



Construction Staking Guide

2021 Edition



Orange County Public Works
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 **Public Works**

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I. Policy

A. General

- OC Survey is responsible for providing construction stakes which are used by the Contractor to establish line and grade for project construction. These stakes are also used by the Project Manager (PM) / Construction Inspector (hereafter referred to as simply "PM") to ensure contract compliance.
- This document provides policy regarding OC Survey furnished stakes, including procedure for requesting stakes, density of staking provided, positional tolerance, and markings.
- All OC Public Works construction projects shall be governed by the procedures established herein. In the event of special circumstances which dictate a variance from these established staking standards, the alternate staking method used shall be approved in advance by the PM and the Senior Land Surveyor.

B. Responsibilities as Related to Construction Staking

1. OC Survey

- Reviews site conditions for survey party safety
- Performs construction staking prior to contract award, as determined necessary by the PM
- Attends the pre-construction meeting with the PM and the Contractor
- Performs all construction staking activities as defined within this document
- Checks data furnished by the Project Engineer for completeness and discrepancies
- Checks the conformity of planned lines and grades with existing conditions at pavement joins, curb and gutter joins, inlets and outlets of drainage facilities, etc.; advises the PM of any problems; makes minor adjustments to lines and grades under the direction of the PM
- Advises the PM of any discovered design issues regarding lines and grades, and records the issues in a diary
- Keeps the PM informed of pertinent construction staking issues; accepts construction staking requests only from the PM; and keeps adequate records of construction staking efforts

2. Project Manager (PM)

- At the preconstruction meeting or other times, explains to the Contractor: the construction staking procedures as detailed in this document; the procedures and requirements for requesting construction staking; the requirements regarding preservation of construction stakes
- Resolves design issues regarding lines and grades; checks/approves line and grade adjustments made by OC Survey
- Coordinates priorities and schedules for all requests for construction stakes
- Verifies that the Contractor's requests for construction stakes are acceptable, including: the requested staking area is ready for stakes; the stakes will be used in a reasonable time period; requests for "original" stakes are truly original
- Determines when restaking costs are to be assessed to the Contractor
- Settles disputes regarding staking priorities and schedules
- Checks the final construction lines and grades against construction stakes to verify that the work was performed at the proper line and grade

3. Contractor

- Discusses scheduling of staking needs for Contractor operations and time estimates of staking operations with the PM and OC Survey at the pre-construction conference and throughout the project
- Submits requests for construction staking to the PM for approval a minimum of 2 working days in advance, on the approved form as attached herein, ensuring that the requested staking area is ready for stakes and that the stakes will begin to be used within 72 hours of staking
- Establishes priorities for requested construction stakes and notes the priorities on the staking request
- Coordinates construction operations so that areas to receive stakes are relatively clear of construction equipment activity, in order that stakes can be set in a safe and expeditious manner
- Preserves construction stakes, including those requested by the PM
- Sets working stakes as required to complete the work
- Reports suspect staking or design issues immediately to the PM

C. Requests for Construction Stakes

- Prior to contract award, requests for construction stakes are initiated by the PM. After contract award, most requests will be initiated by the Contractor.
- When the Contractor requires construction stakes, a formal request shall be submitted to the PM in writing. This written request may be transmitted to the PM via the "Request for Survey" form (see [Figure 1](#)), or on any other form approved by the PM.
- The PM shall review the Request to ensure the following: the type and location of requested staking is clearly identified; the area is indeed ready for staking and that stakes will be used in a timely manner; the "due" date allows a reasonable amount of time for staking operations to be completed; multiple listed tasks are prioritized; these will be original stakes and not a restake.
- The PM and OC Survey will discuss and resolve any issues regarding priorities and due dates, seeking clarification from the Contractor if necessary.
- When it is determined that the Request meets requirements outlined above, the PM will translate the information from the Contractor's written request to OC Survey's [Additional Survey Request](#) form (see [Figure 2](#)) and deliver via online submittal, through the Project Management software (Easy Projects). **No stakes will be set without receipt of this online Request.**
- OC Survey will begin staking within 2 working days of receipt of the Request. Some requests for stakes will require more time to complete, and thus the Contractor must allow for a due date extension beyond the standard 2 business days. The Contractor, PM, and OC Survey will discuss staking time estimates.
- In the event the area is not satisfactorily prepared for staking, the Request will be voided by the PM and the Contractor must submit a new Request when the area or facility has been properly prepared. If a survey party has been mobilized to an area that is not ready for stakes, the PM may assess the Contractor with restaking charges for the survey party's time. OC Survey will document the time as directed below under "Section D – Restaking."
- After receiving the Request from the PM, OC Survey will schedule the work. To facilitate scheduling, Requests will include calendar dates to indicate when the stakes are needed and all Requests should be specific as to area and types of stakes to be set. If no priority number is listed on a Request listing multiple items, staking will proceed in the order listed.
- When all tasks of a Request have been completed, OC Survey will notify the PM in writing (e-mail) and provide the PM with a copy of the field notes and/ or cutsheet/s (see [Figure 3](#)) for all work performed. OC Survey shall notify the PM when a Request believed to be for original stakes is actually for restaking.

- With regards to the use of construction stakes by the Contractor, as per the [Standard Specifications for Public Works Construction](#), Section 2-9.4, “*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 (PM). In the absence of such report, the Contractor shall be responsible for any error in the grade of the Work.*”
- Stakes not used within **72 hours of being set** will be considered to be of suspect integrity and to be used at the Contractor’s own risk. Inspection and/or resetting of aged stakes by OC Survey will incur restaking charges (see “[Section D – Restaking.](#)”)

D. Restaking

- As per the [Standard Specifications for Public Works Construction](#), Section 2-9.2, “If any construction survey stakes are lost or disturbed and need to be replaced, such replacement will be performed by the Engineer (OC Survey, under the direction of the PM) at the expense of the Contractor.”
- Requests which represent a restake shall be clearly identified as such. OC Survey will complete a “[Restaking Form](#)” (see [Figure 4](#)) and submit it along with the field notes to the PM.
- Witness lath for stakes representing a restake shall be marked with black flagging in addition to the typical flagging color shown in [Section V](#) below.



Figure 1 - Request for Survey

REQUEST FOR SURVEY ORANGE COUNTY SURVEYOR

NAME OF PROJECT	WORK ORDER No.	REQUEST NUMBER
LIMITS OF PROJECT		

REQUESTED BY	PHONE NUMBER	DATE
AUTHORIZED SIGNATURE	DIVISION/SECTION	
START SURVEY BY	COMPLETE SURVEY BY	TENTATIVE CONST. DATE

WORK REQUESTED (PLEASE BE SPECIFIC)

--

DESCRIPTION AND REASON FOR PROJECT

--

ADDITIONAL COMMENTS

--

Figure 2 - Additional Request for Survey Page 1

AN INITIAL SURVEY REQUEST FOR THIS PROJECT MUST HAVE BEEN SUBMITTED AND APPROVED PRIOR TO THIS REQUEST.

Additional Requests are to be used for extra work or staking request related to existing Survey project.

OC Survey Field Services Additional Survey Request Form

Project Name

Job Code #


Request #

Requestor Name

Requestor E-mail

Requestor Phone

Date Requested

Authorized Requestor Supervisor (E-Mail)

☐ **I have reviewed the request and have determined that it meets the below criteria:**

- **The type and location of requested staking is clearly identified**


Figure 2 - Additional Request for Survey Page 2

- The area will be ready for staking and the stakes will be used in a timely manner
- The “construction” date allows a reasonable amount of time for staking to be completed


Requesting Service Area

-- Please select--

Target Start Date (Subject to Change per Further Correspondence)



Target Delivery and/or Construction Date



Work Requested (Please Be Specific)

Additional Comments

File attachment

Choose file

Wade Weaver, Deputy County Surveyor

Figure 3 – Example Cutsheet



Sewer Line

Project: Greenville Banning Channel



Request Number:	17	JOB File Name:	2019-11-13 Sewer.JOB
Date Received:	11/12/2019	Survey Crew:	F. Boyd and Party
Date Completed:	11/13/2019	Grades To:	Invert (unless noted)

ATTENTION CONTRACTOR: The following rules must be observed when using survey stakes provided by the Orange County Surveyor: Cuts / Fills are given from the TOP of hub or nail. Stakes are NOT to be used without cut sheets. When a conflict exists between data on cut sheets and markings on survey stakes, the cut sheets are to be deemed paramount. No single stake is to be used without consideration of adjacent stakes; that is, three consecutive stakes that are known to be on the same line and rate of slope must be used in common, in order that any variation from this straight line or grade may be identified. In the event such discrepancy in the stakes is found, or if it is apparent that stakes do not reflect the intent of the most current approved contract plans, the Survey Party Chief must be notified ASAP. Otherwise the Orange County Surveyor will NOT be responsible for any error in the finished work. Stakes not used within 72 hours of being set will be considered to be of suspect integrity and to be used at Contractor's own risk. Inspection and/or resetting of aged stakes by the Orange County Surveyor will incur restaking charges as dictated by Section 2-9.2 of the "Standard Specifications for Public Works Construction".

Point Number	Station	Offset	Stake Elevation	Design Elevation	Cut / Fill
10001	10+00.00 CL MH #1	10.00 Rt	29.21	29.40	Fill 0.19 Rim
10002	10+02.00 Begin Pipe	10.00 Rt	29.22	23.05	Cut 6.17
10003	10+25.00	10.00 Rt	29.59	23.34	Cut 6.25
10004	10+50.00	10.00 Rt	29.96	23.65	Cut 6.31
10005	10+75.00	10.00 Rt	30.29	23.96	Cut 6.33
10006	11+00.00	10.00 Rt	30.66	24.28	Cut 6.38
10007	11+25.00	10.00 Rt	31.01	24.59	Cut 6.42
10008	11+50.00	10.00 Rt	31.37	24.90	Cut 6.47
10009	11+75.00	10.00 Rt	31.62	25.21	Cut 6.41
10010	12+00.00	10.00 Rt	31.92	25.53	Cut 6.39
10011	12+25.00	10.00 Rt	32.06	25.84	Cut 6.22
10012	12+50.00	10.00 Rt	32.34	26.15	Cut 6.19
10013	12+75.00	10.00 Rt	32.61	26.46	Cut 6.15
10014	12+98.00 End Pipe	10.00 Rt	32.84	26.75	Cut 6.09
10015	13+00.00 CL MH # 2	10.00 Rt	32.86	33.00	Fill 0.14 Rim

Figure 4 - Restaking Form

Restaking Form for Construction Projects

Project: _____ Work Order No: _____

Date of Restaking: _____ Request No: _____

Date of Original Staking: _____ Request No: _____

Type of Staking Performed: _____

Limits of Restaking: _____

Reason for Restaking: _____

Party Chief's Comments: _____

Survey Personnel: _____ Time Spent on Staking: _____ Hours

Construction Inspector's Name

Party Chief's Name

Construction Inspector's Signature

Party Chief's Signature

II. Pre-Construction Conferences

A. Project Manager/OC Survey

- After the Project Manager (PM) has been assigned to a construction project, a preconstruction meeting between the PM and OC Survey should be scheduled. Any OC Survey Senior Land Surveyor(s) and Party Chief(s) permanently assigned to a project should attend this meeting. The purpose of this meeting is to establish a working relationship between the PM and OC Survey, and to review the anticipated survey work, including tentative schedules and project-specific safety issues. Anticipated staking requirements prior to contract award should also be discussed.

B. Resident Engineer/Contractor

- After a Contractor has been selected, a pre-construction meeting between the PM and the Contractor will be scheduled. OC Survey should attend this meeting. At this time the Contractor will be given a copy of this Construction Staking Guide with an explanation that, along with the Standard Specifications, it represents OC Survey procedures concerning County furnished construction stakes. OC Survey should be prepared to describe the types, density, placement and marking of stakes, and explain the construction staking request process. The need for preserving stakes and the restaking process should also be discussed.



III. Stake Tolerances and Documentation

A. Tolerances Defined

- Tolerances stated for each type of staking outlined within this document indicate the acceptable deviation of the position of each stake from its computed position relative to the given alignment and grade. For features requiring higher accuracies, such as structures, stakes may also be bound by a positional tolerance relative to each other.
- When stakes are positioned within these tolerances, they are deemed “good”. Staked positions are generally checked using stakeout tolerance reports, and if within tolerance, the staked position is accepted. Tolerances are not to be confused with accuracy standards. Accuracy is a function of the random errors associated with the survey methods and procedures that are used for the entirety of the survey project, including project control, construction control, and stakeout set-up points. Accuracy standards indicate the expected variation in position based on random errors for the set-up points, not variation in the construction stakes themselves.

B. Checking

- Sufficient independent field checks shall be made at the discretion of OC Survey to assure the positional integrity of the stakes. The integrity of stakeout control points should be verified before use by making check measurements to/from other control points.
- All positions staked in the field should be checked against the computed positions and the results recorded in electronic stakeout tolerance reports.

C. Field Notes

- Construction staking operations shall be documented by reports, sketches, or other suitable format, collectively known as “cut sheets” and will be filed with the PM upon completion of the survey. The PM shall provide copies to the Contractor.

D. Archiving of Survey Data

- Electronic cut sheets shall be transferred to an OC Survey staff PC along with associated stakeout tolerance reports. Sketches or hand-recorded notes will be scanned and filed electronically.
- Data Collector Job files shall also be transferred to an OC Survey staff PC.

IV. Stake Markings

A. General – Physical Nature and Use of Stakes

- The term “stake” refers to a physical object set to facilitate establishment of line and grade on construction projects. Stakes may be wooden hubs, nails, ink marks, etc. and are typically set flush (at ground level) in dirt, asphalt, or concrete.
- Stakes are set as a reference to the position of the actual feature being constructed, and are most often set on an offset.
- Stakes set in dirt are typically accompanied by witness lath, 2 to 4 feet in height, which are marked with information necessary to establish the horizontal and/or vertical position of the feature to be constructed. Stakes set in asphalt or concrete will not have witness lath, but will be marked on the pavement surface with paint or ink.
- Offsets are measured from the center of the stakes (or when present, the tack in wooden hubs). Cuts/fills (collectively referred to herein as “cuts”) are measured from the top of the stakes.

B. Typical Stake Markings

- See “Figure 5” for examples of witness lath and painted stake markings

C. Abbreviations

- See “Figure 6” for a list of abbreviations used with stake markings



Figure 5 - Typical Stake Markings

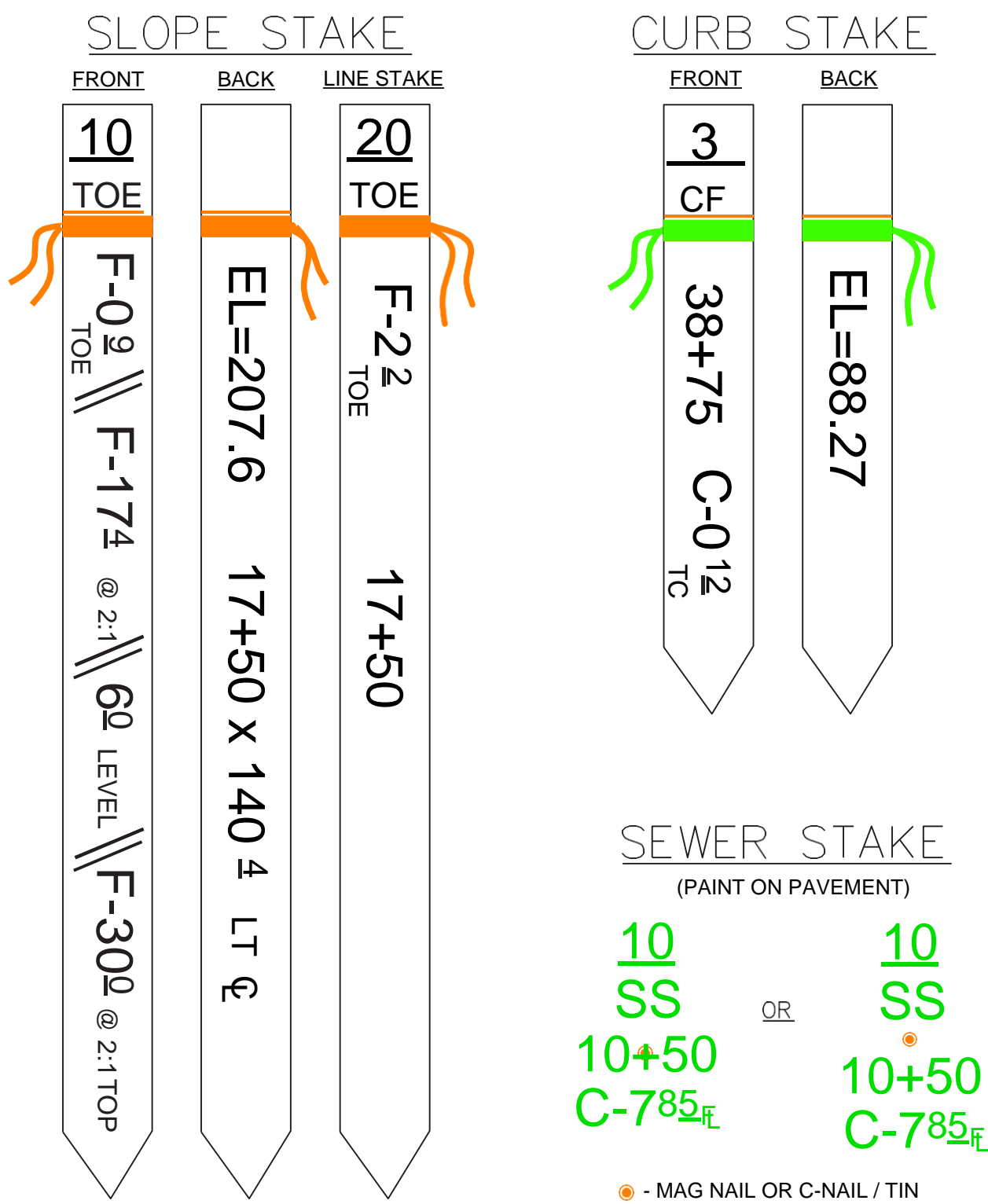


Figure 6 - Standard Abbreviations

Abutment	ABUT	Finished Floor	FF
Ahead	AHD	Finished Grade	FG
Air Relief Valve	ARV	Finished Surface	FS
Angle Point	ANG PT	Fire Hydrant	FH
Asphalt	AC	Flowline	FL
At	@	Grade Break	GB
Back	BK	Grade Line	GL
Bearing	BRG	Hinge Point	HP
Begin	BEG	Invert of Pipe	INV
Begin Curb Return	BCR	Junction Structure	JS
Begin Bridge	B	Layout Line	LOL
Begin Horizontal Curve	BC	Left	LT
Begin Vertical Curve	BVC	Manhole	MH
Bench Mark	BM	Offset	O/S
Bottom of Footing	BOF or BF	Point	PT
Bottom of Pipe	BOP or BP	Point of Compound Curvature	PCC
Building Corner	BLDG COR	Point of Reverse Curvature	PRC
Building Outline	BDO	Point on Curve	POC
Catch Basin	CB	Point on Line	POL
Catch Point	CP	Portland Cement Concrete	PCC
Cathodic Test Station	CTS	Pressure Relief Valve	PRV
Centerline	CL	Property Line	PL
Column	COL	Radius	RAD or R
Concrete	CONC	Radius Point	RAD PT
Construction	CONST	Reference Point	RP
Control Point	CP	Reinforced Concrete Box	RCB
Corrugated Metal Pipe	CMP	Reinforced Concrete Pipe	RCP
Corrugated Steel Pipe	CSP	Retaining Wall	RW
Curb Face	CF	Right	RT
Curve Increments	$\frac{1}{4} \Delta$, $\frac{1}{2} \Delta$, etc.	Right of Way	ROW or R/W
Cut	C	Sanitary Sewer	SS
Ductile Iron Pipe	DIP	Slope Stake	SS
Drop Inlet	DI	Station	STA
Driveway	DWY	Station Line	SL
Edge of Deck	EOD	Storm Drain	SD
Edge of Pavement	EP	Subgrade	SG
Edge of Shoulder	ES	Temporary Bench Mark	TBM
Edge of Traveled Way	ETW	Top of Curb	TC
Elevation	EL or ELEV	Top of Footing	TOF or TF
End Curb Return	ECR	Top of Pipe	TOP or TP
End Bridge	EB	Top of Wall	TOW or TW
End Horizontal Curve	EC	Turning Point	TP
End Vertical Curve	EVC	Vitrified Clay Pipe	VCP
Equation	EQ	Water Valve	WV
Existing	Exist	Wing Wall	WW
Fill	F		

V. Typical Staking Provided

A. Earthwork and Roadway Staking

1. Clearing and Grubbing / ESA / Limits of Grading

- Color: Red
- Spacing: As needed to ensure intervisibility, but not greater than 100 feet
- Tolerances: Rural Areas - within 1.0 feet horizontally; urban areas or where possible encroachments exist - on a case by case basis
- Markings: No offsets necessary - stakes set on actual line; elevations will not be recorded
- Notes: No reference stake necessary - lath only may be set

2. Slope Staking

- Color: Orange
- Spacing: 100 feet in tangents; 50 feet in horizontal curves with radius of less than 1000 feet or where cuts are greater than 10 feet
- Tolerances: Within 0.25 feet for stationing; 0.15 feet for offset distance; 0.1 feet for elevation
- Markings: Offsets referenced to actual or theoretical catch point with incremental cuts to ultimate top, toe, or hinge point; cuts recorded to 1 decimal place; if line stakes are provided, they will also be referenced horizontally and vertically to catch point.
- Notes: Although the actual slope stake "catch points" may be located and referenced in real time on the existing ground, these actual catch points are generally not located in the field. Instead, theoretical locations are determined from the Plans and cross-section information. Thus the catch points as referenced might not actually fall on the ground surface - they might fall above or below the ground surface. In this case, it is the Contractor's responsibility to determine the actual ground location of the catch point.

Slope Staking (cont.)

- Slope Rounding: The need for slope rounding will be determined by OC Survey personnel in cooperation with the PM. General slope rounding staking guidelines, based on the slope rounding length, are as follows:
 - Length of 20 feet or less: No slope rounding references provided. It is the responsibility of the Contractor to construct the slope rounding as shown on the Plans.
 - Length of 20 feet to 40 feet: Beginning, mid-point, and ending (the catch point) are referenced.
 - Length of 40 feet to 90 feet: Beginning, quarter points, mid-point, and ending (the catch point) are referenced.
 - Length of 90 feet or greater: Slope rounding points are referenced at an interval of 30 feet.

3. Terrace Drains

- Color: Orange
- Spacing: 100 feet in tangents; 50 feet in horizontal curves with radius of less than 1000 feet; also at BCs, ECs, and grade breaks
- Tolerances: Within 0.25 feet for stationing; 0.15 feet for offset distance; 0.1 feet for elevation
- Markings: Offsets referenced to top, toe, hinge point, or centerline of v-ditch; cuts recorded to 1 decimal place
- Notes: Stakes will be set as slopes are being “dressed” to their finished grade

4. Rough Grade

- Color: Orange
- Spacing: 100 feet in tangents; 50 feet in horizontal curves with radius of less than 1000 feet or where cuts are greater than 10 feet; also at BCs, ECs, angle points, and grade breaks
- Tolerances: Within 0.25 feet for stationing; 0.15 feet for offset distance; 0.1 feet for elevation
- Markings: Offsets referenced to top, toe, or hinge point; cuts recorded to 1 decimal place
- Notes: Stakes will be set after clearing/grubbing activities have been completed. Also, after slopes are constructed using provided slope stakes, rough grade stakes will be set to reference final top/toe locations and used to “dress” slopes to their finished grade.

5. Pavement Final Grade (Edge of Pavement, Crown, etc.)

- Color: Fluorescent green
- Spacing: 50 feet in tangents; 25 feet in horizontal curves with radius of less than 1000 feet, in vertical curves, or where grades are flatter than 1.0 percent; also at BCs, ECs, angle points, BVCs, EVCs, and grade breaks
- Tolerances: Within 0.15 feet for stationing; 0.03 feet for offset distance; 0.02 feet for elevation
- Markings: Offsets referenced to edge of pavement; cuts to finished surface recorded to 2 decimal places
- Notes: On roadways with no median curb, it is preferred to set edge of pavement stakes and crown stakes on common stations, so that string lines may be pulled to establish grade across the full width of the roadway. Typically a crown is staked with a zero offset, set at grade as a "blue top" for subgrade or top of aggregate base or with cuts to finished surface recorded to 2 decimal places. "Blue tops" set for establishment of an intersection grid are set at grid intersection positions shown on the Plans. Tolerances for grid points are 0.15 feet horizontally and 0.02 feet for elevation and are recorded to 2 decimal places.

6. Curb and Gutter

- Color: Fluorescent green
- Spacing: 50 feet in tangents; 25 feet in horizontal curves with radius of less than 1000 feet, in vertical curves, or where grades are flatter than 1.0 percent; smaller spacing as needed to accurately represent flares, tapers, and curb returns; also at BCs, ECs, angle points, BVCs, EVCs, and grade breaks
- Tolerances: Within 0.15 feet for stationing; 0.03 feet for offset distance; 0.02 feet for elevation
- Markings: Offsets referenced to face of curb; cuts to top of curb recorded to 2 decimal places
- Notes: One line of stakes set for each side of roadway and median; roadways with no median may require a row of stakes establishing finished grade along crown (as outlined above)

7. Driveways

- Color: Fluorescent green
- Spacing: When specific driveway details are included in the plan set, stakes will be set so as to accurately represent the provided details; otherwise spacing is as follows:
 - One stake set at centerline of driveway in tangents; also one stake set at top of "x" on each side of driveway when in horizontal curves with radius of less than 1000 feet, in vertical curves, or where grades are flatter than 1.0 percent
- Tolerances: Within 0.1 feet for stationing; 0.03 feet for offset distance; 0.02 feet for elevation
- Markings: Stake at centerline of driveway - offsets referenced to face of curb, width of driveway is recorded, cuts are not recorded; stakes at top of X - offsets referenced to face of curb, cuts to top of curb recorded to 2 decimal places
- Notes: Stakes for driveways are typically set at the same time as stakes for adjacent curb and gutter

8. Curb Ramps

- Color: Fluorescent green
- Spacing: When specific curb ramp details are included in the plan set, stakes will be set so as to accurately represent the provided details; otherwise one stake set at centerline of ramp; line only stakes (or radius point) will also be set
- Tolerances: Within 0.1 feet for stationing; 0.03 feet for offset distance; 0.02 feet for elevation
- Markings: Offsets referenced to face of curb, back of sidewalk, and/or grade break; cuts to top of curb and/or finished surface recorded to 2 decimal places
- Notes: Stakes for curb ramps are typically set at the same time as stakes for adjacent curb and gutter



B. Walls, Fences, Buildings, and Minor Structures

1. Retaining Walls

- Color: Orange
- Spacing: 25 feet in tangents and horizontal curves; also at BCs, ECs, angle points, BVCs, EVCs, grade breaks, and vertical footing steps
- Tolerances: Within 0.15 feet for stationing; 0.02 feet for offset distance; 0.02 feet for elevation
- Markings: Offsets referenced to wall layout line; cuts to top or bottom of footing (whichever is shown on the Plans) recorded to 2 decimal places
- Notes: Angle points may be staked at either "ahead" or "back" stations but must be clearly indicated as such on lath; cuts at vertical footing steps given for both design grades ; no reference will be made to top of wall unless this is the only grade shown on Plans; in areas requiring more than 2 feet of grading, rough grade stakes will be provided, but note that NO stakes will be set for footing back-cuts

2. Fences

- Color: Yellow
- Spacing: 100 feet in tangents; 50 feet in horizontal curves with radius of less than 1000 feet; also at BCs, ECs, and angle points
- Tolerances: Within 0.25 feet for stationing; 0.1 feet for offset distance where not adjacent to Right of Way, 0.03 feet for offset distance where adjacent to Right of Way
- Markings: Where fence is not adjacent to Right of Way, offsets referenced to centerline of fence; where fence is adjacent to Right of Way, offsets referenced to Right of Way; elevations will not be recorded
- Notes: If Right of Way is monumented, clearly mark existing monuments and notify the Contractor and PM that the monuments must be preserved; refer the Contractor to Standard Plan 600-0-OC to reinforce the relationship between the positions of fence posts and monuments; follow all provisions of Section 8771 of the Business and Professions Code with regard to preservation of existing monumentation

3. Building Layout

- Color: Orange - rough grade; white - final grade
- Spacing: At major building corners, or on building grid lines when provided
- Tolerances: Within 0.03 feet horizontally and 0.02 feet relative to other stakes for the same structure; 0.02 feet for elevation
- Markings: Offsets referenced to building line, or to grid line intersections when provided; cuts referenced to finished floor or other relevant feature shown on Plans
- Notes: One set of rough grade stakes and one set of final grade stakes will be provided; building corners and angle points call for one stake perpendicular to each face or a single stake perpendicular to both faces and labeled, for example, as "5 x 5"; before concrete is poured, certification of forms will be provided as necessary

4. Minor Structures (Sign Bases, Misc. Foundations)

- Color: White
- Spacing: One or two pairs of stakes per structure, one pair along station line and/or one pair at 90 degrees to station line
- Tolerances: Within 0.03 feet horizontally and 0.02 feet relative to other stakes for the same structure; 0.02 feet for elevation
- Markings: Offsets referenced to centerline of foundation; cuts referenced to elevation point noted on Plans
- Notes: Where possible, orient each pair of stakes so that the center of foundation lies at the mid-point of the line strung between the two stakes



C. Major Structures

1. Rough Grade

- Color: Orange
- Spacing: As shown below for final grade
- Tolerances: Within 0.1 feet horizontally and 0.1 feet relative to other stakes set for the same structure; 0.1 feet for elevation
- Markings: Offsets referenced as shown below for final grade; cuts referenced to bottom of footing recorded to one decimal place
- Notes: Curved piers staked with radial offsets to pier centerline
- One set of rough grade stakes (alignment only) may be set along edge of deck at ground level to facilitate placement of falsework

2. Bridge Piers

- Color: White
- Spacing: One pair of stakes at each end of pier, along pier centerline
- Tolerances: Within 0.03 feet horizontally and 0.02 feet relative to other stakes set for the same structure; 0.02 feet for elevation
- Markings: Offsets referenced to end of pier wall; cuts referenced to bottom of footing recorded to two decimal places
- Notes: Stakes will not be set for individual pile locations; curved piers staked with offsets radial to pier centerline

3. Bridge Columns – Bent Foundations

- Color: White
- Spacing: One pair of stakes for each column foundation, either along bent centerline or at 90 degrees to bent centerline
- Tolerances: Within 0.03 feet horizontally and 0.02 feet relative to other stakes set for the same structure; 0.02 feet for elevation
- Markings: Offsets are referenced to bent centerline; cuts to bottom of footing recorded to two decimal places
- Notes: Stakes will not be set for individual pile locations

4. Bridge Abutments

- Color: White
- Spacing: One pair of stakes at each end of abutment, along abutment centerline bearing
- Tolerances: Within 0.03 feet horizontally and 0.02 feet relative to other stakes set for the same structure; 0.02 feet for elevation
- Markings: Offsets referenced to end of abutment; cuts to bottom of footing recorded to two decimal places
- Notes: Stakes will not be set for individual pile locations

5. Bridge Wing Walls

- Color: White
- Spacing: One pair of stakes at end of each wing wall, along wing wall layout line
- Tolerances: Within 0.03 feet horizontally and 0.02 feet relative to other stakes set for the same structure; 0.02 feet for elevation
- Markings: Offsets referenced to end of wing wall; cuts to bottom of footing recorded to two decimal places
- Notes: Stakes will not be set for individual pile locations; curved wing walls staked with offsets radial to wing wall layout line

6. Bridge Superstructure – Edge of Deck

- Color: White
- Spacing: 25 feet; also at BCs and ECs
- Tolerances: Edge of deck stakes within 0.1 feet for stationing; 0.02 feet for offset distance
- Markings: Stakes are referenced to Edge of Deck
- Notes: Stakes are typically cup tacks with flagging set in plywood soffit forms at a zero offset; elevations and cuts are not provided

7. General Notes Regarding Structures

- Prior to placement of falsework, Temporary Bench Marks (TBMs) will be provided at base of columns, typically one per bent
- After columns are constructed, TBMs will be provided on top of columns, typically one per bent
- No cuts will be provided for bridge decks – interpretation and layout of deck contours will be the responsibility of the Structural Representative

D. Utilities

1. Sewer Lines

- Color: Fluorescent green
- Spacing: 25 feet in tangents and horizontal curves; also at BCs, ECs, begin/end pipe, and slope anchor stations; line-only stakes set at begin/end pipe stations
- Tolerances: Within 0.15 feet for stationing; 0.1 feet for offset; 0.02 feet for elevation
- Markings: Offsets referenced to centerline of pipe; cuts to invert recorded to 2 decimal places
- Notes: Stakes for laterals are typically set at the same time as stakes for mainline

2. Storm Drains

- Color: Orange
- Spacing: 25 feet in tangents and horizontal curves; also at BCs, ECs, begin/end pipe, grade break, and slope anchor stations; line-only stakes set at begin/end pipe stations
- Tolerances: Within 0.15 feet for stationing; 0.1 feet for offset; 0.03 feet for elevation
- Markings: Offsets referenced to centerline of pipe; cuts to invert recorded to 2 decimal places; cuts to rim at centerline manholes recorded to 2 decimal places
- Notes: Stakes for laterals are typically set at the same time as stakes for mainline

3. Catch Basins

- Color: Fluorescent green - when staked with curb; orange - when staked with storm drain
- Spacing: One pair of stakes is set (one offset to face of curb and one line-only stake) at the beginning and end of each catch basin, in line with the inside walls of the structure (or outside walls, if that is what is referenced on Plans)
- Tolerances: Within 0.1 feet for stationing; 0.03 feet for offset; 0.02 feet for elevation
- Markings: Offsets referenced to face of curb; cuts to top of curb recorded to 2 decimal places
- Notes: If stakes are set at the same time as adjacent curb and gutter stakes, line-only stakes may be omitted

4. Manholes and Junction Structures

- Color: Fluorescent green - sewer; orange - storm drain
- Spacing: Stakes set at begin/end pipe stations and key stations labeled "Sta." on Plans (refer to OC Public Works Standard Plans); line-only stakes set at begin/end pipe and key stations; also see "Notes" below
- Tolerances: Within 0.1 feet horizontally; 0.02 feet for elevation
- Markings: Offsets referenced to centerline of pipe; cuts to invert, "Elev. R", or "Elev. S" (refer to OC Public Works Standard Plans) recorded to 2 decimal places
- Notes: Manholes and junction structures are typically constructed using stakes set for sewer or storm drain mainline, thus no special staking is needed; stakes for laterals are typically set at the same time as stakes for mainline

5. Drop Inlets

- Color: Orange
- Spacing: One pair of stakes is set (one offset to center of inlet and one line-only stake) for each drop inlet
- Tolerances: Within 0.1 feet horizontally; 0.03 feet for elevation
- Markings: Offsets referenced to centerline of inlet; cuts to "Elev. A" (refer to OC Public Works Standard Plans) recorded to 2 decimal places
- Notes: Stakes for drop inlets are typically set at the same time as stakes for mainline and laterals

6. Water Lines

- Color: Blue
- Spacing: 100 feet in tangents; 50 feet in curves with radius of less than 1000 feet; also at BCs, ECs, angle points, valves and other accessories, and grade breaks
- Tolerances: Within 0.15 feet for stationing; 0.15 feet for offset distance; 0.1 feet for elevation
- Markings: Offsets referenced to centerline of pipe; cuts to top or bottom of pipe recorded to 1 decimal place
- Notes: Stakes will only be set per master project plan set – “shop drawings” or “lay sheets” produced by/for the contractor shall NOT be used; fire hydrants and other accessories located behind curb will be referenced horizontally and vertically to face of curb and top of curb respectively, with tolerances of 0.15 feet for stationing, 0.03 feet for offset distance, and 0.02 feet for elevation

7. Gas Lines and Dry Utilities

- Color: White
- Spacing: 100 feet in tangents; 50 feet in curves with radius of less than 1000 feet
- Tolerances: Within 0.5 feet for stationing; 0.15 feet for offset distance; 0.1 feet for elevation
- Markings: Offsets referenced to face of curb; cuts to top of curb recorded to 1 decimal place
- Notes: If utilities are to be placed parallel/concentric with curb and gutter, curb stakes or existing curb shall be used as reference and no additional staking is necessary.



E. Flood Control Channels and Basins

1. Earthen Levees and Retarding Basins

- Color: Orange
- Spacing: 100 feet in tangents; 50 feet in horizontal curves with radius of less than 1000 feet; also at BCs, ECs, angle points, and grade breaks
- Tolerances: Within 0.3 feet for stationing; 0.15 feet for offset distance; 0.1 feet for elevation
- Markings: Offsets referenced to outside hinge point of levee or inside hinge point of basin; cuts recorded to 1 decimal place
- Notes: Stakes will be set after clearing/grubbing activities have been completed

2. Concrete Lined Channels – Rough Grade

- Color: Orange
- Spacing: 100 feet in tangents; 50 feet in horizontal curves with radius of less than 1000 feet; also at BCs, ECs, angle points, and grade breaks
- Tolerances: Within 0.3 feet for stationing; 0.15 feet for offset distance; 0.1 feet for elevation
- Markings: Offsets referenced to hinge point; cuts to hinge point and grade line recorded to 1 decimal place
- Notes: Stakes will be set after clearing/grubbing activities have been completed

3. Concrete Lined Channels – Bottom Stakes

- Color: White
- Spacing: 25 feet in tangents and horizontal curves; also at BCs, ECs, angle points, and grade breaks
- Tolerances: Within 0.15 feet for stationing; 0.03 feet for offset distance; 0.02 feet for elevation
- Markings: Offsets referenced to grade line or flow line; cuts to finished surface recorded to 2 decimal places
- Notes: One line of stakes is set to control each grade line; an additional line of stakes may be set to control low flow line, where applicable; stakes will be set after rock has been placed and graded in bottom of channel

4. Concrete Lined Channels – Top Stakes

- Color: White
- Spacing: 50 feet in tangents; 25 feet in horizontal curves with radius of less than 1000 feet; also at BCs, ECs, angle points, and grade breaks
- Tolerances: Within 0.15 feet for stationing; 0.03 feet for offset distance; 0.02 feet for elevation
- Markings: Offsets referenced to hinge point or face of wall; cuts to hinge point or top of wall recorded to 2 decimal places
- Notes: Stakes will be set after invert has been poured

5. Sheet Pile Walls – Top Stakes

- Color: White
- Spacing: 50 feet in tangents; 25 feet in horizontal curves with radius of less than 1000 feet; also at BCs, ECs, angle points, and grade breaks;
- Note that the spacing defined above may be modified at the request of the PM on a project by project basis
- Tolerances: Within 0.15 feet for stationing; 0.03 feet for offset distance; 0.02 feet for elevation
- Markings: Offsets referenced to face of wall; cuts to top of wall recorded to 1 decimal places
- Notes: After piles have been driven, a second line of stakes may be set to control concrete pile cap

6. Paved Access Roads

- Color: Fluorescent green
- Spacing – asphalt roadways: 50 feet in tangents; 25 feet in horizontal curves with radius of less than 1000 feet, in vertical curves, or where grades are flatter than 1.0 percent; also at BCs, ECs, angle points, BVCs, EVCs, and grade breaks
- Spacing – concrete roadways: 25 feet in tangents and horizontal curves; also at BCs, ECs, angle points, BVCs, EVCs, and grade breaks
- Tolerances: Within 0.15 feet for stationing; 0.03 feet for offset distance; 0.02 feet for elevation
- Markings: Offsets referenced to edge of pavement; cuts to finished surface recorded to 2 decimal places
- Notes: Stakes will be set after channel walls have been constructed

