFI 's, ETC.	DATES			ORIG. OR RESTAKE (O/R)
			AREA READY	STAKES REQUIRED	COMPL-ETED	

COMMENTS _____

_____ REQUESTED BY:
_____ DATE _____
OF _____ (COMPANY) TELEPHONE _____

RESTAKING CHARGES

REASON: CONTRACTOR DID NOT PROTECT STAKES DATE _____
 AREA NOT READY ON DATE REQUESTED
OTHER: _____

COMMENTS: _____

HOURS WORKED TO RESTAKE = _____ DATE _____

PARTY CHIEF _____ PROJECT ENGINEER _____ INSPECTOR _____

FOR SURVEY DIVISION USE ONLY

SURVEY NO. _____ W.O. _____ TASK _____ SUB-TASK _____

FB _____ PG _____ GRADE SHEETS COMPLETED _____ PICKED UP _____ FAXED _____ MAILED _____

STANDARD INTERVALS FOR CONSTRUCTION STAKING - METERS

Curves will be divided into equal parts between BC and EC. Intervals refer to arc distance on the long side of concentric curves and are maximum limits

TYPE OF STAKES	TANGENT	CURVES (RADIUS IN METERS)							
		<15	15-22.5	22.5-30	30-45	45-60	60-75	75-150	>150
INTERVALS IN METERS									
SLOPE AT ALL RATES	15	6	6	6	6	7.5	7.5	6	15
PAVING (ROUGH , SUB AND FINISHED GRADE) ALL RATES	15	6	6	6	6	7.5	7.5	12	15
TYPE C CURB @ RATE = <0.5%	3.75	3	3	3	3	3.75	3.75	3.75	3.75
TYPE C CURB @ RATE = >0.5%	7.5	3	3	3	3	4.5	4.5	6	7.5
ALLEY GUTTER @ RATE =<0.50%	3.75	3	3	3	3	3.75	3.75	3.75	3.75
ALLEY GUTTER @ RATE =>0.50%	7.5	3	3	3	3	4.5	4.5	6	7.5
TYPE A OR B CURB (ALL RATES)	7.5	3	3	3	3	4.5	4.5	6	7.5
SEWER (ALL RATES)	7.5	3	3	3	3	4.5	4.5	6	6
STORM DRAIN (ALL RATES)	7.5	3	3	3	3	4.5	4.5	6	6
HEADER (STREET) ALL RATES	15	3	3	3	3	4.5	4.5	6	7.5
HEADER (ALLEY) ALL RATES	7.5	4.5	4.5	4.5	4.5	6	6	6	7.5
RETAINING WALL AND BULKHEAD ALL RATES	7.5	2	2.5	3	4.5	4.5	6	6	7.5

STANDARD INTERVALS FOR CONSTRUCTION STAKING - FEET

Curves will be divided into equal parts between BC and EC. Intervals refer to arc distance on the long side of concentric curves and are maximum limits

TYPE OF STAKES	TANGENT	CURVES (RADIUS IN FEET)							
		<50	51-75	76-100	101-150	151-200	201-250	250-500	>500
		INTERVALS IN METERS							
SLOPE AT ALL RATES	50	20	20	20	20	25	25	20	50
PAVING (ROUGH , SUB AND FINISHED GRADE) ALL RATES	50	20	20	20	20	25	25	40	50
TYPE C CURB @ RATE = <0.5%	12.5	10	10	10	10	12.5	12.5	12.5	12.5
TYPE C CURB @ RATE = >0.5%	25	10	10	10	10	15	15	20	25
ALLEY GUTTER @ RATE =<0.50%	12.5	10	10	10	10	12.5	12.5	12.5	12.5
ALLEY GUTTER @ RATE =>0.50%	25	10	10	10	10	15	15	20	25
TYPE A OR B CURB (ALL RATES)	25	10	10	10	10	15	15	20	25
SEWER (ALL RATES)	25	10	10	10	10	15	15	20	20
STORM DRAIN (ALL RATES)	25	10	10	10	10	15	15	20	20
HEADER (STREET) ALL RATES	50	10	10	10	10	15	15	20	25
HEADER (ALLEY) ALL RATES	25	15	15	15	15	20	20	20	25
RETAINING WALL AND BULKHEAD ALL RATES	25	6	85	10	15	15	20	20	25

**CONSTRUCTION ACCURACY SPECIFICATIONS
(FEET)**

TYPE OF STAKES	HORIZONTAL ACCURACY (IN FEET ±)		VERTICAL ACCURACY (IN FEET ±)
	STATIONING	ALIGNMENT	ELEVATIONS
CLEARING AND GRUBBING	1.0	1.0	N/A
REMOVALS	0.5	0.5	N/A
SLOPE STAKES	0.5	0.1	0.1
ROUGH GRADE	0.5	0.5	0.1
SUBGRADE	0.5	0.5	0.05
FINISHED GRADE	0.2	0.2	0.01
HEADER STAKES	0.1	0.02	0.02
CURB STAKES	0.2	0.01	0.01
FLOW LINE STAKES	0.2	0.01	0.01
SEWER STAKES	0.2	0.1	0.01
STORM DRAIN STAKES	0.2	0.1	0.01
BIKEWAY STAKES	0.3	0.1	0.02
WALL STAKES	0.2	0.02	0.1
PILE STAKES	0.02	0.02	0.1
BUILDING STAKES	0.01	0.01	0.01
BRIDGE STAKES	0.01	0.01	0.01

**CONSTRUCTION ACCURACY SPECIFICATIONS
(METRIC)**

TYPE OF STAKES	HORIZONTAL ACCURACY (METERS ±)		VERTICAL ACCURACY (METERS ±)
	STATIONING	ALIGNMENT	ELEVATIONS
CLEARING AND GRUBBING	0.3	0.3	N/A
REMOVALS	0.15	0.15	N/A
SLOPE STAKES	0.15	0.03	0.03
ROUGH GRADE	0.15	0.15	0.03
SUBGRADE	0.15	0.15	0.015
FINISHED GRADE	0.06	0.06	0.005
HEADER STAKES	0.03	0.005	0.005
CURB STAKES	0.06	0.005	0.005
FLOW LINE STAKES	0.06	0.005	0.005
SEWER STAKES	0.06	0.06	0.005
STORM DRAIN STAKES	0.06	0.06	0.005
BIKEWAY STAKES	0.09	0.06	0.005
WALL STAKES	0.06	0.005	0.03
PILE STAKES	0.005	0.005	0.03
BUILDING STAKES	0.005	0.005	0.005
BRIDGE STAKES	0.005	0.005	0.005