Caltrans Order (See Notes 1 and 2)	STANDARDS			PROCEDURES				TYPICAL APPLICATIONS	
	RELATIVE	POSITIONAL ACCURACY		MONUMENT SPACING AND TYPE		SURVEY METHODS			
	STANDARDS	HORIZONTAL	VERTICAL	HORIZONTAL	VERTICAL	HORIZONTAL	VERTICAL	HORIZONTAL	VERTICAL
Five Millimeter (0.015 ft) Network Accuracy	Supersedes Former Caltrans Order B or better for GNSS surveys	0.005 m or less 95% confidence circle Network Accuracy	0.005 m or less 95% confidence vertical Network Accuracy Equivalent to First Order, Class I proportional standards	10,000 ft min. (3,000m) CORS/CGPS Receivers or passive monument types Per Sec. 5.8-1	Average Spacing 1.0 mi (1.6 km) Maximum 1.8 mi (3 km) NGS 3-D monuments	GNSS : Static	Use NGS First Order standards	Primary Control monuments - Basis of Coordinates / Bearings.	Used in Lieu of FGDC First Order, Class I Vertical Control Network Standards (Not required for Caltrans Projects)
One Centimeter (0.03 ft) Network Accuracy	Supersedes First Order for GNSS surveys; Used in lieu of Second Order. Class I vertical	0.010 m (0.03 ft) or less 95% confidence circle Network Accuracy	Equivalent to Second Order, Class I proportional standards	2300 ft min. (700 m) Monuments types Per Section 5.8-2	Average Spacing 1.0 mi (1.6 km) Maximum 1.8 mi (3 km) NGS 3-D monuments	GNSS : Static / Fast Static (See NOTE 3)	Differential : Digital level / Invar bar code rod	Corridor or Project control: Azimuth Pairs- Basis of Coordinates / Bearings (See NOTE 4)	Geodetic Control - Used in lieu of FGDC Second Order Class I proportional vertical surveys
Two Centimeter (0.07 ft) Network Accuracy	Used in lieu of Caltrans Second Order (Class II) for GNSS surveys	0.020 m (0.07 ft) or less 95% confidence circle Network Accuracy	Equivalent to Third Order Proportional Accuracy	1860 ft min. (570 m) Monument types Per Section 5.8-2	Average Spacing 4.3 miles (7 km) Monuments per Section 5.8-2	GNSS : Static/ Fast Static Total Station System (TSS) Traverse	GNSS: Static/ Fast-Static Differential : Digital or Optical level with standard rod	Primary Project Control , Base Stations and Azimuth Pairs to be saved for future projects. (See NOTE 5)	Used in lieu of Third Order proportional vertical surveys for GNSS network surveys
0.07 ft (Two Centimeter) Local Accuracy	Substitute for Horizontal and Vertical Third Order surveys	0.07 ft (0.02 m) or less 95% confidence circle Local Accuracy	Equivalent to Third Order Proportional Accuracy	500 ft (140 m) Min. Monuments as above or 30" - #6 Rebar with metal or plastic cap	Maximum Spacing 10 turns (4400 ft) Monuments same as above	GNSS : Static/ Fast Static / Real Time Kinematic (RTK); TSS Traverse	Differential: Digital or Optical levels with standard rod; TSS - trigonometric leveling	Land net surveys and Supplemental Project Control - Traverse between Azimuth Pairs	Densification of vertical Project Control network
0.2 ft (Five centimeter) Local Accuracy	Substitute for General Order surveys	0.2 ft (0.05 m) or less 95% confidence circle Local Accuracy	N/A	N/A	N/A	GNSS: RTK TSS: Sideshot within 500 ft (Gound)	GNSS : RTK ; TSS - Same as horizontal; Optical level or better	Topographical features (signs, water valves, etc.), High-Risk utilities, existing culverts	Original Ground elevations, utility As-Builts
0.3 ft (Ten centimeter) Local Accuracy	Substitute for General Order surveys	0.3 ft (0.1 m) Local Accuracy	N/A	N/A	N/A	As needed	As needed	Utility As-builts and 2-D locations	Utility As-builts
3 FT (One meter) Resource Accuracy	N/A	3 ft (1 m)	N/A	N/A	N/A	GNSS Receiver with correction signal	N/A	Locating features for GIS database, such as signs, trees, or drainage pipes	N/A
33 FT (Ten meter) Resource Accuracy	N/A	33 ft (10 m)	N/A	N/A	N/A	GNSS Receiver without correction signal	N/A	Locating sites of interest, such as environmentally senstive areas or accident scenes.	N/A

NOTE 1: Network accuracy is described as the accuracy of a control that represents the uncertainty of its coordinates with respect to the geodetic datum at the 95-percent confidence level.

NOTE 2: Local accuracy is the relative accuracy between local control points and represents the uncertainty of its coordinates relative to other directly connected, adjacent control points at the 95-percent confidence level.

NOTE 3: Static GNSS methods required if baseline lengths are greater than 12 miles - See Chapter 6A.5

Note 4: 1-cm. Network Accuracy is the preferred accuracy for Horizontal Control Surveys directly tied to NGS CORS and using the latest NSRS Datum Tag. 2-cm Network accuracy is the minimum accuracy for project control surveys.

NOTE 5: See Section 5.7 for relative position precision for Azimuth Pairs

CALTRANS ORDER	STANDARDS			MONUMENT SPACING AND SURVEY METHODS (NOTE 5)			APPLICATION – TYPICAL SURVEYS	
	CLASSICAL		POSITIONAL	MONUMENT SPACING	TYPICAL SURVEY METHOD			
	HORIZONTAL (Note 5)	VERTICAL (Note 5)		(TYPICAL)	HORIZONTAL	VERTICAL	HORIZONTAL	VERTICAL
FGDC Second, Class I	1:50,000	e = 0.025√M (NOTE 6)	Equivalent to 1 cm. Horiz. and Vertical Network Accuracy	TSSS 2300 ft Min Vertical - 1.6 km (1.0 mi) average	Total Station Trig Network	Digital Bar code level with Invar Staff	Precise Control for structures and tunnels (Not required for typical projects)	Geodetic Control (Rare)
Caltrans Second (FGDC Class II)	1 : 20,000	e = 0.035√M	Equivalent to 2 cm. Horiz. Network Accuracy Only	TSSS 930 Ft. Min Vertical - 3 km (1.8 mi) average	Total Station Trig Network	Digital Bar Code Leveling 3-Wire Optical Leveling	Corridor and Project Control – Horizontal Interchange and Major Structure control	Preferred Project Control Major Structure points (staked)
Third	1 : 10,000	e = 0.05√M	Equivalent to 2 cm Horiz. And Vertical Local Accuracy	As Required	Total Station Network or Traverse	Bar-Code or Optical Level Total Station - Trig Leveling	Supplemental Control Construction Control Photo. Control – Horizontal Right of Way Surveys (NOTE 7) Construction Surveys (NOTE 8) Engineering Surveys (NOTE 9) STLS and MTLS Control Points	Project Control – Vertical Supplemental Control Photo. Control – Vertical Construction Surveys (NOTE 7) Engineering Surveys (NOTE 8) STLS and MTLS Control Points
G (General)	1: 1,000	0.1 per 100 feet	Used in lieu of 0.2 ft Local Accuracy	Not Applicable	Total Station Steel or Nylon Tape	TS: Trig Leveling, Single Wire, Direct Elevation Rod, Hand Level	Topographic Surveys (Data Points), Supplement Design Data Surveys, Construction Surveys (Staked Points), Right of Way Flagging, Asset Inventory Surveys, Archeological Surveys, Environmental Surveys, Historical Preservation Surveys, Monitoring Surveys, Earthwork Surveys such as stockpiles, borrow pits, and	

NOTE 5: Proportional or relative accuracy accuracy is described as the ratio between the overall length of a traverse and the misclosure of the final course.

NOTE 6: M= Distance of level run, in miles.

NOTE 7: See Chapter 10 for the accuracy requirements of Right of Way Surveys

NOTE 8 : See Chapter 12 for the accuracy requirements of Construction stakes

NOTE 9 : See Chapter 11 for the accuracy requirements of engineering surveys