

# 2014

## SCRRA Geodetic Survey Control Network System Wide Project Summary Report



Prepared for the Southern California  
Regional Rail Authority

By Rail Surveyors and Engineers, Inc.

26 April, 2014

**A Summary of the Preparation and Performance  
of the System Wide Geodetic Survey Control Network along the  
River, Valley, Ventura, Orange, and San Gabriel Subdivisions  
Kern, Los Angeles, Ventura, Orange and San Gabriel Counties, California**

**General**

This Geodetic Control Network (GCN) was established in order to provide the Southern California Regional Rail Authority (SCRRA) with a system-wide survey control network for future corridor improvements within the territories owned and operated by the SCRRA. An integrated control system will establish consistency and continuity along the corridors allowing for multiple construction projects operating under separate contracts to maintain a consistent datum. The GCN was designed to meet the standards set forth by the Federal Geodetic Subcommittee and outlined in the California Department of Transportation's Survey Standards (Figure 5-1) to achieve B-Order standards for horizontal accuracy. Every effort was made to constrain to the geodetic surveying guidelines as presented in the documents "NOAA Technical Memorandum NOS NGS-58" and "NOAA Technical Memorandum NOS NGS 59." These documents outline the proposed guidelines for establishing both ellipsoidal (NOAA 58) and subsequently calculating orthometric heights (NOAA 59) using Global Navigation Satellite Systems. This GCN also adheres to the standards set forth for Geodetic control surveys and the California Coordinate System per the California Public Resources Code Sections 8801-8819, 8850-8861, 8870-8880, and 8890-8902.

The GCN is designed to provide positional data as required by the geodetic surveyor to establish Third or General Order survey control as needed throughout the SCRRA's Valley, Ventura, and River subdivisions. The expected relative geodetic accuracy is 0.010 meters (0.0328 ft) horizontally and 0.020 meters (0.0656 ft) vertically, relative to the GRS80 ellipsoid.

*Special Circumstances*

*The GCN was performed as a two part survey system. The Valley, Ventura, and River Subdivisions portion of the GCN was surveyed April-May of 2013, while the Orange, Olive, and San Gabriel Subdivisions portions were more recently surveyed in February-March-April of 2014. This posed a challenge within the adjustment. The adjusted positions from the latter surveyed network, where overlapped, were not cohesive with the recently surveyed positions. In order to achieve a maximum level of precision within the network it was decided to re-run all survey data within a single adjustment for all subdivisions and re-deliver this information as a whole. A table outlining the separations is provided as Addendum C below.*

***This Survey Report is written in conjunction with the report published under CTO-004***

**Monumentation**

Every effort was made to utilize previously established passive geodetic control monuments set and filed by the National Geodetic Survey (NGS) or similar agency. In the absence of an established monument, new points were set into substantial structures that can be reasonably expected to experience little, if any, movement under normal circumstances. Respective control point locations were chosen with regard not only for point stability, but also for safety (from train movement, vehicular traffic, potential construction activity, etc), ease of access, horizon clarity, and permanency.

## **Horizontal Datum**

This GCN is based on the National Spatial Reference System (NSRS) and the North American Datum of 1983 (NAD83). All geodetic surveying work performed adheres to this datum.

## **Epoch**

On September 06, 2011, the NGS updated the National Spatial Reference System positions and velocities for all Continuously Operating Reference Station (CORS) sites to NAD83 (2011, MA11, PA11). Rail Surveyors and Engineers, Inc. (RSE) realized this datum epoch by utilizing 13 separate CORS, chosen for their relative position to the geometry of the GCN proposed during the initial analysis of the rail corridors. Refer to Appendix A for additional information pertaining to the individual CORS sites used to establish this GCN.

## **Heights, Elevations**

During the adjustment of the network, discrepancies between heights obtained from North American Vertical Datum of 1988 (NAVD88) benchmarks and the corresponding GPS-derived orthometric heights were discerned. So as to maintain vertical continuity throughout the network, RSE decided not to constrain to the leveled NAVD88 elevations and therefore omitted them from the adjustment. It was decided to hold the GPS-derived ellipsoidal heights instead. The differences between the NAVD88 elevations and the GPS-derived orthometric heights are found in Appendix B of this report.

On September 11, 2012 the NGS updated its geoid model to GEOID12A. RSE applied the GEOID12A model to all GPS-derived ellipsoidal heights in its calculation of control point orthometric heights. All GCN control point heights are GPS-derived orthometric heights.

## **Vertical Datum**

Fourteen (14) NGS vertical monuments (Leveled NAVD88) were used as part of a vertical datum quality control study. The leveled heights were compared to the GPS-derived orthometric heights and any differences between these values were evaluated. As mentioned above, RSE chose to exclude leveled NAVD88 heights so as to maintain vertical continuity. The vertical datum for the GCN is NAVD88 and shall be referred to as “GPS Derived-California Orthometric Heights of 1988”, as defined in the California Public Resources Code Sections 8890-8902.

## **California State Plane Coordinates**

The GCN lies within Zones 5 and 6 of the California State Plane Coordinate System. Geodetic values will be reduced to both systems and delivered accordingly.

## **Control Network**

The GCN is comprised of sixty-four (64) control points. The weight of these monuments is equal in all aspects but to conform to the processing and adjustment requirements of NOAA-58 and NOAA-59, as well as subsequent application of GPS-derived heights, the suffixes are meant to separate the points as follows:

- P - Primary Control Points (40-km separation)
- S - Secondary Control Points (15-km separation)
- L - Local Control Points (7-km separation)

## Network Adjustment

Three constrained, 3-D adjustments were applied to the observed static baselines. These are designed to follow the guidelines outlined in NOAA-58 and NOAA-59. They are as follows:

1. Primary (“P”) Point Constraints - Average Spacing 40km (See Exhibit A)
  - a. All static observations made on the P-class control points were processed in conjunction with nearby CORS. These baselines were processed in every possible configuration within the parameters of less-than-75km and with minimum occupation times of five (5) hours. Loop closure reports are available with the QA/ QC documentation
  - b. Post-processed baselines were then imported into the StarNET Version 7 Least Squares Adjustment Module. Minimally and fully constrained adjustments were processed and reviewed. Only the CORS coordinate and elevation values (which define a respective station’s Geodetic Reference Mark and are listed on the associated NGS datasheet) were held during this adjustment. The resulting, adjusted coordinates and elevations of the P-class control points were then held for subsequent processing. Copies of both the fully and the minimally constrained adjustment reports are available as part of the QA/ QC documentation.
2. Secondary (“S”) Point Constraints - Average Spacing 15km (See Exhibit B)
  - a. All static observations made on S-class control points were processed in conjunction with P-class points. These baselines were processed in every possible configuration within the parameters of less-than-75 km and with minimum overlapping occupation times of 30 minutes.
  - b. Post-processed baselines were then imported into the StarNET Version Least Squares Adjustment Module. Fully constrained adjustments were processed and reviewed. During the adjustment of S-class control points, coordinates and elevations of the P-class points were held. The resulting coordinates and elevations of the S-class points were then held for subsequent processing. Copies of both fully constrained adjustment reports are available as part of the QA/ QC documentation.
3. Local (“L”) Point Constraints - Average Spacing 7km (See Exhibit C)
  - a. All static observations made on L-class control points were processed in conjunction with P- and S-class points. These baselines were processed in every possible configuration within the parameters of less-than-75km and with minimum occupation times of 30 minutes. Loop closure reports are available with the QA/ QC documentation.
  - b. Post-processed baselines were then imported into the StarNET Version 7 Adjustment Module. Fully constrained adjustments were processed and reviewed. Fixed values utilized during this adjustment include the adjusted coordinates and elevations of the P- and S-class control points. That these positional values were held during this last adjustment, which resulted in finalized coordinates and elevations of the L-class control points, no further processing of the network was necessary. Copies of both fully constrained adjustment reports are available as part of the QA/ QC documentation.

## **Deliverables**

1. Control point coordinates and elevations will be delivered per the following:

- NAD83, Zone 5 of the California State Plane Coordinate System
  - o Point ID, Northing, Easting, Orthometric Height, Geoid Separation (US Survey Feet), Scale Factor, Elevation Factor, Combined Factor (Grid to Ground)
- GRS80
  - o Latitude, Longitude, Ellipsoidal Height (US Survey Feet And Meters)

2. Each Control Point will have a corresponding recovery sheet that includes all relevant information (positional and recovery) necessary for its utilization.

3. A file in Keyhole Markup Language (.kml), readable by Google Earth Mapping software and other geographic information systems (GIS) applications.

## **Network Densification**

To accommodate the plane surveyor, RSE recommends densifying this GCN in terms of Third or General Order accuracy standards as a single campaign. This includes the setting of intervisible azimuth pairs at crucial locations (e.g. – at-grade crossings, stations, centralized traffic control block limits, etc.).

## **Application**

In order to consistently apply the GCN geometry to specific projects it is recommended that the project surveyor utilizes RTK GPS to set project control from a minimum of two (2) control points. It is essential to perform differential leveling for each project specific control network in order to ensure localized vertical precision. It is recommended that the project surveyor utilizes a least squares adjustment engine (eg. StarNET, LGO, TGO) to derive positional data with the inclusion of GPS vectors and differential leveling data. The application of NAVD88 leveled elevations is at the discretion of the project specific surveyor.

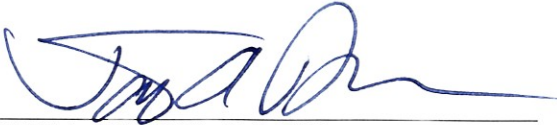
## **Monitoring**

As Southern California lies within an area of moderate to severe tectonic movement, RSE recommends that the SCRRA monitor this GCN for movement at a minimum of every three years or following any significant seismic event.

## **Recordation**

It is the recommendation of RSE to the SCRRA that per The Professional Land Surveyors Act (Business and Professions Code) Sections 8726(f), 8762(a), and 8875-8899, a Record of Survey be prepared and recorded in the Counties of Los Angeles, Ventura, Orange, San Gabriel and Kern in which the survey was performed. This will provide a public record of the control network ensuring availability to Engineering and Land Surveying contractors working within the corridors. This will also ensure that Engineering and Land Surveying contractors are working with the same datum throughout the corridors which will therefore enhance the accuracy and consistency of their work.

Prepared by Cody Festa, LSIT No. 7780 under the supervision of:



JAMES A. DRENON, PLS 6153  
Expires 03/31/2016



## Summary of SCRRRA Control Points:

See 2014 – SCRRRA\_Control.kml for Google Earth Application, File Attached in CD

Pnt ID	Northing	Easting	Ortho-- metric Height	Latitude	Longitude	Ellipsoidal Height	Combined Sale Factor	Adjacent Subdivision	Zone
L001	2115736.602	6515594.465	2303.893	34.80599248	-118.15348033	2197.959	0.99981744	Mojave (UPRR)	5
L002	2073381.724	6521852.573	2380.902	34.68963640	-118.13244680	2274.715	0.99981388	Valley	5
L003	2026034.584	6526976.631	2747.829	34.55955341	-118.11522042	2642.693	0.99980127	Valley	5
L004	1995161.534	6505907.795	2788.963	34.47463305	-118.18501016	2684.114	0.99980529	Valley	5
L005	1982750.733	6468377.259	2067.697	34.44027655	-118.30941059	1961.332	0.99984292	Valley	5
L006	1974201.525	6424709.634	1444.388	34.41632903	-118.45411212	1334.748	0.99987524	Valley	5
L007	1944482.762	6409379.108	1454.774	34.33446609	-118.50444863	1343.057	0.99988414	Valley	5
L008	1906647.446	6445366.458	870.975	34.23093803	-118.38476307	758.688	0.99992675	Valley	5
L009	1868152.801	6485091.879	450.145	34.12550657	-118.25301716	337.203	0.99996517	Valley	5
L010	1828318.557	6505264.300	188.482	34.01616888	-118.18612025	72.794	1.00000028	San Bern. (BNSF)	5
L011	1807298.744	6540020.599	157.500	33.95853197	-118.07137994	41.661	1.00001506	San Bern. (BNSF)	5
L012	1925987.123	6318991.375	716.503	34.28202773	-118.80335565	602.153	0.99992661	Ventura	5
L013	1917982.870	6362003.577	1122.659	34.26089452	-118.66079781	1009.295	0.99991019	Ventura	5
L014	1907580.030	6393854.819	825.266	34.23283881	-118.55519627	711.543	0.99992871	Ventura	5
L015	1894793.490	6447079.020	732.663	34.19838299	-118.37894950	619.930	0.99993867	Ventura	5
L016	1854521.779	6542023.051	332.677	34.08829775	-118.06487717	219.879	0.99997803	San Gabriel	5
L017	1863069.983	6611532.470	840.548	34.11169222	-117.83526155	730.510	0.99994899	San Gabriel	5
L018	1856881.484	6664341.185	1222.987	34.09432341	-117.66087075	1114.000	0.99993405	San Gabriel	5
L019	1854165.999	6701600.101	1096.183	34.08645362	-117.53784899	987.803	0.99994165	San Gabriel	5
L020	1857592.935	6733843.878	1257.330	34.09541597	-117.43129715	1149.480	0.99993213	San Gabriel	5
L021	1854731.712	6765390.861	1062.009	34.08701850	-117.32716331	954.063	0.99994315	San Gabriel	5
L023	1840187.065	6808229.285	1398.766	34.04618229	-117.18607613	1291.689	0.99993544	San Gabriel	5
L024	1776351.709	6556068.800	64.818	33.87351436	-118.01844077	-51.339	1.00004093	San Bern. (BNSF)	5
L025	2244111.611	6061081.045	158.015	33.81493030	-117.89807864	42.981	0.99998723	Orange	6
L026	2203066.155	6088535.890	60.476	33.70330851	-117.80568673	-53.103	0.99997740	Orange	6
L027	2175405.438	6115930.895	314.763	33.62839227	-117.71434502	202.115	0.99995764	Orange	6
L028	2138252.073	6128932.199	204.101	33.52679274	-117.66997592	90.729	0.99995545	Orange	6
L029	2112166.086	6158634.935	243.336	33.45618212	-117.57143533	130.447	0.99995017	Orange	6
L030	2086359.111	6154692.881	87.437	33.38512584	-117.58327695	-26.615	0.99995581	Orange	6
L031	1853348.123	6505216.496	467.292	34.08494630	-118.18643119	353.676	0.99997230	San Gabriel	5
L032	1830773.930	6841528.533	2297.254	34.01952648	-117.07644384	2191.723	0.99989817	San Gabriel	5
L032	1830773.930	6841528.533	2297.254	34.01952648	-117.07644384	2191.723	0.99989817	San Gabriel	5
P001	2136927.122	6513745.135	2336.963	34.86420977	-118.15975319	2231.492	0.99981732	Mojave (UPRR)	5
P002	2001230.432	6523096.693	3208.074	34.49138296	-118.12800243	3103.536	0.99978388	Valley	5
P003	1983077.218	6379518.464	1016.613	34.44006414	-118.60412742	905.226	0.99989346	Valley	5

Pnt ID	Northing	Easting	Ortho-- metric Height	Latitude	Longitude	Ellipsoidal Height	Combined Sale Factor	Adjacent Subdivision	Zone
P004	1887156.433	6468894.627	569.935	34.17760197	-118.30672716	457.748	0.99994997	Valley	5
P005	1792283.599	6542415.944	113.031	33.91727720	-118.06344981	-3.317	1.00002733	San Bern. (BNSF)	5
P006	1927120.405	6295431.570	512.618	34.28459931	-118.88137743	397.608	0.99993603	Ventura	5
P007	1917262.646	6378177.122	967.053	34.25919586	-118.60725739	853.731	0.99991789	Ventura	5
P009	1854410.568	6584205.726	437.323	34.08798667	-117.92556029	325.623	0.99997303	San Gabriel	5
P010	1856212.802	6716863.300	1159.950	34.09187452	-117.48740636	1051.880	0.99993750	San Gabriel	5
P011	2310135.667	6323876.262	2610.966	34.00477099	-117.03456384	2506.009	0.99990265	San Gabriel	6
P013	2191952.728	6103315.813	205.872	33.67336758	-117.75656823	93.003	0.99996719	Orange	6
P014	2075051.776	6170685.996	155.048	33.35460346	-117.53043278	41.466	0.99995222	San Diego (NCTC)	6
S001	2096835.110	6517733.138	2305.122	34.75406492	-118.14626416	2198.855	0.99981694	Mojave (UPRR)	5
S002	2051014.630	6523958.997	2575.244	34.62818382	-118.12534673	2469.456	0.99980628	Valley	5
S003	1981927.893	6492738.196	2462.739	34.43819469	-118.22860741	2357.439	0.99982417	Valley	5
S004	1980736.017	6444973.661	1686.377	34.43451769	-118.38700628	1578.418	0.99986179	Valley	5
S005	1973920.254	6403086.411	1205.834	34.41526656	-118.52580273	1094.946	0.99988682	Valley	5
S006	1924638.784	6431670.869	1073.319	34.28022294	-118.43032731	961.315	0.99990968	Valley	5
S007	1843860.749	6490033.734	283.007	34.05878858	-118.23649958	168.125	0.99998654	River	5
S008	1817310.961	6521036.038	162.535	33.98599072	-118.13402727	46.583	1.00000837	San Bern. (BNSF)	5
S009	1922038.414	6337339.818	911.089	34.27156533	-118.74252045	797.242	0.99991877	Ventura	5
S010	1899862.848	6425900.365	778.806	34.21207317	-118.44906285	665.465	0.99993423	Ventura	5
S014	1854374.466	6520945.069	479.150	34.08783555	-118.13449093	365.934	0.99997113	San Gabriel	5
S015	1850617.856	6561809.456	323.129	34.07758775	-117.99952847	210.511	0.99998064	San Gabriel	5
S016	1856193.501	6638533.019	1064.601	34.09264212	-117.74611926	954.947	0.99994199	San Gabriel	5
S017	1856028.365	6683122.603	1100.422	34.09178913	-117.59884844	991.784	0.99994040	San Gabriel	5
S018	1858148.363	6749671.720	1213.232	34.09668474	-117.37900758	1105.418	0.99993399	San Gabriel	5
S019	1848377.293	6781528.811	1024.353	34.06924924	-117.27401812	916.483	0.99994856	San Gabriel	5
S020	1835719.575	6822563.664	1837.464	34.03357850	-117.13888574	1731.042	0.99991713	San Gabriel	5
S021	2260636.799	6035885.809	100.078	33.85921283	-117.98191769	-15.790	0.99999682	San Bern. (BNSF)	6
S022	2222597.564	6064741.638	107.816	33.75597518	-117.88491829	-7.059	0.99998153	Orange	6
S023	2162018.332	6128020.914	349.177	33.59206633	-117.67403090	236.509	0.99995294	Orange	6
S024	2109014.858	6133918.061	18.362	33.44663531	-117.65232703	-95.820	0.99996066	Orange	6



**Exhibit A** – Summary of Statistical Analysis as part of the Least Squares Adjustment on the Primary (P) control points. For full report, entitled “Metrolink Primary.pdf”, see compact disc, a part of the GCN delivery.

MicroSurvey STAR\*NET-PRO Version 7, 2, 2, 7  
Run Date: Fri May 23 2014 16:43:19  
Summary of Files Used and Option Settings  
=====

Project Folder and Data Files  
Project Name **METROLINK PRIMARY**

Project Option Settings  
=====

STAR\*NET Run Mode : Adjust with Error Propagation  
Type of Adjustment : 3D  
Project Units : Meters; DMS  
Coordinate System : Lambert NAD83; CA Zone 5 0405  
Geoid Height Model : F:\SURVEY\...\CALGEOID12A.GHT  
Longitude Sign Convention : Positive West  
Input/Output Coordinate Order : North-East  
Angle Data Station Order : At-From-To  
Distance/Vertical Data Type : Slope/Zenith  
Convergence Limit; Max Iterations : 0.010000; 10  
Default Coefficient of Refraction : 0.070000  
Create Coordinate File : Yes  
Create Geodetic Position File : No  
Create Ground Scale Coordinate File : No  
Create Dump File : No  
GPS Vector Standard Error Factors : None  
GPS Vector Centering (Meters) : 0.01800 (Horiz), 0.01800 (Vert)  
GPS Vector Transformations : None

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Metrolink Primary.lst 5/23/2014  
Adjustment Statistical Summary  
=====

Iterations = 3  
Number of Stations = 34  
Number of Observations = 1881  
Number of Unknowns = 38  
Number of Redundant Obs = 1843  
Observation Count Sum Squares Error  
of StdRes Factor  
GPS Deltas 1881 1903.226 1.016  
Total 1881 1903.226 1.016  
The Chi-Square Test at 5.00% Level Passed  
Lower/Upper Bounds (0.968/1.032)

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**Control Recovery Form**

[www.rsecorp.com](http://www.rsecorp.com)

**Control Point ID: P001**

**RSE Control Network:** MetroCON

**Type:** Primary

**Set Date:** 02/19/13

**Set by:** RKC & JD

**City:** Rosamond

**Station:** RR West of Lancaster

**Subdivision:** Mojave (UPRR)

**Milepost:** 393.9

**Distance from Track:** 0.16 miles' E of Track

**Reference Ellipsoid:** WGS84

**Latitude:** 34.86420822

**Longitude:** -118.15975319

**Ellipsoidal Height:** 2231.492'

**Coordinate System:** NAD 83, CA CS Z5

**Epoch:** 2010.00 ("2011, MA11, PA11")

**Northing:** 2136927.122

**Easting:** 6513745.135

**Combined Scale Factor:** 0.99981732

**Alt. Coord. System:** N/A

**Northing:** N/A

**Easting:** N/A

**Combined Scale Factor:** N/A

**Vertical Datum:** GPS-Derived

**Geoid Height Model:** GEOID12A

**Orthometric Height:** 2336.963'



Map data ©2014 Google Imagery ©2014, DigitalGlobe, U.S. Geological Survey, USDA Farm  
Report a map error



**Description:** 2" aluminum disk stamped "SCRRRA CONTROL P001", set atop the west curb of Office Ct, +/-40' southerly of the south curb of Rosamond Blvd, 4' from a fire hydrant, opposite Address No. 1571.



Rail Surveyors and Engineers, Inc.  
Control Recovery Form

[www.rsecorp.com](http://www.rsecorp.com)

**Control Point ID: P002**

**RSE Control Network:** MetroCON

**Type:** Primary

**Set Date:** 1977

**Set by:** NGS

**City:** Acton

**Station:** RR East of Vincent Grade/ Acton

**Subdivision:** Valley

**Milepost:** 60.76

**Distance from Track:** +/-160" NW of Track

**Reference Ellipsoid:** WGS84

**Latitude:** 34.4913826

**Longitude:** -118.12800243

**Ellipsoidal Height:** 3103.536'

**Coordinate System:** NAD 83, CA CS Z5

**Epoch:** 2010.00 ("2011, MA11, PA11")

**Northing:** 2001230.432

**Easting:** 6523096.693

**Combined Scale Factor:** 0.99978388

**Alt. Coord. System:** N/A

**Northing:** N/A

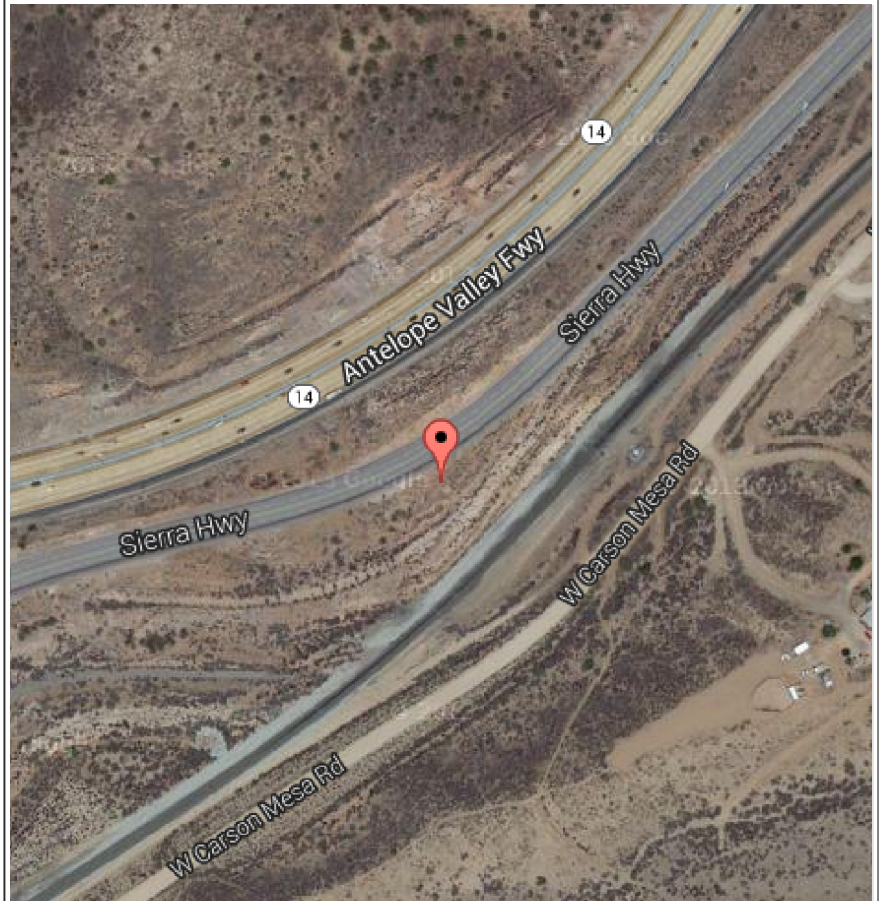
**Easting:** N/A

**Combined Scale Factor:** N/A

**Vertical Datum:** GPS-Derived

**Geoid Height Model:** GEOID12A

**Orthometric Height:** 3208.074'



Map data ©2014 Google Imagery ©2014, DigitalGlobe, U.S. Geological Survey, USDA Farm  
Report a map error



**Description:** 3.5" brass disk stamped "F1290 1977" (NGS PID EW6880), set in rock, southwest side of Soledad Canyon Rd, 7' above road surface, +/-200' easterly of road milepost marker 23.64, opposite an electrical sub station, +/-0.75 miles westerly of Metrolink's Acton Station, southwesterly of road cut section on curve concave to the Northwest.



Rail Surveyors and Engineers, Inc.  
**Control Recovery Form**

[www.rsecorp.com](http://www.rsecorp.com)

**Control Point ID: P003**

**RSE Control Network:** MetroCON

**Type:** Primary

**Set Date:** 1989

**Set by:** NGS

**City:** Santa Clarita

**Station:** RR East of Santa Clarita

**Subdivision:** Valley

**Milepost:** +/-33

**Distance from Track:** 3.8 miles' NW of Track

**Reference Ellipsoid:** WGS84

**Latitude:** 34.44006348

**Longitude:** -118.60412742

**Ellipsoidal Height:** 905.226'

**Coordinate System:** NAD 83, CA CS Z5

**Epoch:** 2010.00 ("2011, MA11, PA11")

**Northing:** 1983077.218

**Easting:** 6379518.464

**Combined Scale Factor:** 0.99989346

**Alt. Coord. System:** N/A

**Northing:** N/A

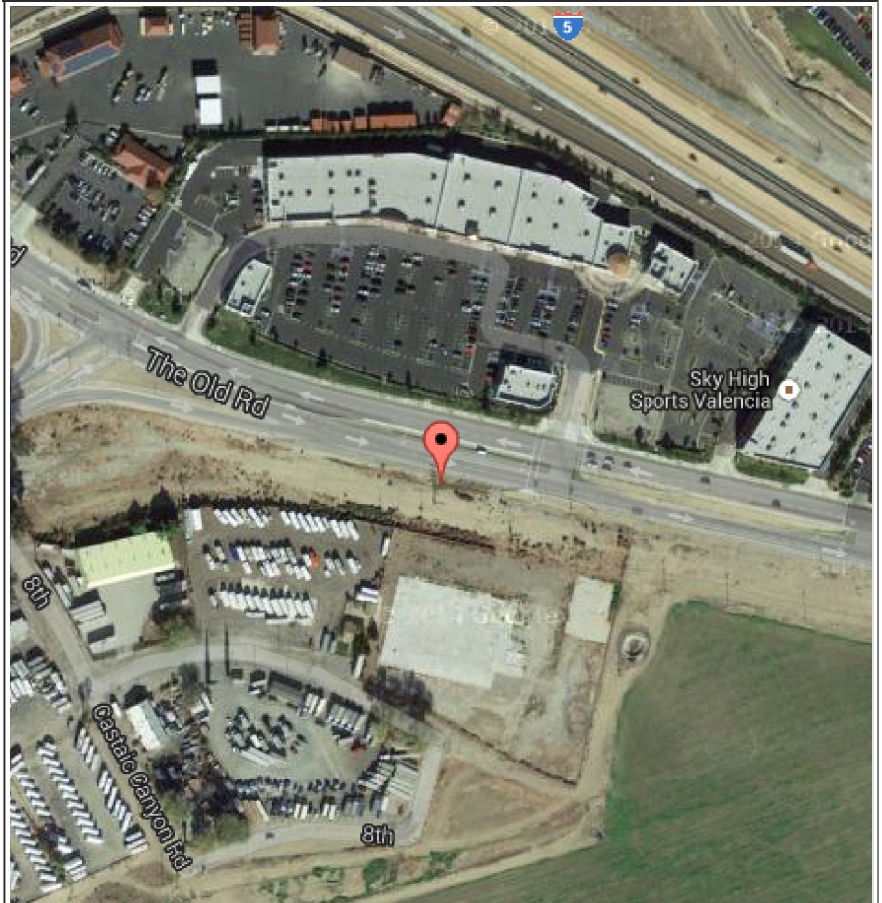
**Easting:** N/A

**Combined Scale Factor:** N/A

**Vertical Datum:** GPS-Derived

**Geoid Height Model:** GEOID12A

**Orthometric Height:** 1016.613'



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**Description:** Steel rod stamped "V 1451 1989" within a monument well with a 5" diameter lid (NGS PID EW9528), 33' northerly of power pole 4699369E, 9.8' southerly of a chain link fence on the south edge of The Old Road, opposite Address Nos. 28700-28708, +/-200' westerly of the center of Gateway Dr.



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Control Recovery Form

[www.rsecorp.com](http://www.rsecorp.com)

**Control Point ID: P004**

**RSE Control Network:** MetroCON

**Type:** Primary

**Set Date:** 02/22/13

**Set by:** RKC & JD

**City:** Burbank

**Station:** RR West of Downtown Burbank

**Subdivision:** Valley

**Milepost:** 10.47

**Distance from Track:** 0.15 miles' NE of Track

**Reference Ellipsoid:** WGS84

**Latitude:** 34.17760086

**Longitude:** -118.30672716

**Ellipsoidal Height:** 457.748'

**Coordinate System:** NAD 83, CA CS Z5

**Epoch:** 2010.00 ("2011, MA11, PA11")

**Northing:** 1887156.433

**Easting:** 6468894.627

**Combined Scale Factor:** 0.99994997

**Alt. Coord. System:** N/A

**Northing:** N/A

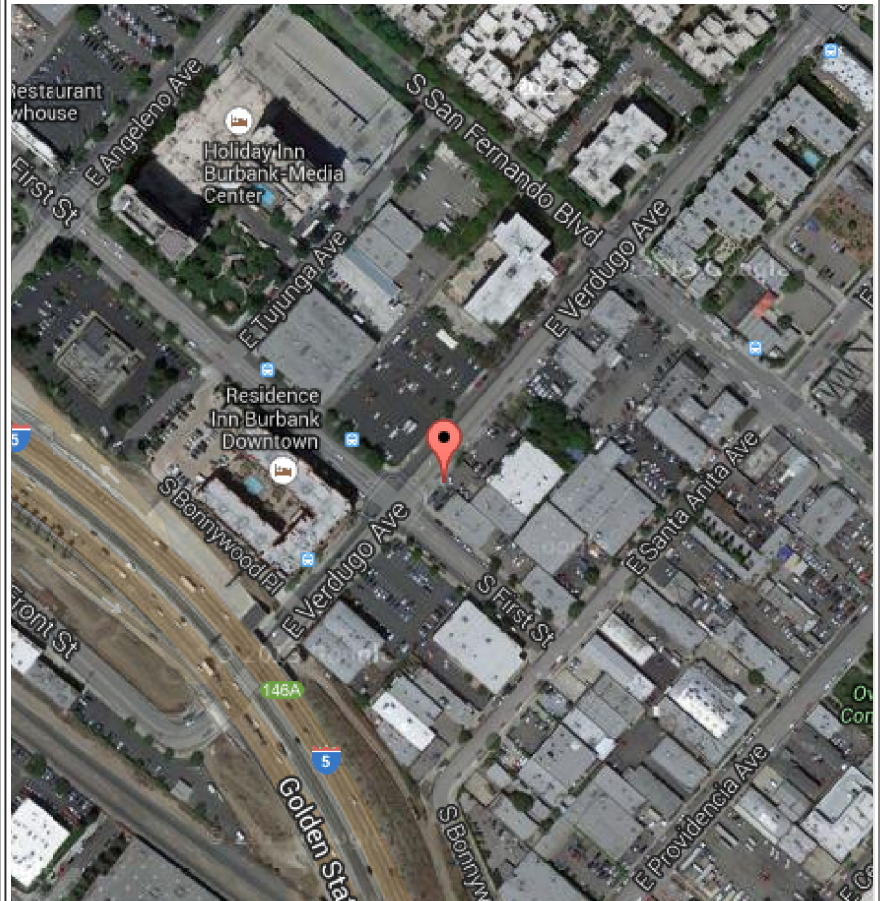
**Easting:** N/A

**Combined Scale Factor:** N/A

**Vertical Datum:** GPS-Derived

**Geoid Height Model:** GEOID12A

**Orthometric Height:** 569.935'



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**Description:** 2" aluminum disk stamped "SCRR CONTROL P004", set on the east sidewalk of Verdugo Ave, +/-50' northerly of the north curb line of First St, 12.5' southerly of the south edge of driveway for Address No. 110 Verdugo Ave, set in the northeast corner of a 5' x 11.5' catch basin.



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**Control Point ID: P005**

**RSE Control Network:** MetroCON

**Type:** Primary

**Set Date:** 1968

**Set by:** MWDSC

**City:** Norwalk

**Station:** RR East of Norwalk/ Santa Fe Springs

**Subdivision:** San Bernardino (BNSF)

**Milepost:** 155.9

**Distance from Track:** 0.15 miles' W of Track

**Reference Ellipsoid:** WGS84

**Latitude:** 33.91727829

**Longitude:** -118.06344981

**Ellipsoidal Height:** -3.317'

**Coordinate System:** NAD 83, CA CS Z5

**Epoch:** 2010.00 ("2011, MA11, PA11")

**Northing:** 1792283.599

**Easting:** 6542415.944

**Combined Scale Factor:** 1.00002733

**Alt. Coord. System:** NAD 83, CA CS Z6

**Northing:** 2282184.718

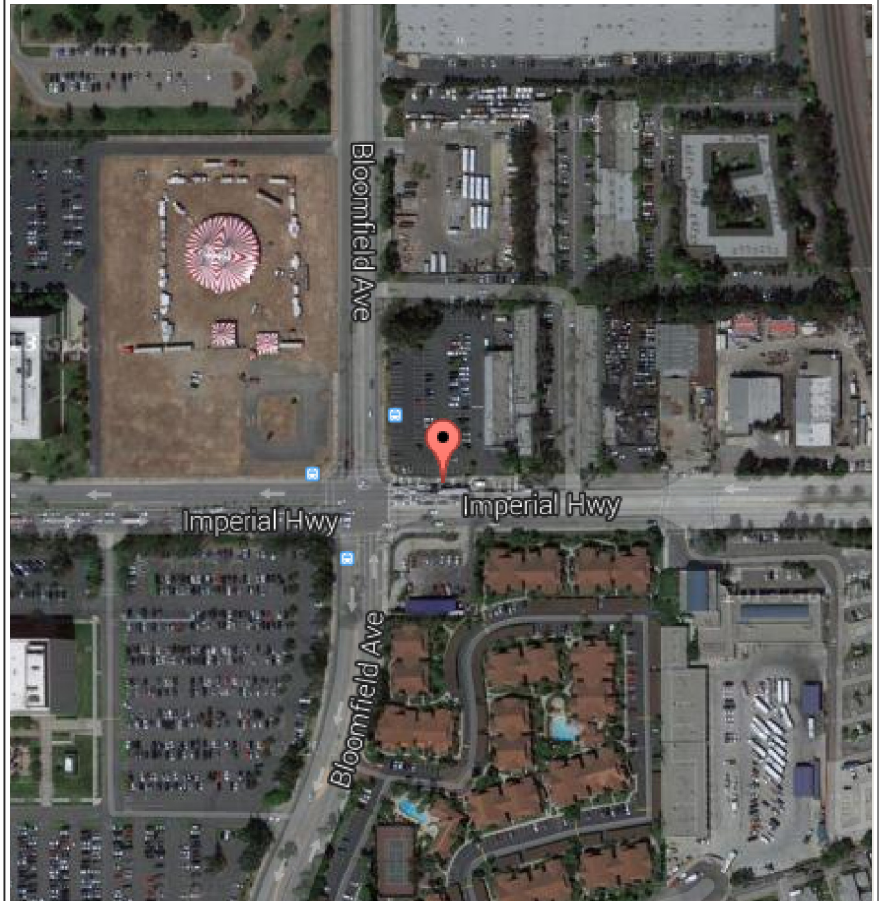
**Easting:** 6011503.971

**Combined Scale Factor:** 1.00000601

**Vertical Datum:** GPS-Derived

**Geoid Height Model:** GEOID12A

**Orthometric Height:** 113.031'



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**Description:** 3" brass disk stamped "OJA 54 1968" (NGS PID AB9362), set atop the north curb of Imperial Hwy, +/-90' easterly of the east curb line of Bloomfield Ave, 23' easterly of Norwalk transit sign.



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Control Recovery Form

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**Control Point ID: P006**

**RSE Control Network:** MetroCON

**Type:** Primary

**Set Date:** 02/22/13

**Set by:** RKC & JD

**City:** Moorpark

**Station:** At Moorpark

**Subdivision:** Ventura

**Milepost:** 427.01

**Distance from Track:** +/-80" S of Track

**Reference Ellipsoid:** WGS84

**Latitude:** 34.2845993

**Longitude:** -118.88137743

**Ellipsoidal Height:** 397.608'

**Coordinate System:** NAD 83, CA CS Z5

**Epoch:** 2010.00 ("2011, MA11, PA11")

**Northing:** 1927120.405

**Easting:** 6295431.570

**Combined Scale Factor:** 0.99993603

**Alt. Coord. System:** N/A

**Northing:** N/A

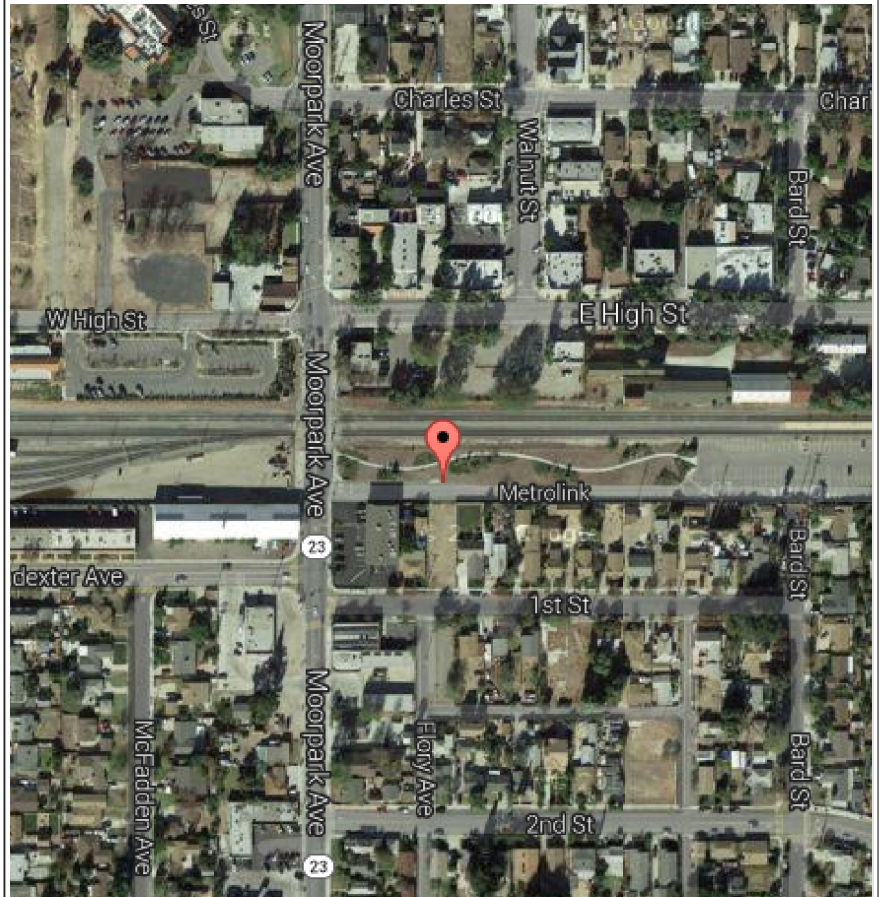
**Easting:** N/A

**Combined Scale Factor:** N/A

**Vertical Datum:** GPS-Derived

**Geoid Height Model:** GEOID12A

**Orthometric Height:** 512.618'



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**Description:** 2" aluminum disk stamped "SCRR CONTROL P006", set at the northeast corner of a catch basin on the north curb line of the entrance to the south parking lot of Metrolink's Moorpark Station, +/-70' easterly of milepost marker 427, +/-210' easterly of the centerline of Moorpark Ave, +/-75' southerly of tracks.



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**Control Point ID: P007**

**RSE Control Network:** MetroCON

**Type:** Primary

**Set Date:** 02/22/13

**Set by:** RKC & JD

**City:** Chatsworth

**Station:** RR West of Chatsworth

**Subdivision:** Ventura

**Milepost:** 445.04

**Distance from Track:** 0.44 miles' W of Track

**Reference Ellipsoid:** WGS84

**Latitude:** 34.25919724

**Longitude:** -118.60725739

**Ellipsoidal Height:** 853.731'

**Coordinate System:** NAD 83, CA CS Z5

**Epoch:** 2010.00 ("2011, MA11, PA11")

**Northing:** 1917262.646

**Easting:** 6378177.122

**Combined Scale Factor:** 0.99991789

**Alt. Coord. System:** N/A

**Northing:** N/A

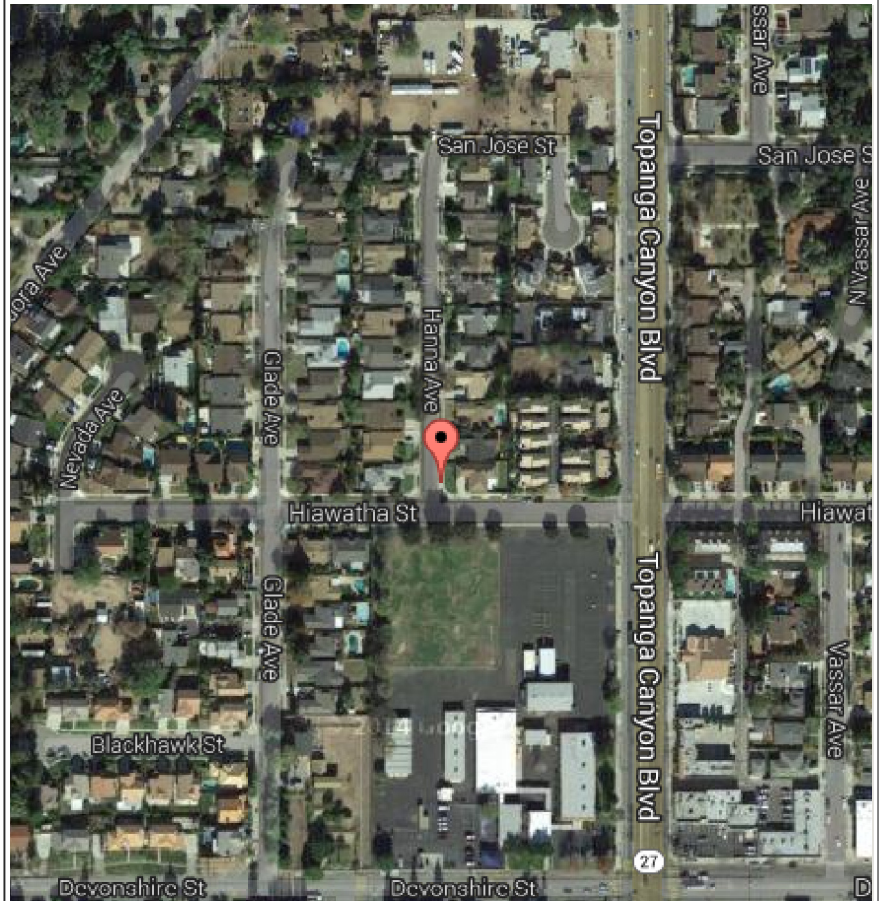
**Easting:** N/A

**Combined Scale Factor:** N/A

**Vertical Datum:** GPS-Derived

**Geoid Height Model:** GEOID12A

**Orthometric Height:** 967.053'



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**Description:** 2" aluminum disk stamped "SCRRRA CONTROL P007", set atop the east curb of Hanna Ave, at Address No. 10400, 33' northerly from the north curb of Hiawatha St.





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Control Recovery Form

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**Control Point ID: P009**

**RSE Control Network:** MetroCON

**Type:** Primary

**Set Date:** 02/06/14

**Set by:** JD & LR

**City:** West Covina

**Station:** RR East of Baldwin Park

**Subdivision:** San Gabriel

**Milepost:** 20.89

**Distance from Track:** 0.29 miles' S of Track

**Reference Ellipsoid:** WGS84

**Latitude:** 34.08798599

**Longitude:** -117.92556029

**Ellipsoidal Height:** 325.623'

**Coordinate System:** NAD 83, CA CS Z5

**Epoch:** 2010.00 ("2011, MA11, PA11")

**Northing:** 1854410.568

**Easting:** 6584205.726

**Combined Scale Factor:** 0.99997303

**Alt. Coord. System:** N/A

**Northing:** N/A

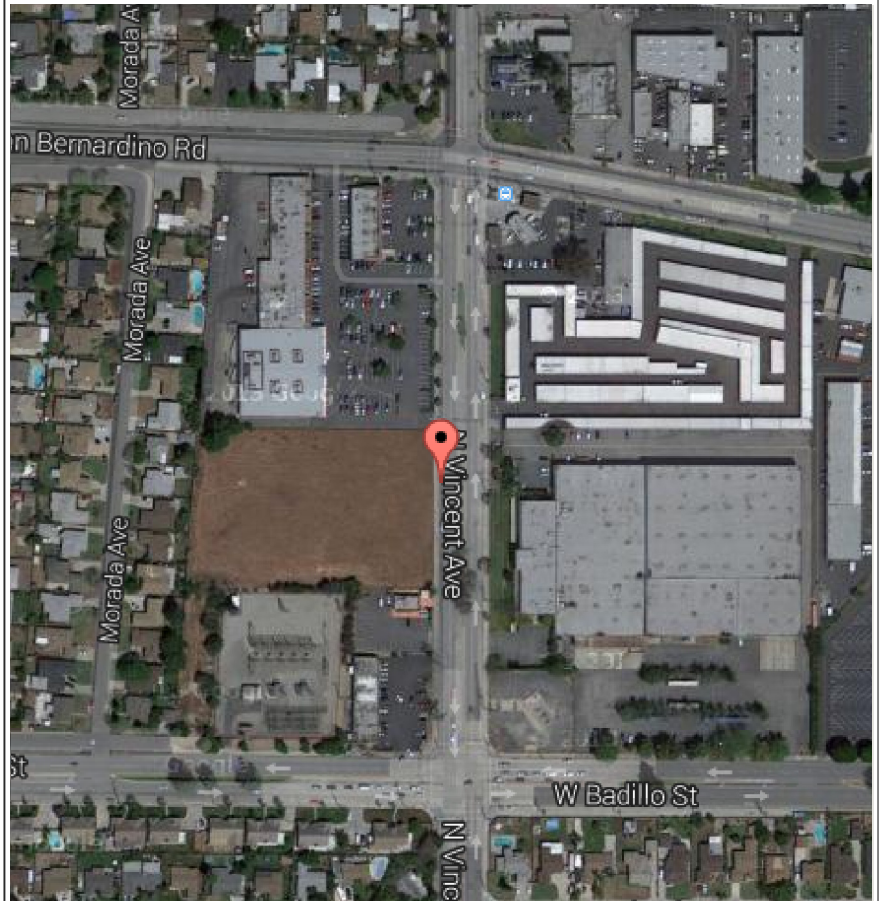
**Easting:** N/A

**Combined Scale Factor:** N/A

**Vertical Datum:** GPS-Derived

**Geoid Height Model:** GEOID12A

**Orthometric Height:** 437.323'



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**Description:** 2" aluminum disk stamped "SCRRRA CONTROL P009", set atop the west curb of North Vincent Ave, +/-490' northerly of the north edge of West Badillo St, opposite Building No. 222 North Vincent Ave.



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[www.rsecorp.com](http://www.rsecorp.com)

**Control Point ID: P010**

**RSE Control Network:** MetroCON

**Type:** Primary

**Set Date:** 02/07/14

**Set by:** CF & TS

**City:** Fontana

**Station:** RR West of Fontana

**Subdivision:** San Gabriel

**Milepost:** 46.22

**Distance from Track:** 0.13 miles' S of Track

**Reference Ellipsoid:** WGS84

**Latitude:** 34.09187317

**Longitude:** -117.48740636

**Ellipsoidal Height:** 1051.880'

**Coordinate System:** NAD 83, CA CS Z5

**Epoch:** 2010.00 ("2011, MA11, PA11")

**Northing:** 1856212.802

**Easting:** 6716863.300

**Combined Scale Factor:** 0.99993750

**Alt. Coord. System:** N/A

**Northing:** N/A

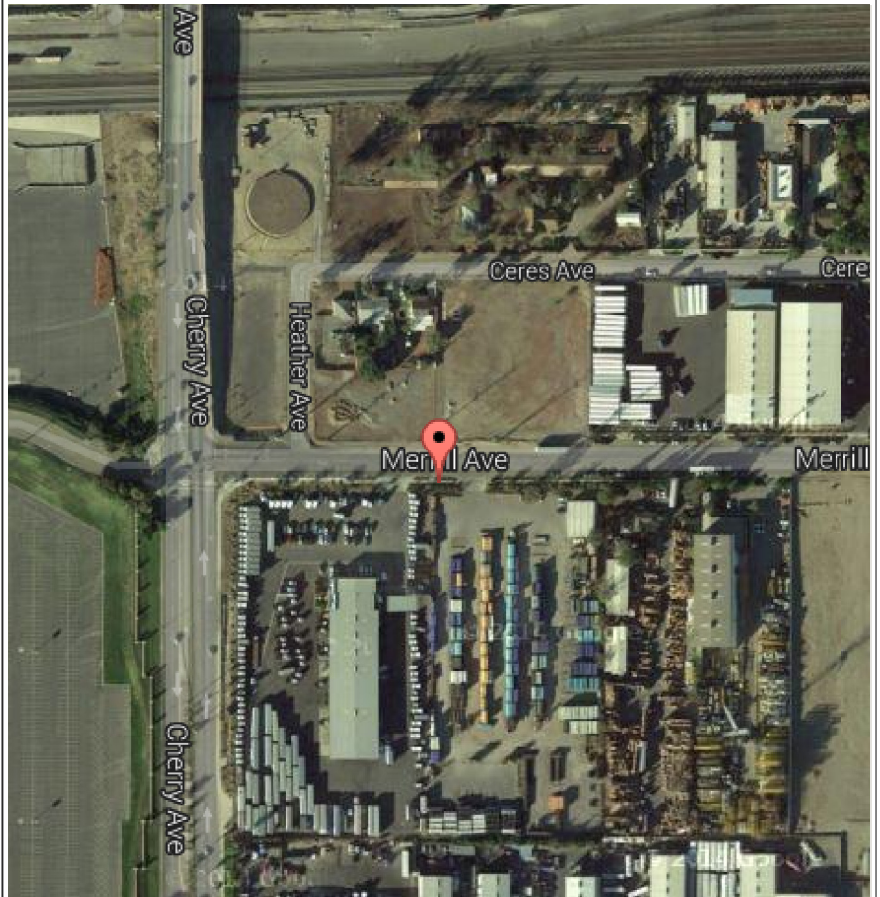
**Easting:** N/A

**Combined Scale Factor:** N/A

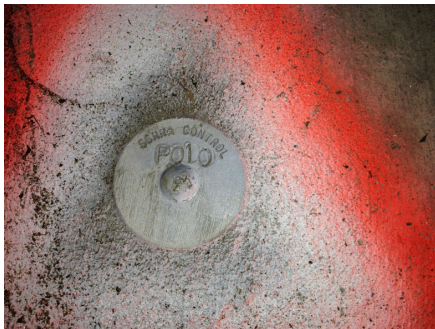
**Vertical Datum:** GPS-Derived

**Geoid Height Model:** GEOID12A

**Orthometric Height:** 1159.950'



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**Description:** 2" aluminum disk stamped "SCRR CONTROL P010", set atop and at the southeast corner of the concrete structure of a catch basin, 2.5' easterly of the manhole of the catch basin, 36' southerly of the centerline of Merrill Ave, immediately east of the driveway to Building No. 14561 Merrill Ave, +/-430' easterly of the centerline of Cherry Ave.



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**Control Point ID: P011**

**RSE Control Network:** MetroCON

**Type:** Primary

**Set Date:** 1988

**Set by:** NGS

**City:** Calimesa

**Station:** Southeasterly of San Bernardino

**Subdivision:** N/A

**Milepost:** N/A

**Distance from Track:** N/A

**Reference Ellipsoid:** WGS84

**Latitude:** 34.00477219

**Longitude:** -117.03456384

**Ellipsoidal Height:** 2506.009'

**Coordinate System:** NAD 83, CA CS Z6

**Epoch:** 2010.00 ("2011, MA11, PA11")

**Northing:** 2310135.667

**Easting:** 6323876.262

**Combined Scale Factor:** 0.99990265

**Alt. Coord. System:** NAD 83, CA CS Z5

**Northing:** 1825523.604

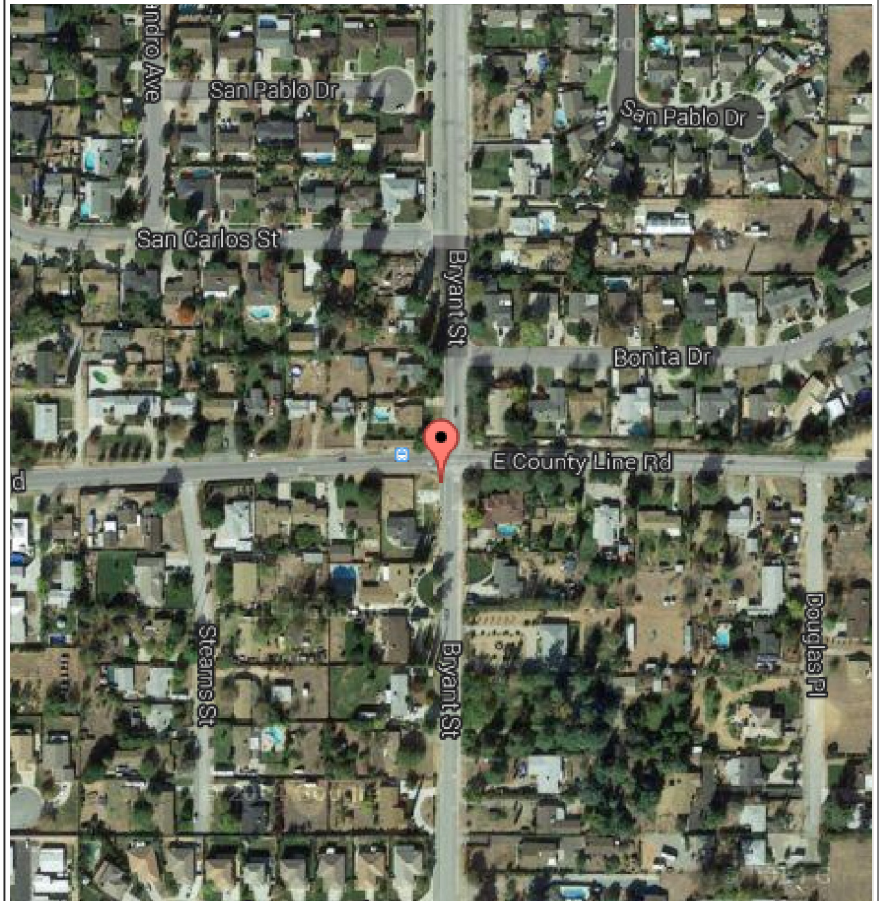
**Easting:** 6854270.471

**Combined Scale Factor:** 0.99988641

**Vertical Datum:** GPS-Derived

**Geoid Height Model:** GEOID12A

**Orthometric Height:** 2610.966'



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**Description:** Steel rod within a 5" diameter monument well equipped with a lid stamped "S 1420 1988" (NGS PID EV9079), in the southwest quadrant of the East County Line Rd and Bryant St intersection, at House No. 906 Bryant St.



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**Control Recovery Form**

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**Control Point ID: P013**

**RSE Control Network:** MetroCON  
**Type:** Primary  
**Set Date:** Unknown  
**Set by:** CADT

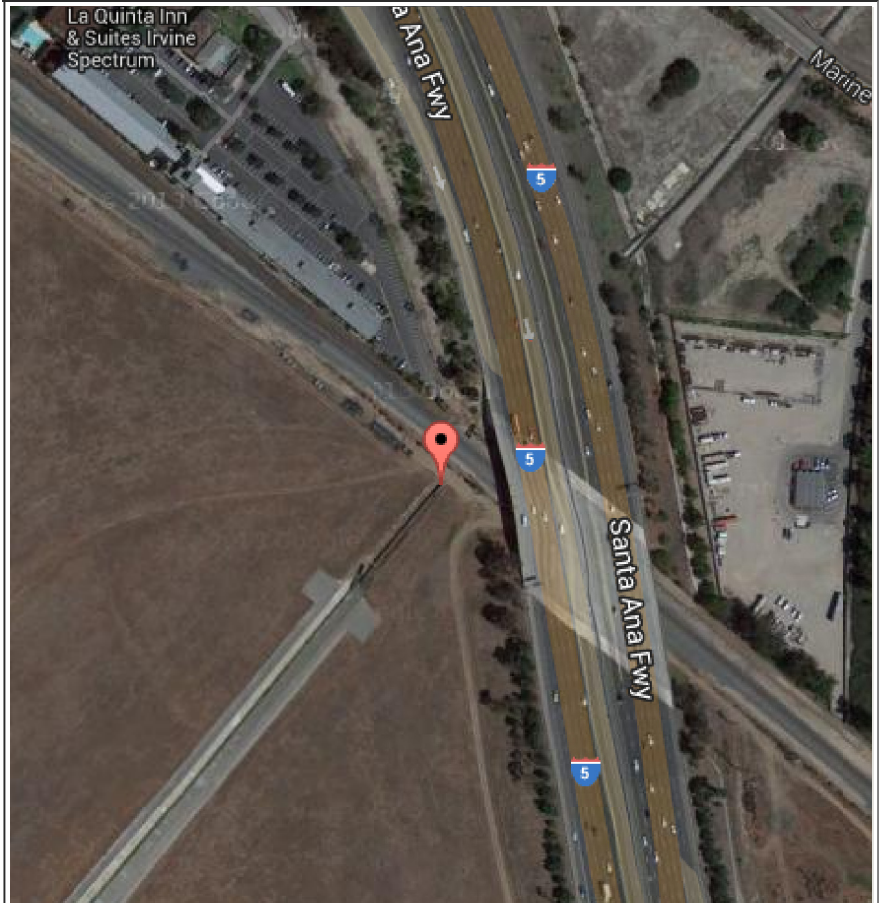
**City:** Irvine  
**Station:** RR West of Irvine  
**Subdivision:** Orange  
**Milepost:** 183.24  
**Distance from Track:** +/-65" SW of Track

**Reference Ellipsoid:** WGS84  
**Latitude:** 33.67336655  
**Longitude:** -117.75656823  
**Ellipsoidal Height:** 93.003'

**Coordinate System:** NAD 83, CA CS Z6  
**Epoch:** 2010.00 ("2011, MA11, PA11")  
**Northing:** 2191952.728  
**Easting:** 6103315.813  
**Combined Scale Factor:** 0.99996719

**Alt. Coord. System:** N/A  
**Northing:** N/A  
**Easting:** N/A  
**Combined Scale Factor:** N/A

**Vertical Datum:** GPS-Derived  
**Geoid Height Model:** GEOID12A  
**Orthometric Height:** 205.872'



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**Description:** 3.5" brass disk stamped "CALIFORNIA DIVISION OF HIGHWAYS", set atop and at the northwest end of a concrete headwall of a concrete culvert (MP 183.29) that extends northeasterly beneath the SCRRR tracks and the Santa Ana Freeway (I-5), +/-65' southwesterly of the centerline of SCRRR Main Track No. 2, +/-125' westerly of the west edge of the I-5 overpass.



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**Control Recovery Form**

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**Control Point ID: P014**

**RSE Control Network:** MetroCON

**Type:** Primary

**Set Date:** 02/05/14

**Set by:** JD & LR

**City:** San Onofre

**Station:** RR East of San Clemente Pier

**Subdivision:** San Diego (NCTC)

**Milepost:** 211.93

**Distance from Track:** +/-200" SW of Track

**Reference Ellipsoid:** WGS84

**Latitude:** 33.35460281

**Longitude:** -117.53043278

**Ellipsoidal Height:** 41.466'

**Coordinate System:** NAD 83, CA CS Z6

**Epoch:** 2010.00 ("2011, MA11, PA11")

**Northing:** 2075051.776

**Easting:** 6170685.996

**Combined Scale Factor:** 0.99995222

**Alt. Coord. System:** N/A

**Northing:** N/A

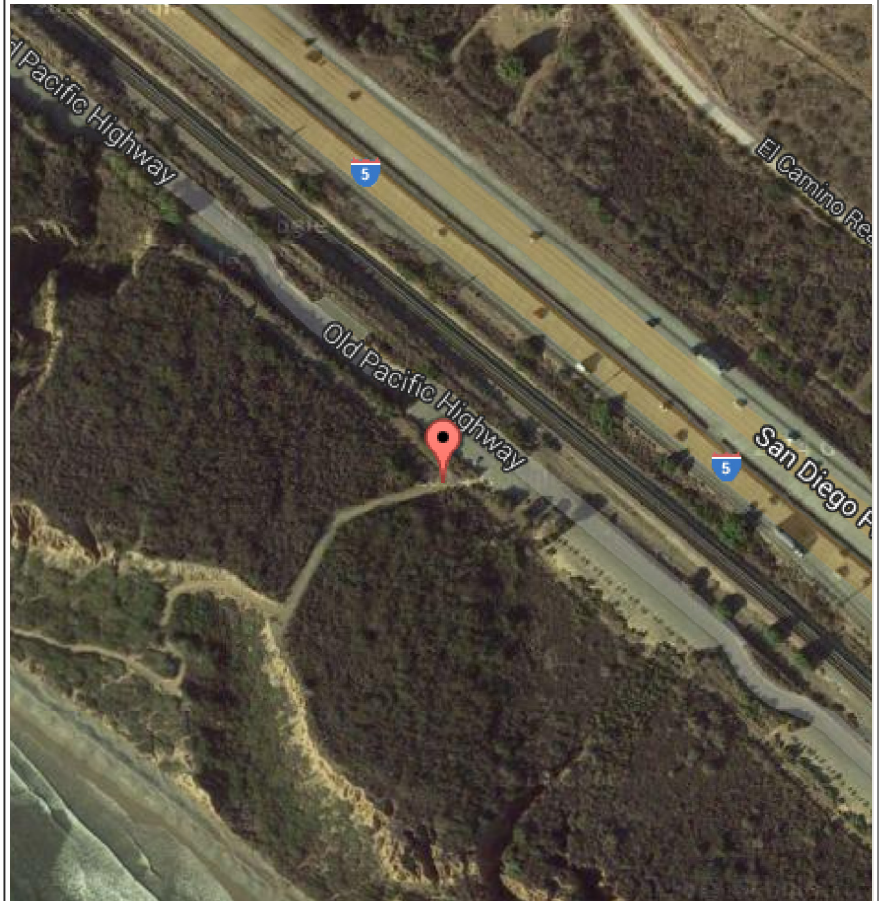
**Easting:** N/A

**Combined Scale Factor:** N/A

**Vertical Datum:** GPS-Derived

**Geoid Height Model:** GEOID12A

**Orthometric Height:** 155.048'



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**Description:** 2" aluminum disk stamped "SCRRR CONTROL P014", set at the southwest corner of a concrete foundation of a steel gate post, within San Onofre State Beach, on the coast trail from a parking lot 0.95 miles southwest of the Park Entrance kiosk, +/-50' southwest of the southwest edge of pavement of the parking lot, +/-200' westerly of a CMU restroom building.

**Exhibit B** – Summary of Statistical Analysis as part of the Least Squares Adjustment on the Secondary (S) control points. For full report, entitled “Metrolink Secondary.pdf”, see compact disc, a part of the GCN delivery.

MicroSurvey STAR\*NET-PRO Version 7, 2, 2, 7  
Run Date: Mon May 19 2014 14:42:54  
Summary of Files Used and Option Settings  
=====  
Project Folder and Data Files  
Project Name **METROLINK SECONDARY**

Project Option Settings  
=====

STAR\*NET Run Mode : Adjust with Error Propagation  
Type of Adjustment : 3D  
Project Units : Meters; DMS  
Coordinate System : Lambert NAD83; CA Zone 5 0405  
Geoid Height Model : F:\SURVEY\...\CALGEOID12A.GHT  
Longitude Sign Convention : Positive West  
Input/Output Coordinate Order : North-East  
Angle Data Station Order : At-From-To  
Distance/Vertical Data Type : Slope/Zenith  
Convergence Limit; Max Iterations : 0.010000; 10  
Default Coefficient of Refraction : 0.070000  
Create Coordinate File : Yes  
Create Geodetic Position File : No  
Create Ground Scale Coordinate File : No  
Create Dump File : No  
GPS Vector Standard Error Factors : None  
GPS Vector Centering (Meters) : 0.01000 (Horiz), 0.01300 (Vert)  
GPS Vector Transformations : None

Adjustment Statistical Summary  
=====

Iterations = 4  
Number of Stations = 33  
Number of Observations = 672  
Number of Unknowns = 63  
Number of Redundant Obs = 609  
Observation Count Sum Squares Error  
of StdRes Factor  
GPS Deltas 672 616.634 1.006  
Total 672 616.634 1.006  
The Chi-Square Test at 5.00% Level Passed  
Lower/Upper Bounds (0.944/1.056)



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**Control Point ID: S001**

**RSE Control Network:** MetroCON

**Type:** Secondary

**Set Date:** 1929

**Set by:** USGS/ L.A. Co.

**City:** Rosamond

**Station:** RR West of Lancaster

**Subdivision:** Mojave (UPRR)

**Milepost:** 401.6

**Distance from Track:** +/-360" W of Track

**Reference Ellipsoid:** WGS84

**Latitude:** 34.75406647

**Longitude:** -118.14626416

**Ellipsoidal Height:** 2198.855'

**Coordinate System:** NAD 83, CA CS Z5

**Epoch:** 2010.00 ("2011, MA11, PA11")

**Northing:** 2096835.110

**Easting:** 6517733.138

**Combined Scale Factor:** 0.99981694

**Alt. Coord. System:** N/A

**Northing:** N/A

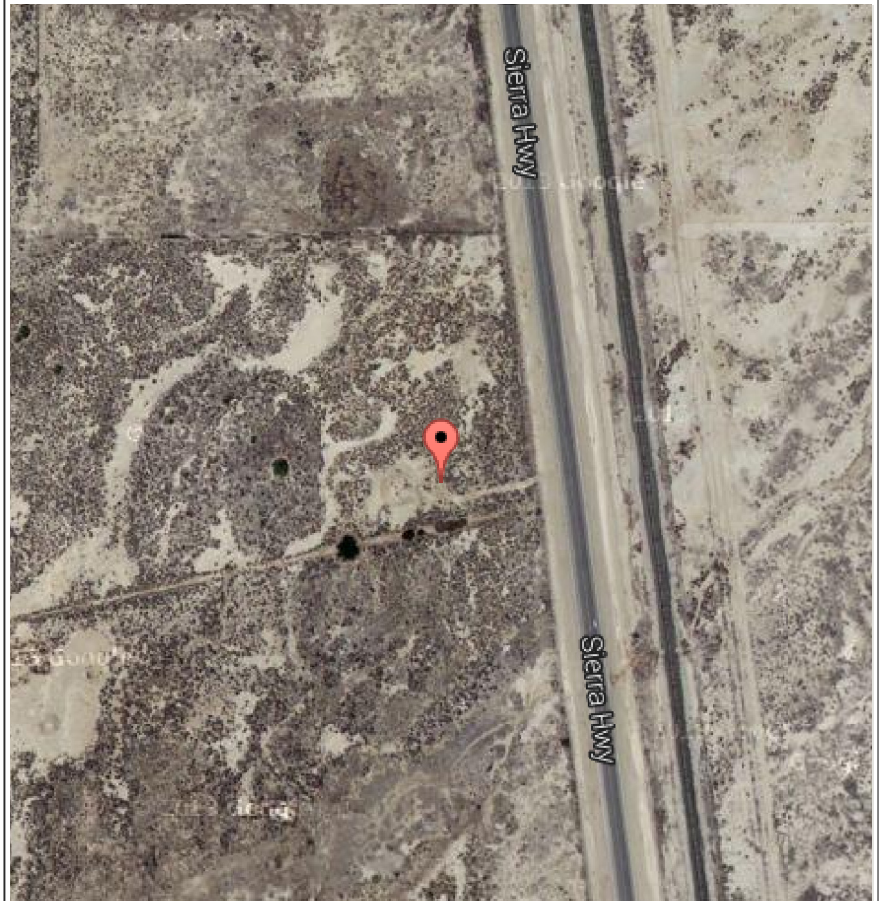
**Easting:** N/A

**Combined Scale Factor:** N/A

**Vertical Datum:** GPS-Derived

**Geoid Height Model:** GEOID12A

**Orthometric Height:** 2305.122'



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**Description:** 3.75" brass disk stamped "OBAN 1929" (NGS PID EW0819), set on a 0.7' by 0.7' by 1.3' tall concrete pedestal, +/-200' westerly of the west edge of Sierra Hwy, +/-350' southerly of a CMU wall, 0.58 miles southerly of Avenue E, 0.43 miles northerly of Avenue F.



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**Control Recovery Form**

[www.rsecorp.com](http://www.rsecorp.com)

**Control Point ID: S002**

**RSE Control Network:** MetroCON

**Type:** Secondary

**Set Date:** 02/25/13

**Set by:** RKC & JD

**City:** Palmdale

**Station:** RR West of Palmdale

**Subdivision:** Valley

**Milepost:** 71.79

**Distance from Track:** +/-50" W of Track

**Reference Ellipsoid:** WGS84

**Latitude:** 34.62818527

**Longitude:** -118.12534673

**Ellipsoidal Height:** 2469.456'

**Coordinate System:** NAD 83, CA CS Z5

**Epoch:** 2010.00 ("2011, MA11, PA11")

**Northing:** 2051014.630

**Easting:** 6523958.997

**Combined Scale Factor:** 0.99980628

**Alt. Coord. System:** N/A

**Northing:** N/A

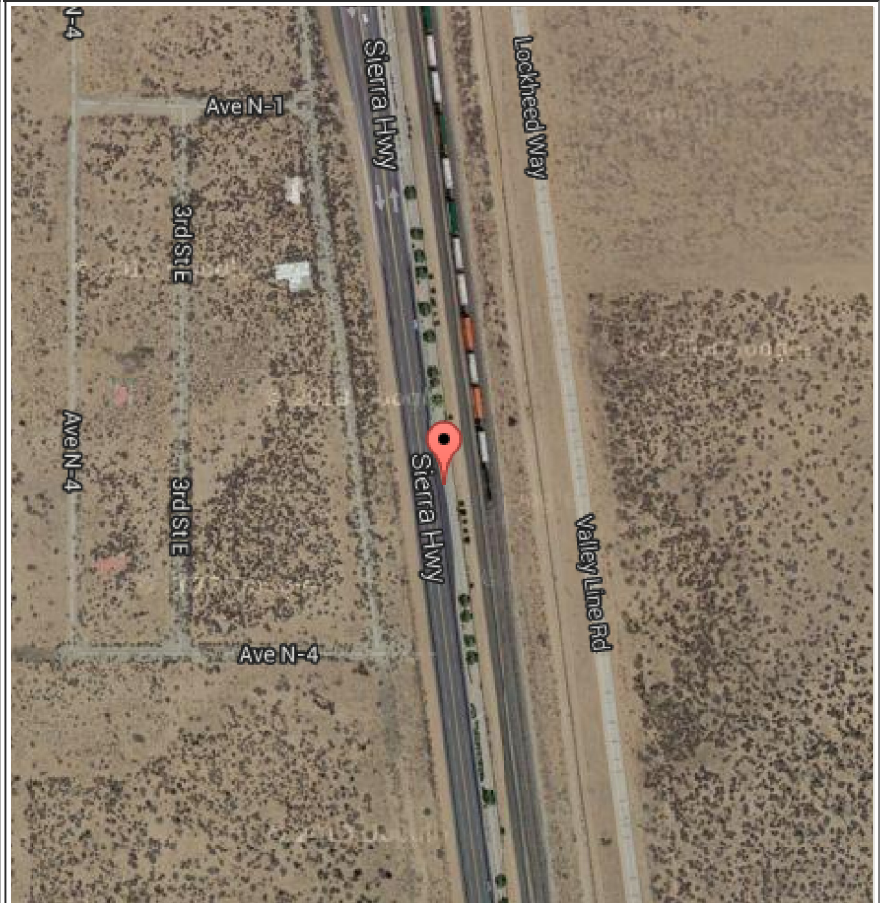
**Easting:** N/A

**Combined Scale Factor:** N/A

**Vertical Datum:** GPS-Derived

**Geoid Height Model:** GEOID12A

**Orthometric Height:** 2575.244'



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**Description:** 2" aluminum disk stamped "SCRR CONTROL S002", set atop the east curb of Sierra Hwy, 0.20 miles southerly of Avenue N, located in the first emergency parking area southerly of West Avenue N, +/-200' southerly of runway for Lockheed Martin.





Rail Surveyors and Engineers, Inc.  
Control Recovery Form

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**Control Point ID: S003**

**RSE Control Network:** MetroCON

**Type:** Secondary

**Set Date:** 02/25/13

**Set by:** RKC & JD

**City:** Acton

**Station:** RR East of Vincent Grade/ Acton

**Subdivision:** Valley

**Milepost:** 53.17

**Distance from Track:** +/-100" NW of Track

**Reference Ellipsoid:** WGS84

**Latitude:** 34.43819427

**Longitude:** -118.22860741

**Ellipsoidal Height:** 2357.439'

**Coordinate System:** NAD 83, CA CS Z5

**Epoch:** 2010.00 ("2011, MA11, PA11")

**Northing:** 1981927.893

**Easting:** 6492738.196

**Combined Scale Factor:** 0.99982417

**Alt. Coord. System:** N/A

**Northing:** N/A

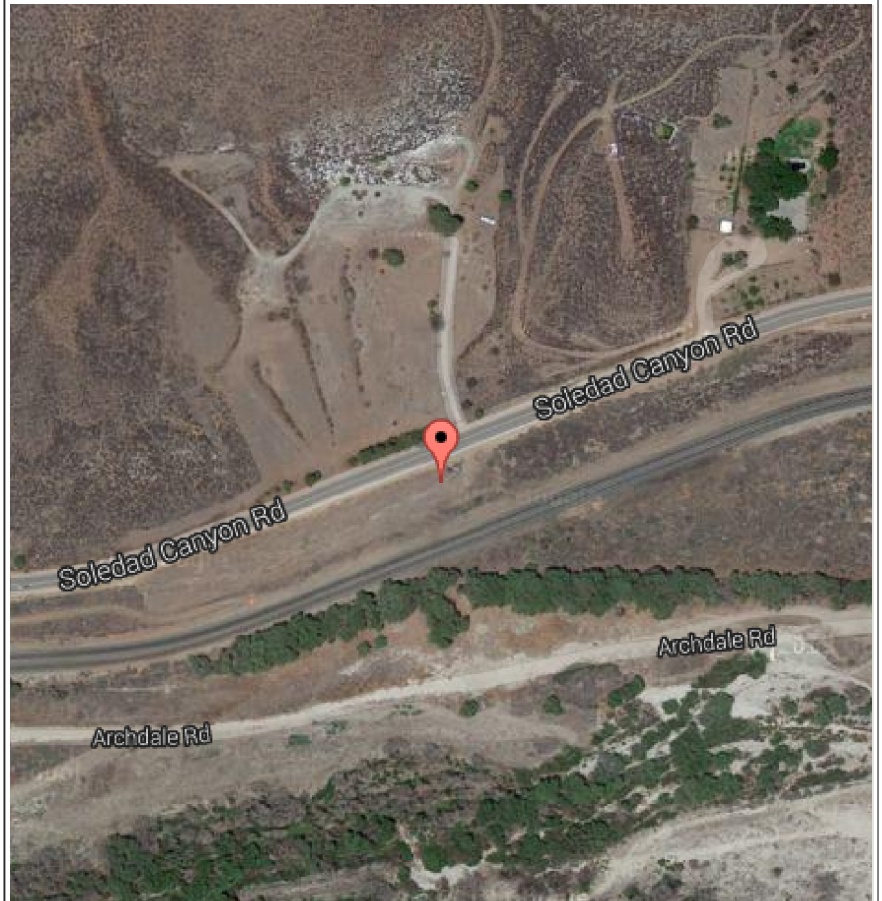
**Easting:** N/A

**Combined Scale Factor:** N/A

**Vertical Datum:** GPS-Derived

**Geoid Height Model:** GEOID12A

**Orthometric Height:** 2462.739'



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**Description:** 1/2" (No. 4) rebar with drill hole set vertically in a 2' x 2' concrete foundation at ground level, adjacent tag stamped "S003" also set in concrete, 45' southerly of the south edge of Soledad Canyon Rd, +/-75' northerly of railroad tracks, +/-250' westerly of Soledad Canyon Rd milepost marker 20.27, +/-75' westerly of a gravel driveway with a chain link gate on the north side of Soledad Canyon Rd, 0.30 miles westerly of Bootlegger Canyon Rd.



Rail Surveyors and Engineers, Inc.  
Control Recovery Form

[www.rsecorp.com](http://www.rsecorp.com)

**Control Point ID: S004**

**RSE Control Network:** MetroCON

**Type:** Secondary

**Set Date:** 02/25/13

**Set by:** RKC & JD

**City:** Lang

**Station:** RR West of Via Princessa

**Subdivision:** Valley

**Milepost:** 43.00

**Distance from Track:** 0.29 miles' N of Track

**Reference Ellipsoid:** WGS84

**Latitude:** 34.43451691

**Longitude:** -118.38700628

**Ellipsoidal Height:** 1578.418'

**Coordinate System:** NAD 83, CA CS Z5

**Epoch:** 2010.00 ("2011, MA11, PA11")

**Northing:** 1980736.017

**Easting:** 6444973.661

**Combined Scale Factor:** 0.99986179

**Alt. Coord. System:** N/A

**Northing:** N/A

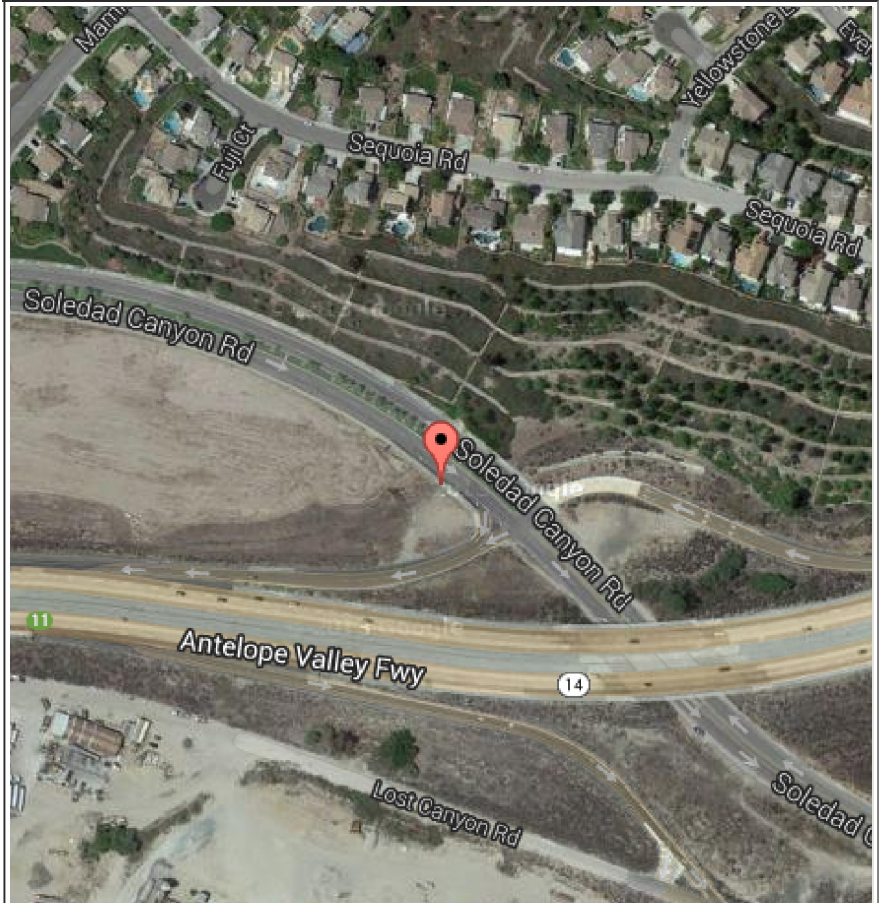
**Easting:** N/A

**Combined Scale Factor:** N/A

**Vertical Datum:** GPS-Derived

**Geoid Height Model:** GEOID12A

**Orthometric Height:** 1686.377'



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**Description:** 2" aluminum disk stamped "SCRR CONTROL S004", set in the southwest corner of a catch basin on the south sidewalk of Soledad Canyon Rd, +/-100' westerly of the Hwy 14 Southbound on-ramp, +/-500' westerly of the Hwy 14 Bridge crossing Soledad Canyon Rd.



Rail Surveyors and Engineers, Inc.  
Control Recovery Form

[www.rsecorp.com](http://www.rsecorp.com)

**Control Point ID: S005**

**RSE Control Network:** MetroCON

**Type:** Secondary

**Set Date:** 02/25/13

**Set by:** RKC & JD

**City:** Santa Clarita

**Station:** At Santa Clarita

**Subdivision:** Valley

**Milepost:** 34.11

**Distance from Track:** 0.10 miles' NE of Track

**Reference Ellipsoid:** WGS84

**Latitude:** 34.41526794

**Longitude:** -118.52580273

**Ellipsoidal Height:** 1094.946'

**Coordinate System:** NAD 83, CA CS Z5

**Epoch:** 2010.00 ("2011, MA11, PA11")

**Northing:** 1973920.254

**Easting:** 6403086.411

**Combined Scale Factor:** 0.99988682

**Alt. Coord. System:** N/A

**Northing:** N/A

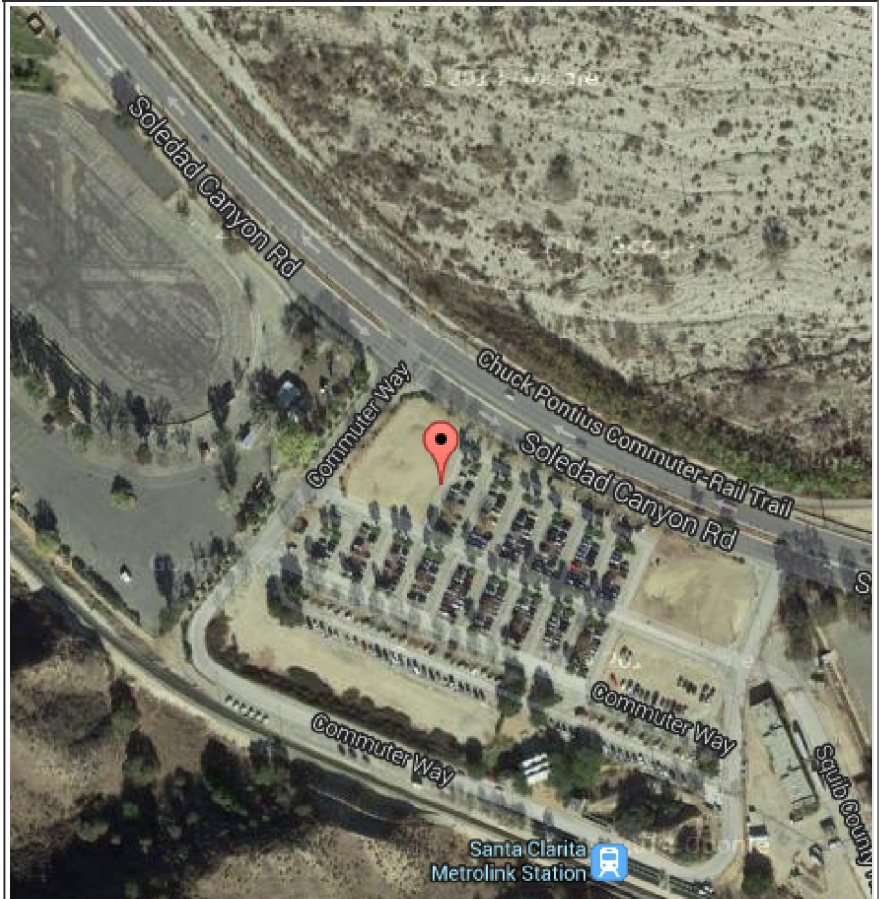
**Easting:** N/A

**Combined Scale Factor:** N/A

**Vertical Datum:** GPS-Derived

**Geoid Height Model:** GEOID12A

**Orthometric Height:** 1205.834'



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**Description:** 2" aluminum disk stamped "SCRR CONTROL S005", set atop the west curb of the parking lot of Metrolink's Santa Clarita Station, +/-100' southerly of the northwest corner of the parking lot, +/-120' southerly of the south curb of Soledad Canyon Rd, +/-145' easterly of the east edge of Commuter Way.



## Rail Surveyors and Engineers, Inc. Control Recovery Form

[www.rsecorp.com](http://www.rsecorp.com)

### Control Point ID: S006

RSE Control Network: MetroCON

Type: Secondary

Set Date: 02/25/13

Set by: RKC & JD

City: San Fernando

Station: RR East of Sylmar/ San Fernando

Subdivision: Valley

Milepost: 20.55

Distance from Track: 0.27 miles' NE of Track

Reference Ellipsoid: WGS84

Latitude: 34.28022385

Longitude: -118.43032731

Ellipsoidal Height: 961.315'

Coordinate System: NAD 83, CA CS Z5

Epoch: 2010.00 ("2011, MA11, PA11")

Northing: 1924638.784

Easting: 6431670.869

Combined Scale Factor: 0.99990968

Alt. Coord. System: N/A

Northing: N/A

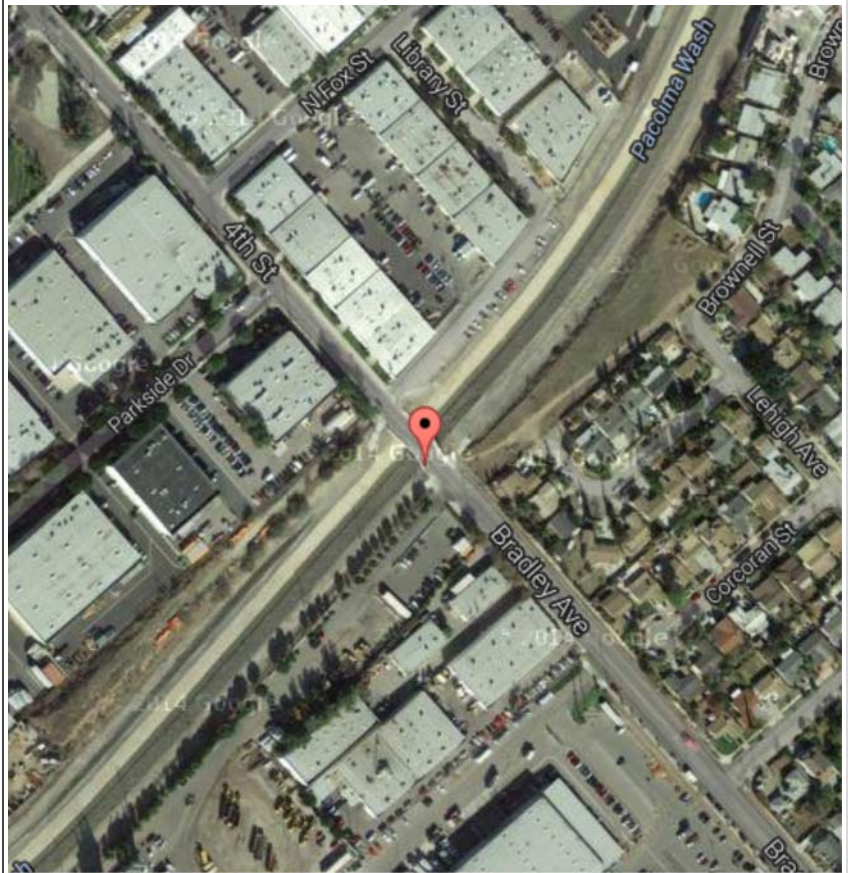
Easting: N/A

Combined Scale Factor: N/A

Vertical Datum: GPS-Derived

Geoid Height Model: GEOID12A

Orthometric Height: 1073.319'



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**Description:** 2" aluminum disk stamped "SCRRRA CONTROL S006", set in the southwest sidewalk of Bradley Ave, immediately northwest of Address No. 11549, above the southeast abutment of the bridge over Pacoima Wash, 22' northwesterly of a light pole, +/-150' southeasterly of Library St.



Rail Surveyors and Engineers, Inc.  
**Control Recovery Form**

[www.rsecorp.com](http://www.rsecorp.com)

**Control Point ID: S007**

**RSE Control Network:** MetroCON

**Type:** Secondary

**Set Date:** 02/22/13

**Set by:** RKC & JD

**City:** Los Angeles

**Station:** RR East of L.A. Union Station

**Subdivision:** River

**Milepost:** 0.25

**Distance from Track:** 0.16 miles' W of Track

**Reference Ellipsoid:** WGS84

**Latitude:** 34.0587883

**Longitude:** -118.23649958

**Ellipsoidal Height:** 168.125'

**Coordinate System:** NAD 83, CA CS Z5

**Epoch:** 2010.00 ("2011, MA11, PA11")

**Northing:** 1843860.749

**Easting:** 6490033.734

**Combined Scale Factor:** 0.99998654

**Alt. Coord. System:** N/A

**Northing:** N/A

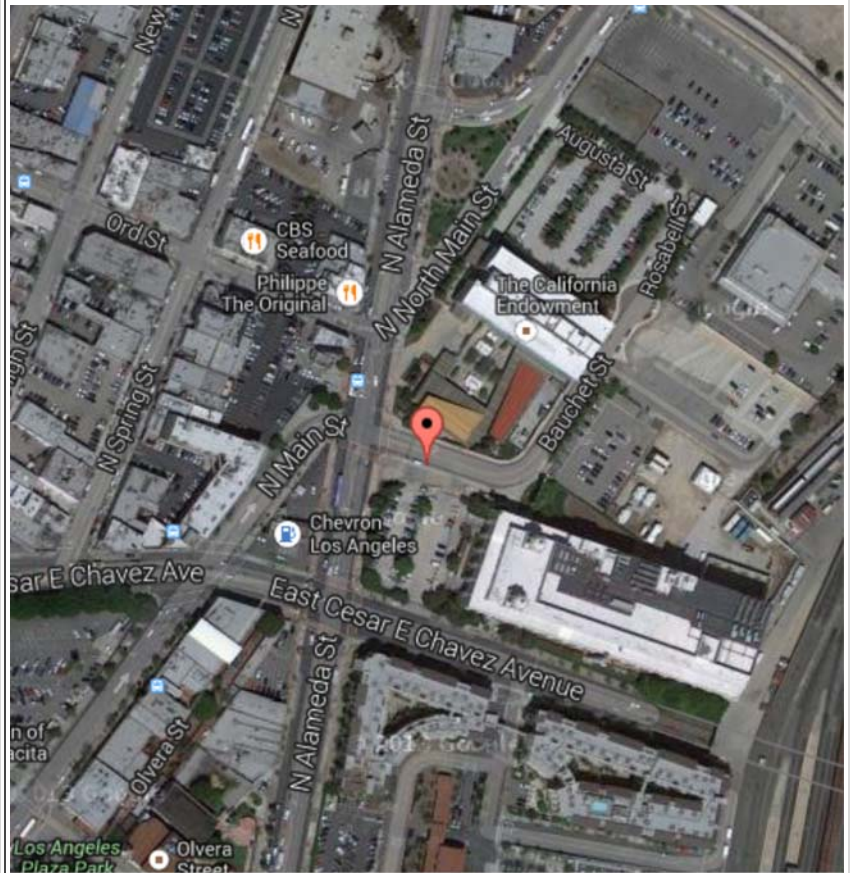
**Easting:** N/A

**Combined Scale Factor:** N/A

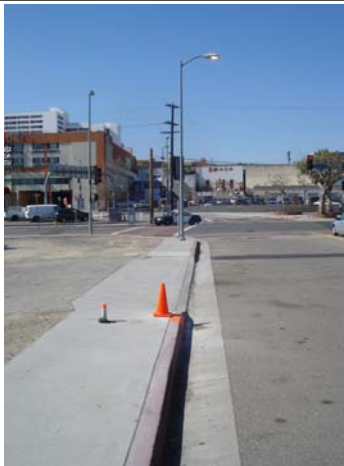
**Vertical Datum:** GPS-Derived

**Geoid Height Model:** GEOID12A

**Orthometric Height:** 283.007'



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**Description:** 2" aluminum disk stamped "SCRRA CONTROL S007", set atop the south curb of Bauchet St, +/-90' easterly of the east curb of Alameda St, at the east edge of a driveway to a parking lot for Address No. 900 Alameda St (United States Post Office).



## Rail Surveyors and Engineers, Inc. Control Recovery Form

[www.rsecorp.com](http://www.rsecorp.com)

### Control Point ID: S008

RSE Control Network: MetroCON

Type: Secondary

Set Date: 02/22/13

Set by: RKC & JD

City: Montebello

Station: RR East of Commerce

Subdivision: San Bernardino (BNSF)

Milepost: 148.9

Distance from Track: +/-510" SW of Track

Reference Ellipsoid: WGS84

Latitude: 33.98599243

Longitude: -118.13402727

Ellipsoidal Height: 46.583'

Coordinate System: NAD 83, CA CS Z5

Epoch: 2010.00 ("2011, MA11, PA11")

Northing: 1817310.961

Easting: 6521036.038

Combined Scale Factor: 1.00000837

Alt. Coord. System: N/A

Northing: N/A

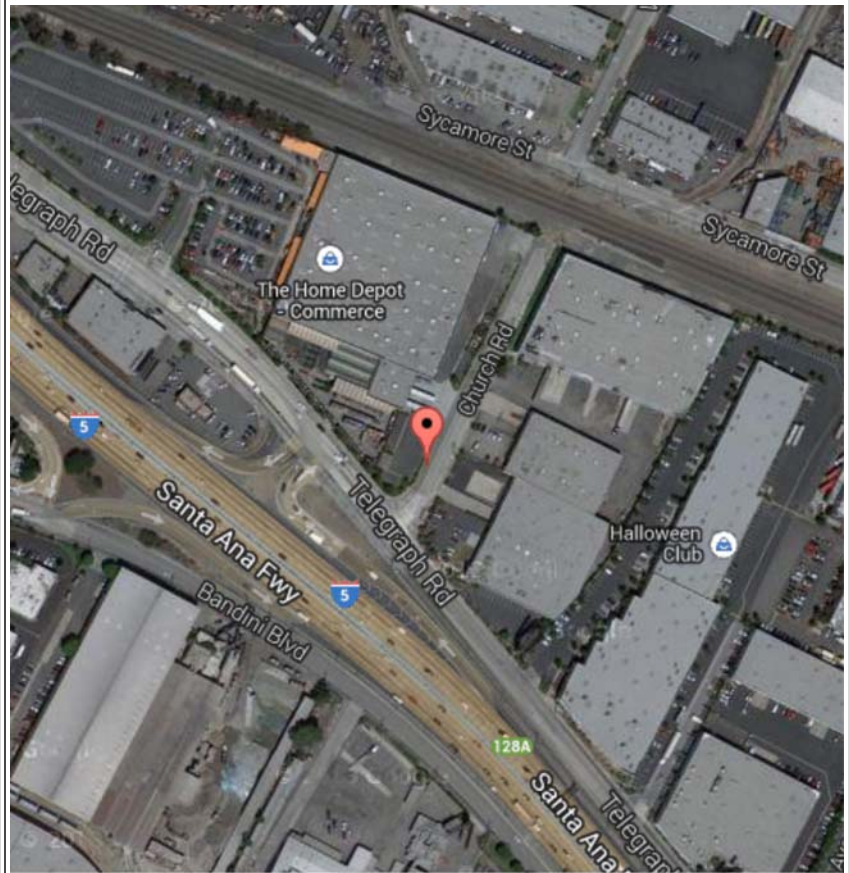
Easting: N/A

Combined Scale Factor: N/A

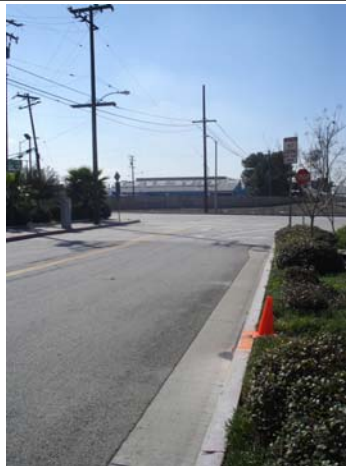
Vertical Datum: GPS-Derived

Geoid Height Model: GEOID12A

Orthometric Height: 162.535'



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**Description:** 2" aluminum disk stamped "SCRRA CONTROL S008", set atop the west curb of Church St, +/-85' northerly of the north curb of Telegraph Rd, east side of a Home Depot store, opposite an irrigation control box, 40' northerly of a drain inlet.



Rail Surveyors and Engineers, Inc.  
Control Recovery Form

[www.rsecorp.com](http://www.rsecorp.com)

**Control Point ID: S009**

RSE Control Network: MetroCON

Type: Secondary

Set Date: 02/22/13

Set by: RKC & JD

City: Simi Valley

Station: RR West of Simi Valley

Subdivision: Ventura

Milepost: 435.39

Distance from Track: +/-140" S of Track

Reference Ellipsoid: WGS84

Latitude: 34.27156448

Longitude: -118.74252045

Ellipsoidal Height: 797.242'

Coordinate System: NAD 83, CA CS Z5

Epoch: 2010.00 ("2011, MA11, PA11")

Northing: 1922038.414

Easting: 6337339.818

Combined Scale Factor: 0.99991877

Alt. Coord. System: N/A

Northing: N/A

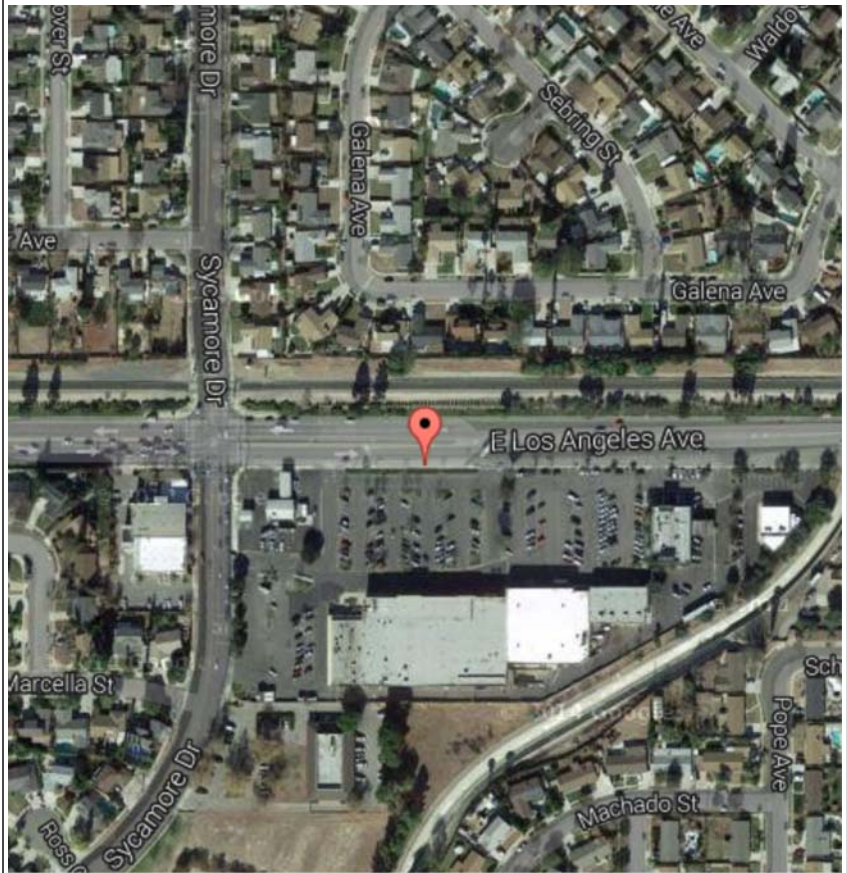
Easting: N/A

Combined Scale Factor: N/A

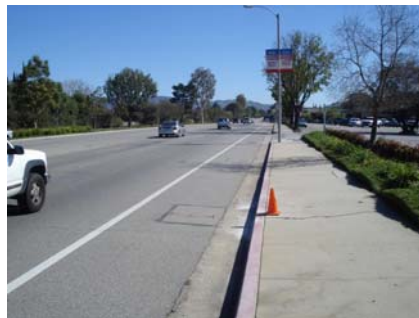
Vertical Datum: GPS-Derived

Geoid Height Model: GEOID12A

Orthometric Height: 911.089'



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**Description:** 2" aluminum disk stamped "SCRRA CONTROL S009", set atop the south curb of Los Angeles Blvd, +/-350' easterly of Sycamore Dr, 15' westerly of a light pole, opposite of a Ralphs grocery store.



## Rail Surveyors and Engineers, Inc. Control Recovery Form

[www.rsecorp.com](http://www.rsecorp.com)

### Control Point ID: S010

RSE Control Network: MetroCON

Type: Secondary

Set Date: 02/22/13

Set by: RKC & JD

City: Panorama City

Station: At Van Nuys

Subdivision: Ventura

Milepost: 454.93

Distance from Track: +/-90" N of Track

Reference Ellipsoid: WGS84

Latitude: 34.21207428

Longitude: -118.44906285

Ellipsoidal Height: 665.465'

Coordinate System: NAD 83, CA CS Z5

Epoch: 2010.00 ("2011, MA11, PA11")

Northing: 1899862.848

Easting: 6425900.365

Combined Scale Factor: 0.99993423

Alt. Coord. System: N/A

Northing: N/A

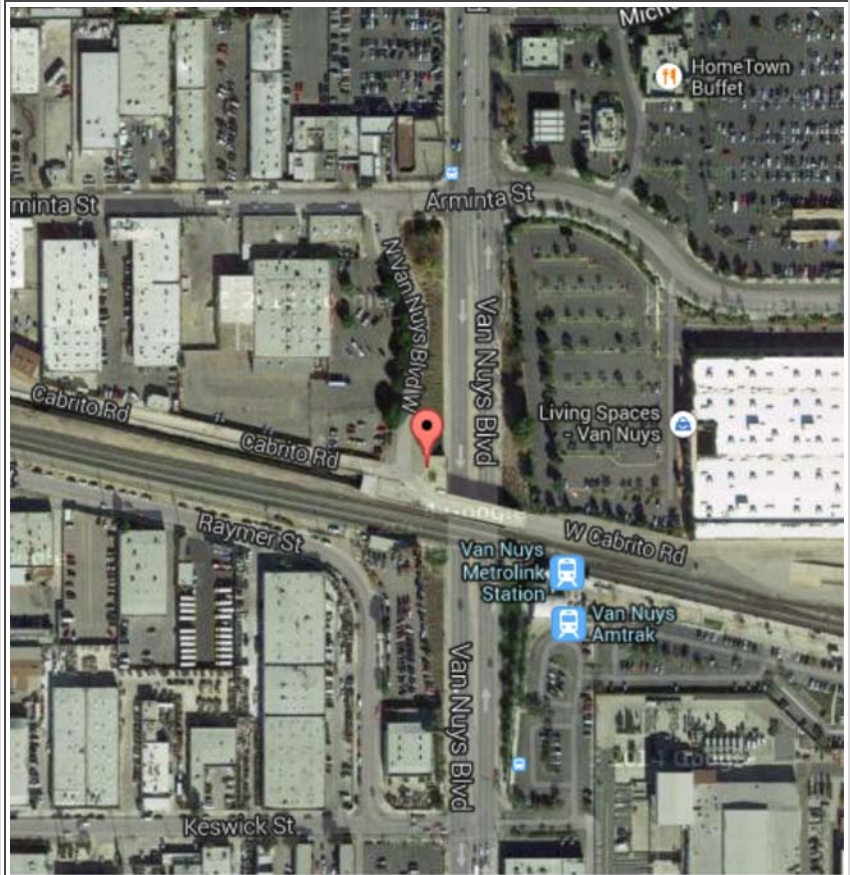
Easting: N/A

Combined Scale Factor: N/A

Vertical Datum: GPS-Derived

Geoid Height Model: GEOID12A

Orthometric Height: 778.806'



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**Description:** 2" aluminum disk stamped "SCRRRA CONTROL S010", set atop the east curb of North Van Nuys Blvd West, +/-35' northerly of the north curb line of Cabrito Rd, at the south edge of a driveway, 8' northerly of a catch basin, +/-80' northerly of the railroad tracks, between railroad and Smart and Final store.





## Rail Surveyors and Engineers, Inc. Control Recovery Form

[www.rsecorp.com](http://www.rsecorp.com)

### Control Point ID: S014

RSE Control Network: MetroCON

Type: Secondary

Set Date: 02/05/14

Set by: JD & LR

City: Alhambra

Station: Northeasterly of Cal State LA

Subdivision: San Gabriel

Milepost: 6.77

Distance from Track: 1.13 miles' N of Track

Reference Ellipsoid: WGS84

Latitude: 34.08783722

Longitude: -118.13449093

Ellipsoidal Height: 365.934'

Coordinate System: NAD 83, CA CS Z5

Epoch: 2010.00 ("2011, MA11, PA11")

Northing: 1854374.466

Easting: 6520945.069

Combined Scale Factor: 0.99997113

Alt. Coord. System: N/A

Northing: N/A

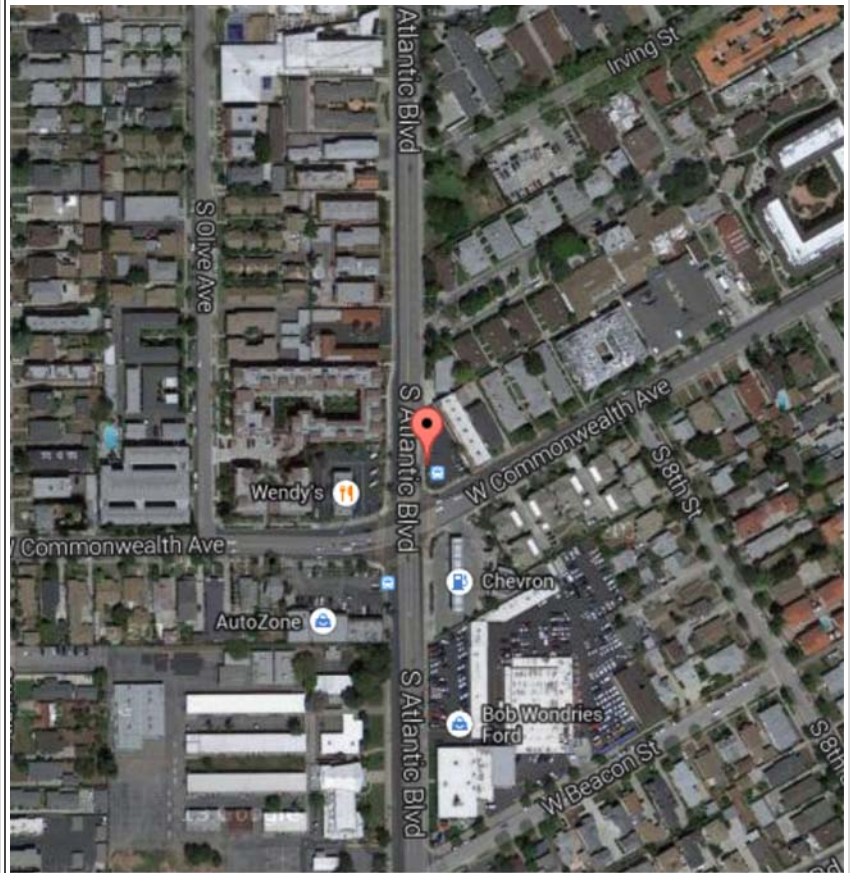
Easting: N/A

Combined Scale Factor: N/A

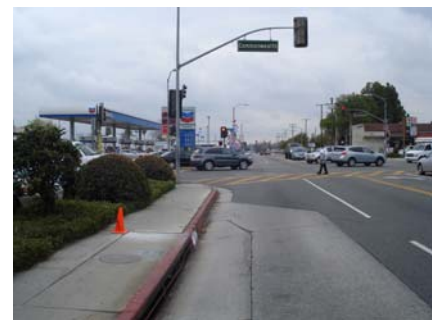
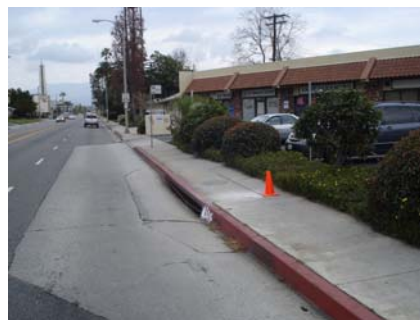
Vertical Datum: GPS-Derived

Geoid Height Model: GEOID12A

Orthometric Height: 479.150'



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**Description:** 2" aluminum disk stamped "SCRRA CONTROL S014", set in the east sidewalk of South Atlantic Blvd, at the southeast corner of a catch basin, +/-50' northerly of the south edge of West Commonwealth Ave.



Rail Surveyors and Engineers, Inc.  
Control Recovery Form

[www.rsecorp.com](http://www.rsecorp.com)

**Control Point ID: S015**

RSE Control Network: MetroCON

Type: Secondary

Set Date: 1991

Set by: CADT

City: Baldwin Park

Station: Easterly of El Monte

Subdivision: San Gabriel

Milepost: 14.18

Distance from Track: 1.35 miles' SW of Track

Reference Ellipsoid: WGS84

Latitude: 34.07758713

Longitude: -117.99952847

Ellipsoidal Height: 210.511'

Coordinate System: NAD 83, CA CS Z5

Epoch: 2010.00 ("2011, MA11, PA11")

Northing: 1850617.856

Easting: 6561809.456

Combined Scale Factor: 0.99998064

Alt. Coord. System: N/A

Northing: N/A

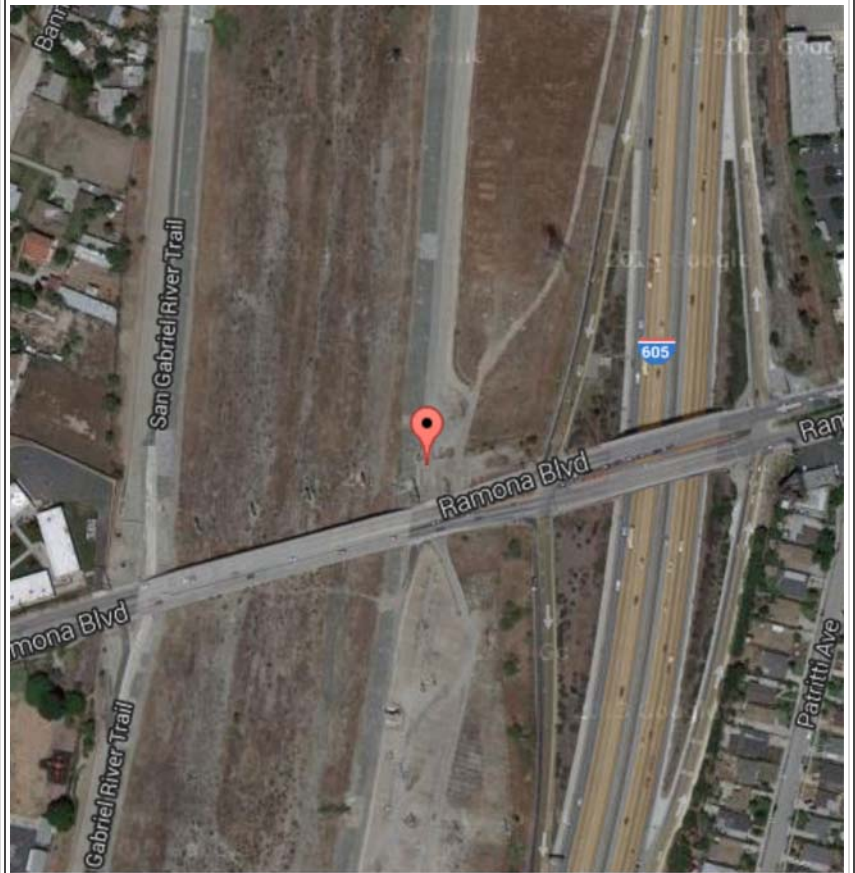
Easting: N/A

Combined Scale Factor: N/A

Vertical Datum: GPS-Derived

Geoid Height Model: GEOID12A

Orthometric Height: 323.129'



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**Description:** 2.5" aluminum disk stamped "CALIF. DEPT. OF TRANSPORTATION HPGN-CALIF. STA 07-02 1991" within a 5" diameter monument well (NGS BM PID EV9239), on the east side of the San Gabriel River, on the north side of Ramona Blvd.



## Rail Surveyors and Engineers, Inc. Control Recovery Form

[www.rsecorp.com](http://www.rsecorp.com)

### Control Point ID: S016

RSE Control Network: MetroCON

Type: Secondary

Set Date: 02/07/14

Set by: CF & TS

City: Pomona

Station: RR East of Pomona (North)

Subdivision: San Gabriel

Milepost: 31.37

Distance from Track: +/-340" S of Track

Reference Ellipsoid: WGS84

Latitude: 34.09264374

Longitude: -117.74611926

Ellipsoidal Height: 954.947'

Coordinate System: NAD 83, CA CS Z5

Epoch: 2010.00 ("2011, MA11, PA11")

Northing: 1856193.501

Easting: 6638533.019

Combined Scale Factor: 0.99994199

Alt. Coord. System: N/A

Northing: N/A

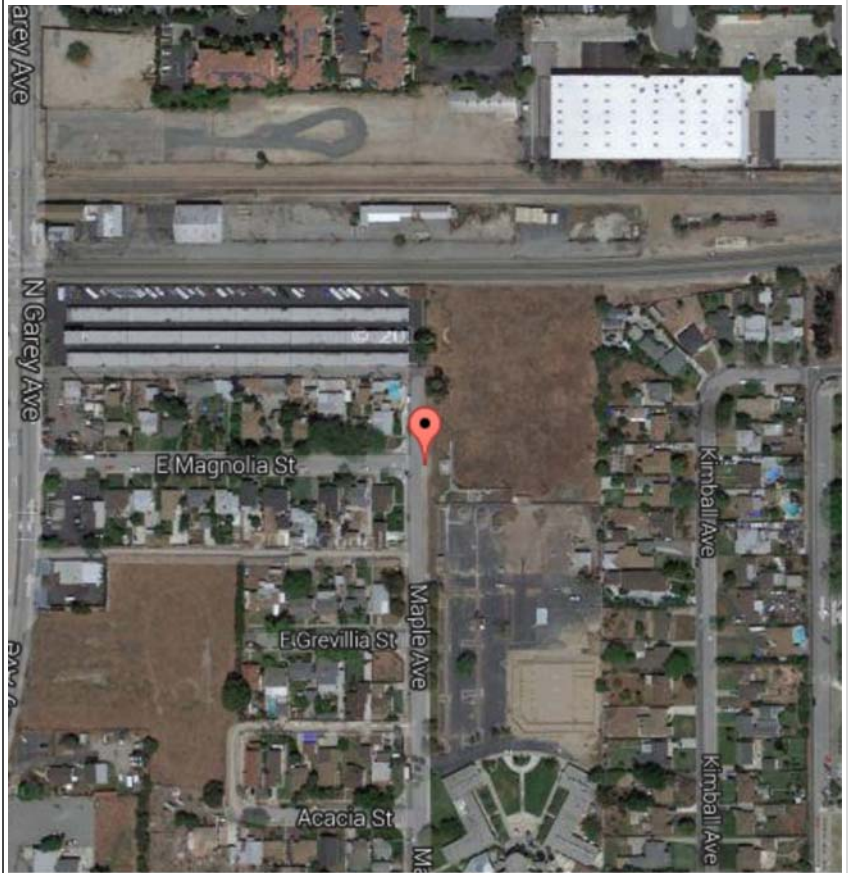
Easting: N/A

Combined Scale Factor: N/A

Vertical Datum: GPS-Derived

Geoid Height Model: GEOID12A

Orthometric Height: 1064.601'



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**Description:** 2" aluminum disk stamped "SCRRRA CONTROL S016", set in a concrete foundation for a manhole, 2.3' northwesterly of the center of the manhole, at the intersection of Magnolia St and Maple Ave, 6' southerly of the extended centerline of Magnolia, 12' easterly of the centerline of Maple.



## Rail Surveyors and Engineers, Inc. Control Recovery Form

[www.rsecorp.com](http://www.rsecorp.com)

### Control Point ID: S017

**RSE Control Network:** MetroCON

**Type:** Secondary

**Set Date:** 02/07/14

**Set by:** CF & TS

**City:** Rancho Cucamonga

**Station:** RR West of Rancho Cucamonga

**Subdivision:** San Gabriel

**Milepost:** 39.85

**Distance from Track:** +/-85" S of Track

**Reference Ellipsoid:** WGS84

**Latitude:** 34.09178925

**Longitude:** -117.59884844

**Ellipsoidal Height:** 991.784'

**Coordinate System:** NAD 83, CA CS Z5

**Epoch:** 2010.00 ("2011, MA11, PA11")

**Northing:** 1856028.365

**Easting:** 6683122.603

**Combined Scale Factor:** 0.99994040

**Alt. Coord. System:** N/A

**Northing:** N/A

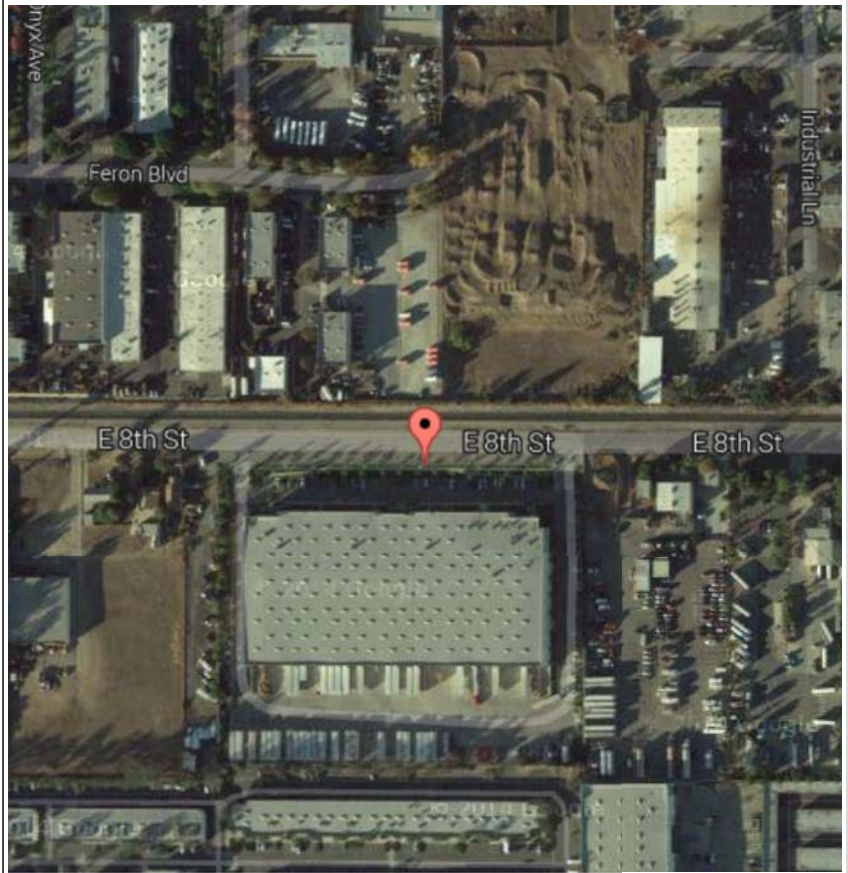
**Easting:** N/A

**Combined Scale Factor:** N/A

**Vertical Datum:** GPS-Derived

**Geoid Height Model:** GEOID12A

**Orthometric Height:** 1100.422'



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**Description:** 2" aluminum disk stamped "SCRRRA CONTROL S017", set in a concrete foundation for a Cal-Edison manhole, 40' southerly of the centerline of East 8th Ave, +/-80' southerly of the centerline of the SCRRRA Main Track, +/-100' northerly of the north edge of Building No. 9449 East 8th Ave.



Rail Surveyors and Engineers, Inc.  
Control Recovery Form

[www.rsecorp.com](http://www.rsecorp.com)

**Control Point ID: S018**

**RSE Control Network:** MetroCON

**Type:** Secondary

**Set Date:** Unknown

**Set by:** Unknown

**City:** Rialto

**Station:** RR West of Rialto

**Subdivision:** San Gabriel

**Milepost:** 52.44

**Distance from Track:** 38" N of Track

**Reference Ellipsoid:** WGS84

**Latitude:** 34.0966835

**Longitude:** -117.37900758

**Ellipsoidal Height:** 1105.418'

**Coordinate System:** NAD 83, CA CS Z5

**Epoch:** 2010.00 ("2011, MA11, PA11")

**Northing:** 1858148.363

**Easting:** 6749671.720

**Combined Scale Factor:** 0.99993399

**Alt. Coord. System:** N/A

**Northing:** N/A

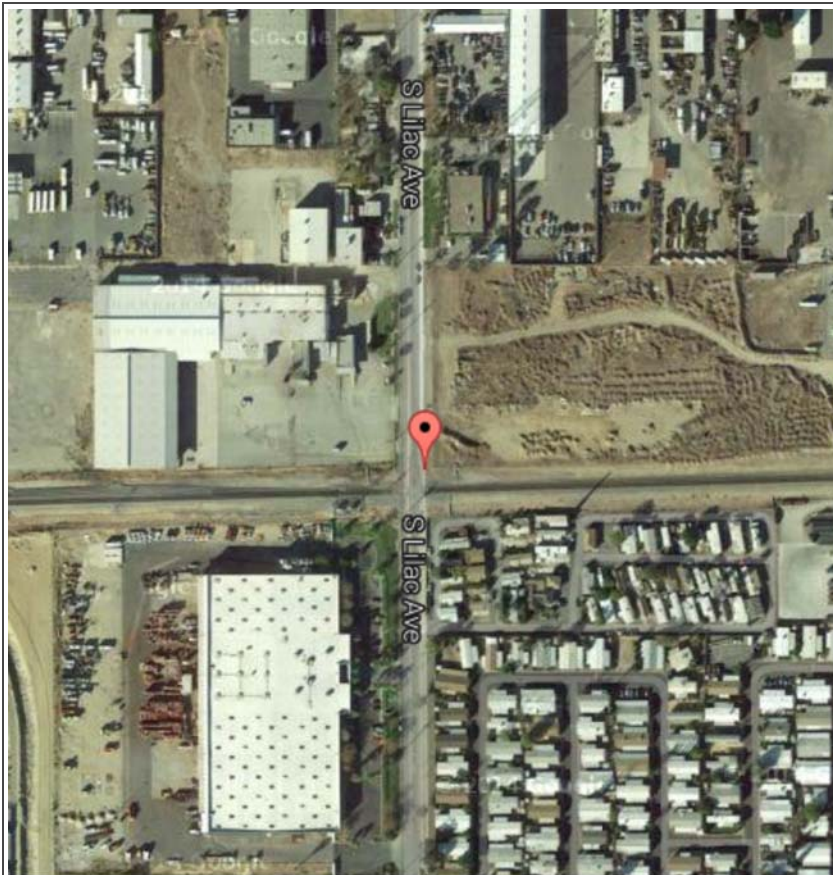
**Easting:** N/A

**Combined Scale Factor:** N/A

**Vertical Datum:** GPS-Derived

**Geoid Height Model:** GEOID12A

**Orthometric Height:** 1213.232'



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**Description:** 2" brass disk stamped "SAN BERNARDINO COUNTY SURVEYOR BENCH MARK RESET NO. 700-6 1973" (NGS BM PID EV3223), 18' easterly of the centerline of South Lilac Ave, 38' northerly of the centerline of the SCRRA Main Track.



## Rail Surveyors and Engineers, Inc. Control Recovery Form

[www.rsecorp.com](http://www.rsecorp.com)

### Control Point ID: S019

RSE Control Network: MetroCON

Type: Secondary

Set Date: 1989

Set by: Unknown

City: San Bernardino

Station: Southeasterly of San Bernardino

Subdivision: N/A

Milepost: N/A

Distance from Track: N/A

Reference Ellipsoid: WGS84

Latitude: 34.0692482

Longitude: -117.27401812

Ellipsoidal Height: 916.483'

Coordinate System: NAD 83, CA CS Z5

Epoch: 2010.00 ("2011, MA11, PA11")

Northing: 1848377.293

Easting: 6781528.811

Combined Scale Factor: 0.99994856

Alt. Coord. System: N/A

Northing: N/A

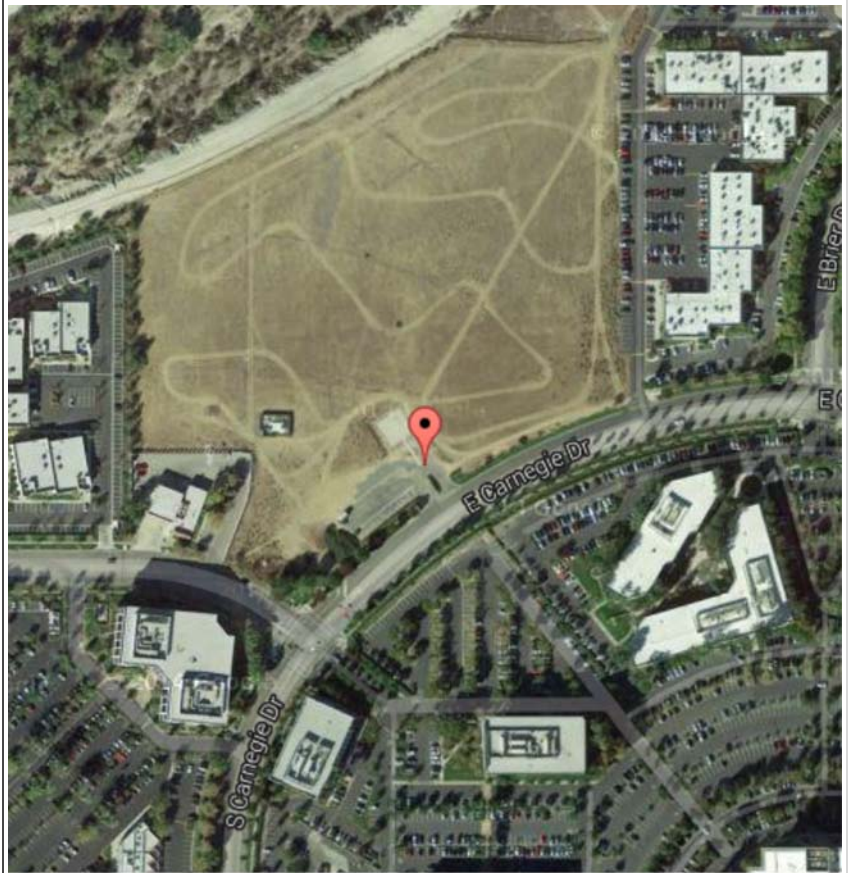
Easting: N/A

Combined Scale Factor: N/A

Vertical Datum: GPS-Derived

Geoid Height Model: GEOID12A

Orthometric Height: 1024.353'



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**Description:** 2" brass disk stamped "HUNSAKER & ASSOC. GPS CONTROL PT. TRICITY HELIPORT 1989", set atop the northwest curb of the driveway to the helicopter pad from the northwest side of East Carnegie Dr.



Rail Surveyors and Engineers, Inc.  
Control Recovery Form

[www.rsecorp.com](http://www.rsecorp.com)

**Control Point ID: S020**

RSE Control Network: MetroCON

Type: Secondary

Set Date: 1996

Set by: MWDSC

City: Redlands

Station: Southeasterly of San Bernardino

Subdivision: N/A

Milepost: N/A

Distance from Track: N/A

Reference Ellipsoid: WGS84

Latitude: 34.03357697

Longitude: -117.13888574

Ellipsoidal Height: 1731.042'

Coordinate System: NAD 83, CA CS Z5

Epoch: 2010.00 ("2011, MA11, PA11")

Northing: 1835719.575

Easting: 6822563.664

Combined Scale Factor: 0.99991713

Alt. Coord. System: NAD 83, CA CS Z6

Northing: 2320872.887

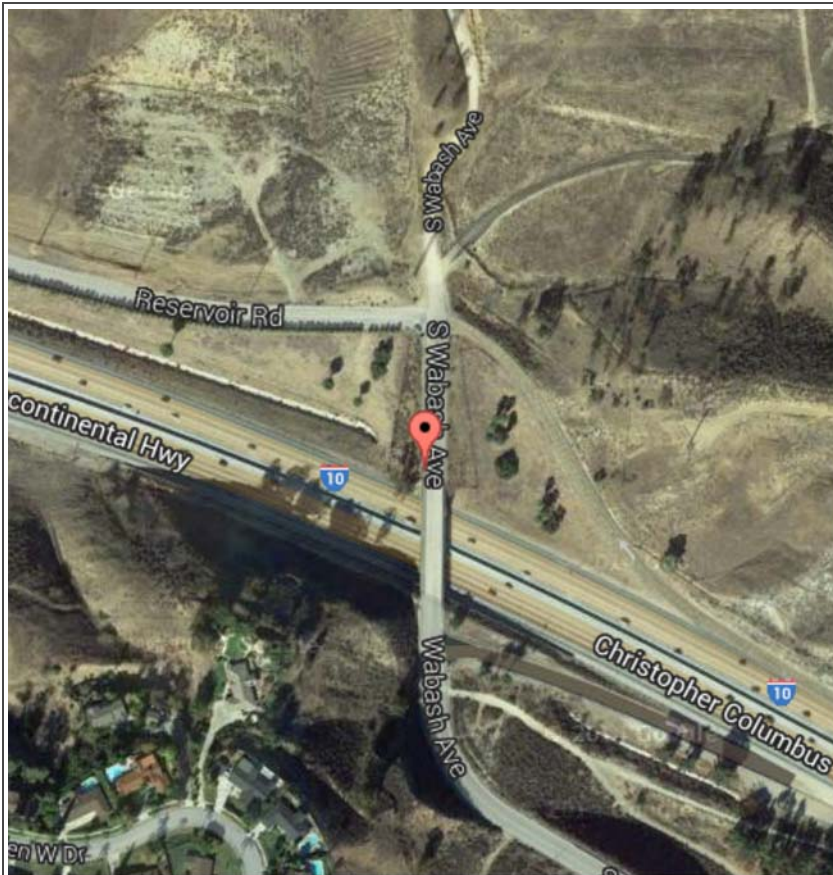
Easting: 6292347.841

Combined Scale Factor: 0.99998731

Vertical Datum: GPS-Derived

Geoid Height Model: GEOID12A

Orthometric Height: 1837.464'



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**Description:** 3.25" brass disk stamped "IVF 91 1996" (NGS BM PID AH2685), at the northwest corner of the Wabash Rd bridge over the Christopher Columbus Transcontinental Highway (I-10), +/-300' southerly of Reservoir Rd.



## Rail Surveyors and Engineers, Inc. Control Recovery Form

[www.rsecorp.com](http://www.rsecorp.com)

### Control Point ID: S021

RSE Control Network: MetroCON

Type: Secondary

Set Date: 02/03/14

Set by: JD

City: Buena Park

Station: Southerly of Buena Park

Subdivision: San Bernardino (BNSF)

Milepost: 161.69

Distance from Track: 1.05 miles' S of Track

Reference Ellipsoid: WGS84

Latitude: 33.85921097

Longitude: -117.98191769

Ellipsoidal Height: -15.790'

Coordinate System: NAD 83, CA CS Z6

Epoch: 2010.00 ("2011, MA11, PA11")

Northing: 2260636.799

Easting: 6035885.809

Combined Scale Factor: 0.99999682

Alt. Coord. System: NAD 83, CA CS Z5

Northing: 1771147.008

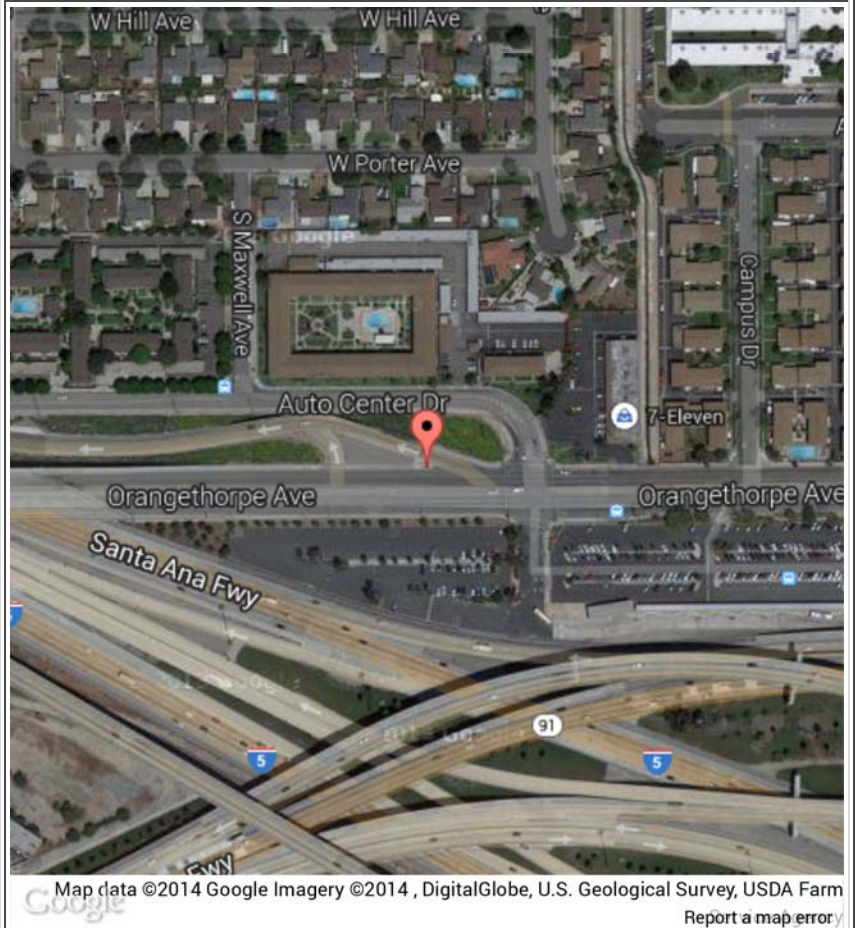
Easting: 6567156.656

Combined Scale Factor: 1.00004304

Vertical Datum: GPS-Derived

Geoid Height Model: GEOID12A

Orthometric Height: 100.078'



**Description:** 2" aluminum disk stamped "SCRRA CONTROL S021", set in the sidewalk on the north side of Orangethorpe Ave, at the northeast corner of a catch basin at the east end of the traffic island at the northbound on-ramp to Interstate Hwy 5.





## Rail Surveyors and Engineers, Inc. Control Recovery Form

[www.rsecorp.com](http://www.rsecorp.com)

### Control Point ID: S022

RSE Control Network: MetroCON

Type: Secondary

Set Date: 1984

Set by: Orange Co. Surveyor

City: Santa Ana

Station: Westerly of Santa Ana

Subdivision: Orange

Milepost: 174.92

Distance from Track: 1.66 miles' W of Track

Reference Ellipsoid: WGS84

Latitude: 33.75597382

Longitude: -117.88491829

Ellipsoidal Height: -7.059'

Coordinate System: NAD 83, CA CS Z6

Epoch: 2010.00 ("2011, MA11, PA11")

Northing: 2222597.564

Easting: 6064741.638

Combined Scale Factor: 0.99998153

Alt. Coord. System: N/A

Northing: N/A

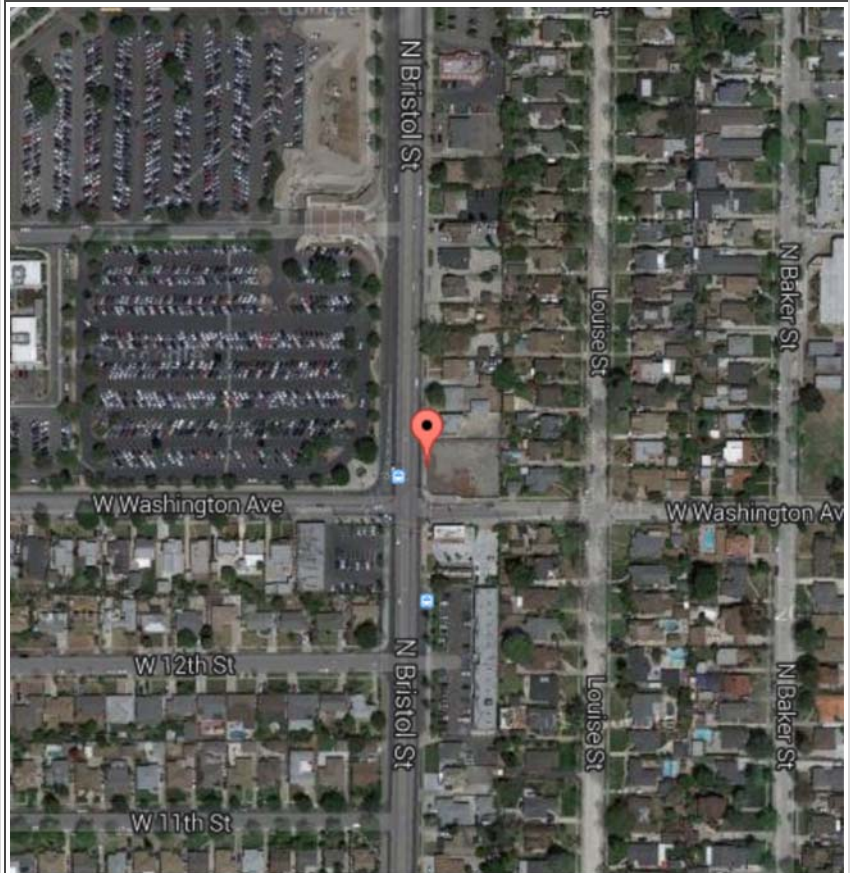
Easting: N/A

Combined Scale Factor: N/A

Vertical Datum: GPS-Derived

Geoid Height Model: GEOID12A

Orthometric Height: 107.816'



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**Description:** 4" aluminum disk stamped "ORANGE COUNTY SURVEYOR SA 318 84" (NGS BM PID AB8652), set in the sidewalk on the east side of North Bristol St, at the northeast corner of a catch basin, +/-90' northerly from the north edge of West Washington Ave, immediately southerly of Building No. 1311 North Bristol St.



## Rail Surveyors and Engineers, Inc. Control Recovery Form

[www.rsecorp.com](http://www.rsecorp.com)

### Control Point ID: S023

RSE Control Network: MetroCON

Type: Secondary

Set Date: 02/04/14

Set by: JD

City: Mission Viejo

Station: RR West of Laguna Niguel

Subdivision: Orange

Milepost: 190.82

Distance from Track: +/-40" E of Track

Reference Ellipsoid: WGS84

Latitude: 33.59206772

Longitude: -117.6740309

Ellipsoidal Height: 236.509'

Coordinate System: NAD 83, CA CS Z6

Epoch: 2010.00 ("2011, MA11, PA11")

Northing: 2162018.332

Easting: 6128020.914

Combined Scale Factor: 0.99995294

Alt. Coord. System: N/A

Northing: N/A

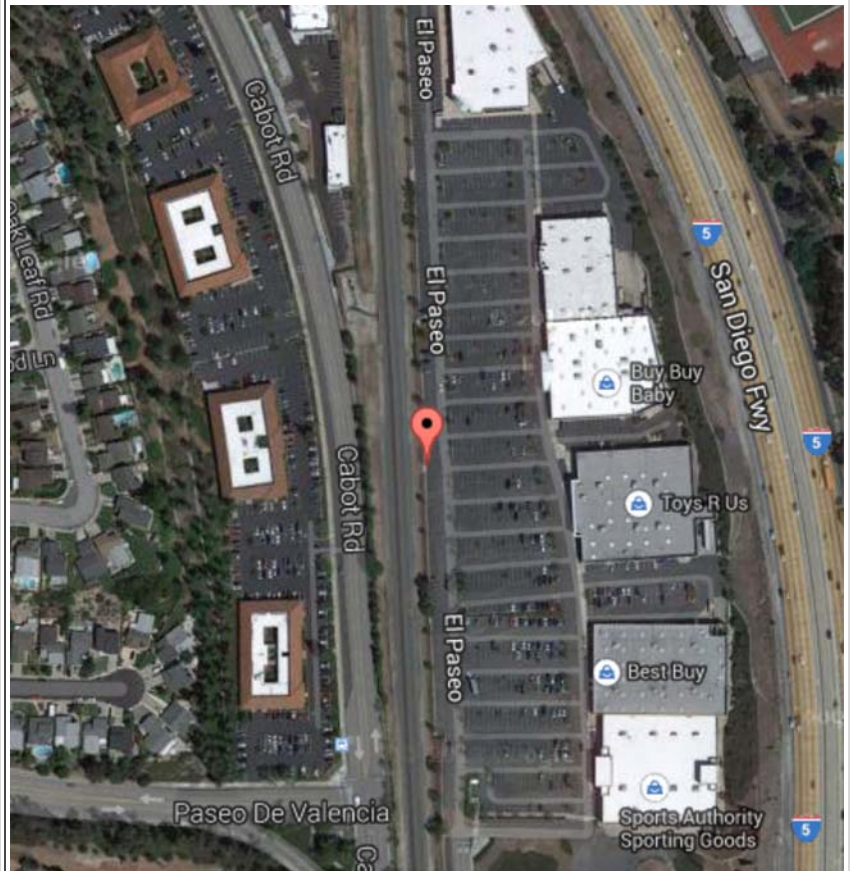
Easting: N/A

Combined Scale Factor: N/A

Vertical Datum: GPS-Derived

Geoid Height Model: GEOID12A

Orthometric Height: 349.177'



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**Description:** 2" aluminum disk stamped "SCRRRA CONTROL S023", set at the northeast corner of a catch basin on the west side of El Paseo, approximately in line with the north edge of Toys R' Us/ Babies R' Us - Building No. 25362 El Paseo.



Rail Surveyors and Engineers, Inc.  
**Control Recovery Form**

[www.rsecorp.com](http://www.rsecorp.com)

**Control Point ID: S024**

**RSE Control Network:** MetroCON  
**Type:** Secondary  
**Set Date:** 1932  
**Set by:** USCGS

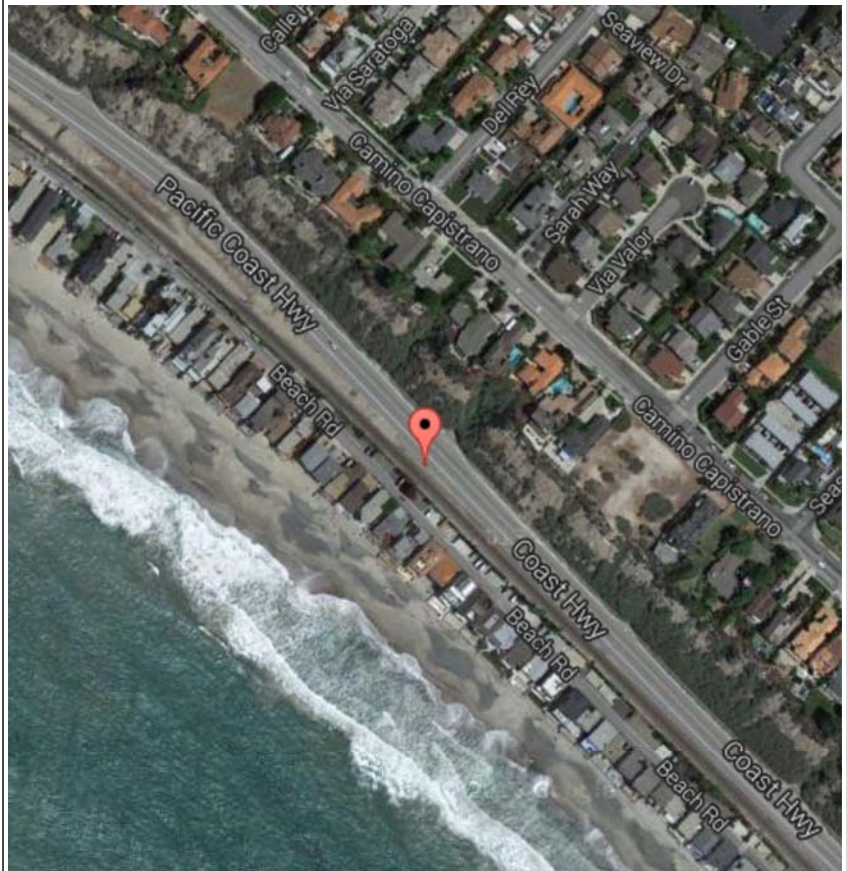
**City:** Capistrano Beach  
**Station:** RR West of San Clemente North Beach  
**Subdivision:** Orange  
**Milepost:** 202.10  
**Distance from Track:** 19" NE of Track

**Reference Ellipsoid:** WGS84  
**Latitude:** 33.4466362  
**Longitude:** -117.65232703  
**Ellipsoidal Height:** -95.820'

**Coordinate System:** NAD 83, CA CS Z6  
**Epoch:** 2010.00 ("2011, MA11, PA11")  
**Northing:** 2109014.858  
**Easting:** 6133918.061  
**Combined Scale Factor:** 0.99996066

**Alt. Coord. System:** N/A  
**Northing:** N/A  
**Easting:** N/A  
**Combined Scale Factor:** N/A

**Vertical Datum:** GPS-Derived  
**Geoid Height Model:** GEOID12A  
**Orthometric Height:** 18.362'



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**Description:** 3.5" USC&GS brass disk stamped "W 130 1932" (NGS BM PID DX1476), atop and at the center of a concrete headwall, 19' northeasterly of the centerline of the SCRRA Main Track, 2' southwesterly of the guardrail on the southwest side of the Coast Hwy, 0.54 miles northwesterly along the Coast Hwy from its intersection with Camino Capistrano.

**Exhibit C** – Summary of Statistical Analysis as part of the Least Squares Adjustment on the Local (L) control points. For full report, entitled “Metrolink Local.pdf”, see compact disc, a part of the GCN delivery.

Run Date: Mon May 19 2014 16:10:22  
Summary of Files Used and Option Settings

=====

Project Folder and Data Files  
Project Name METROLINK LOCAL

Project Option Settings  
=====

STAR\*NET Run Mode : Adjust with Error Propagation  
Type of Adjustment : 3D  
Project Units : FeetUS; DMS  
Coordinate System : Lambert NAD83; CA Zone 6 0406  
Geoid Height Model : F:\SURVEY\...\CALGEOID12A.GHT  
Longitude Sign Convention : Positive West  
Input/Output Coordinate Order : North-East  
Angle Data Station Order : At-From-To  
Distance/Vertical Data Type : Slope/Zenith  
Convergence Limit; Max Iterations : 0.010000; 10  
Default Coefficient of Refraction : 0.070000  
Create Coordinate File : Yes  
Create Geodetic Position File : Yes  
Create Ground Scale Coordinate File : Yes  
Create Dump File : No  
GPS Vector Standard Error Factors : None  
GPS Vector Centering (Meters) : 0.01000 (Horiz), 0.01100 (Vert)  
GPS Vector Transformations : None

1

Adjustment Statistical Summary

=====

Iterations = 3  
Number of Stations = 64  
Number of Observations = 1104  
Number of Unknowns = 93  
Number of Redundant Obs = 1011  
Observation Count Sum Squares Error  
of StdRes Factor  
GPS Deltas 1104 1066.478 1.027  
Total 1104 1066.478 1.027  
The Chi-Square Test at 5.00% Level Passed  
Lower/Upper Bounds (0.956/1.044)



Rail Surveyors and Engineers, Inc.  
**Control Recovery Form**

[www.rsecorp.com](http://www.rsecorp.com)

**Control Point ID: L001**

**RSE Control Network:** MetroCON

**Type:** Local

**Set Date:** 02/25/13

**Set by:** RKC & JD

**City:** Rosamond

**Station:** RR West of Lancaster

**Subdivision:** Mojave (UPRR)

**Milepost:** 397.9

**Distance from Track:** +/-55" W of Track

**Reference Ellipsoid:** WGS84

**Latitude:** 34.80599213

**Longitude:** -118.15348033

**Ellipsoidal Height:** 2197.959'

**Coordinate System:** NAD 83, CA CS Z5

**Epoch:** 2010.00 ("2011, MA11, PA11")

**Northing:** 2115736.602

**Easting:** 6515594.465

**Combined Scale Factor:** 0.99981744

**Alt. Coord. System:** N/A

**Northing:** N/A

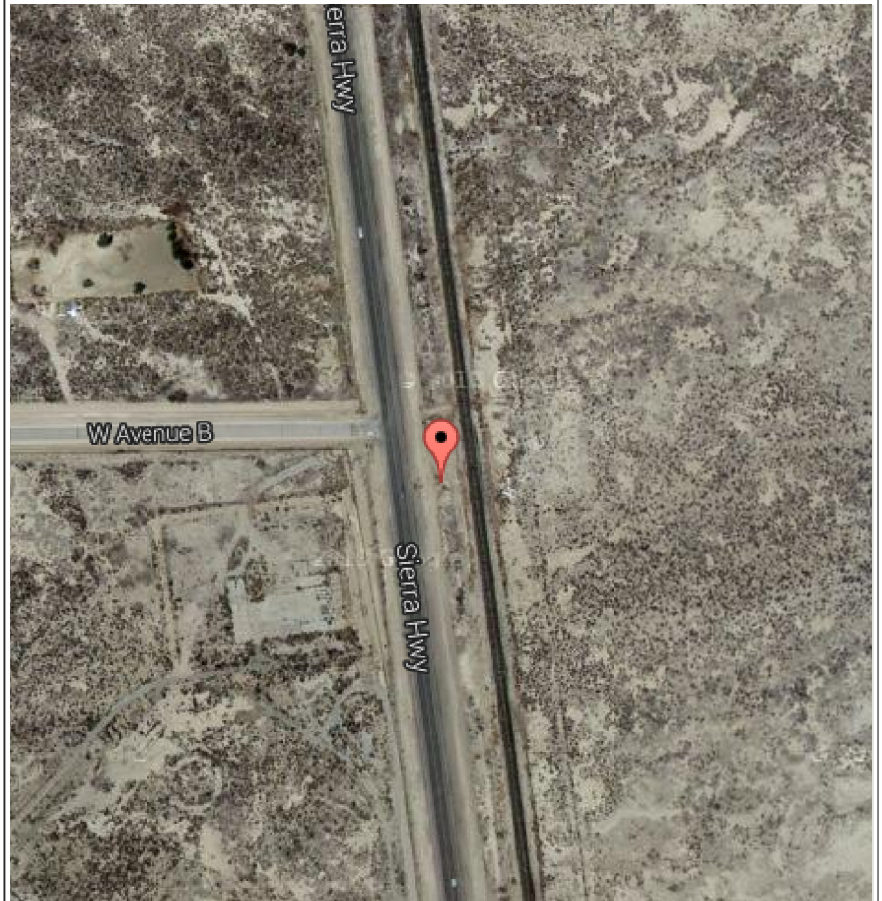
**Easting:** N/A

**Combined Scale Factor:** N/A

**Vertical Datum:** GPS-Derived

**Geoid Height Model:** GEOID12A

**Orthometric Height:** 2303.893'



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**Description:** 1/2" (No. 4) rebar with drill hole set vertically in a 2' x 2' concrete foundation at ground level, adjacent tag stamped "L001" also set in concrete, opposite the Sierra Hwy milepost marker 1.03 at culvert, +/-75' southeasterly of the southeast edge of Avenue B, +/-50' easterly of the east edge of Sierra Hwy, +/-180' northerly of railroad milepost marker 398.



## Rail Surveyors and Engineers, Inc. Control Recovery Form

[www.rsecorp.com](http://www.rsecorp.com)

### Control Point ID: L002

RSE Control Network: MetroCON

Type: Local

Set Date: 02/25/13

Set by: RKC & JD

City: Lancaster

Station: At Lancaster

Subdivision: Valley

Milepost: 76.05

Distance from Track: 0.13 miles' E of Track

Reference Ellipsoid: WGS84

Latitude: 34.68963623

Longitude: -118.1324468

Ellipsoidal Height: 2274.715'

Coordinate System: NAD 83, CA CS Z5

Epoch: 2010.00 ("2011, MA11, PA11")

Northing: 2073381.724

Easting: 6521852.573

Combined Scale Factor: 0.99981388

Alt. Coord. System: N/A

Northing: N/A

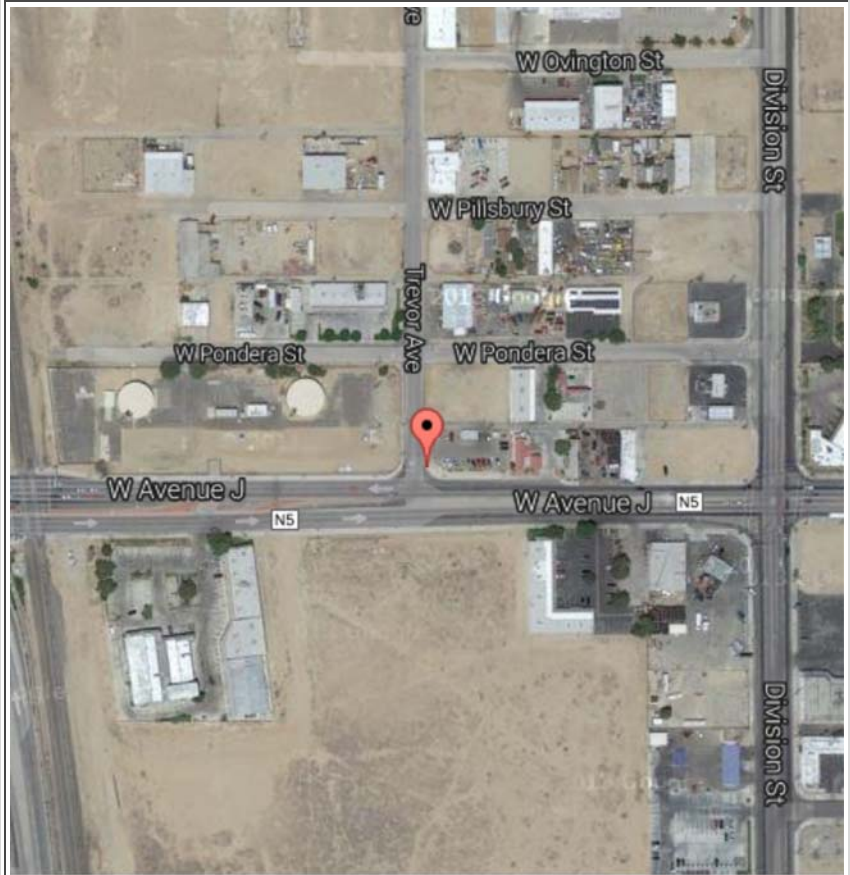
Easting: N/A

Combined Scale Factor: N/A

Vertical Datum: GPS-Derived

Geoid Height Model: GEOID12A

Orthometric Height: 2380.902'



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**Description:** 2" aluminum disk stamped "SCRRA CONTROL L002", set atop the east curb return of Trevor Ave, 19' northerly of the north curb of Avenue J, immediately south of the driveway to the parking lot of Address No. 221 Avenue J (Avis Rent a Car).



Rail Surveyors and Engineers, Inc.  
Control Recovery Form

[www.rsecorp.com](http://www.rsecorp.com)

**Control Point ID: L003**

**RSE Control Network:** MetroCON

**Type:** Local

**Set Date:** 1935

**Set by:** USCGS

**City:** Palmdale

**Station:** RR East of Palmdale

**Subdivision:** Valley

**Milepost:** 67.02

**Distance from Track:** +/-90" E of Track

**Reference Ellipsoid:** WGS84

**Latitude:** 34.55955505

**Longitude:** -118.11522042

**Ellipsoidal Height:** 2642.693'

**Coordinate System:** NAD 83, CA CS Z5

**Epoch:** 2010.00 ("2011, MA11, PA11")

**Northing:** 2026034.584

**Easting:** 6526976.631

**Combined Scale Factor:** 0.99980127

**Alt. Coord. System:** N/A

**Northing:** N/A

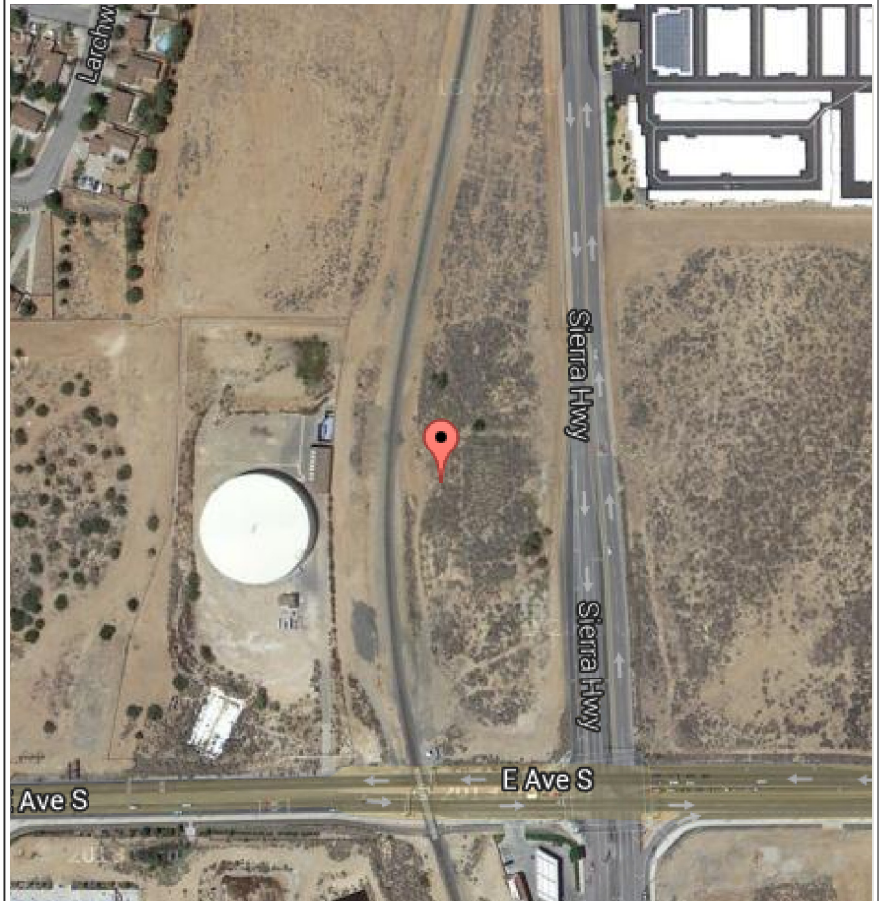
**Easting:** N/A

**Combined Scale Factor:** N/A

**Vertical Datum:** GPS-Derived

**Geoid Height Model:** GEOID12A

**Orthometric Height:** 2747.829'



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**Description:** 3.5" Brass disk Stamped "V 427 1935" (NGS PID EW0283), set in a 6" x 6" concrete post at ground level, +/-75' northerly of railroad milepost marker 67, +/-60' southerly of a 24" corrugated metal pipe beneath the railroad tracks, +/-250' westerly of Sierra Hwy, +/-500' northerly of Avenue S, opposite water tank to the west and opposite the end of a power pole line to the east on the east side of Sierra Hwy.



Rail Surveyors and Engineers, Inc.  
Control Recovery Form

[www.rsecorp.com](http://www.rsecorp.com)

**Control Point ID: L004**

**RSE Control Network:** MetroCON

**Type:** Local

**Set Date:** 02/25/13

**Set by:** RKC & JD

**City:** Acton

**Station:** RR East of Vincent Grade/ Acton

**Subdivision:** Valley

**Milepost:** 57.04

**Distance from Track:** 0.19 miles' N of Track

**Reference Ellipsoid:** WGS84

**Latitude:** 34.47463226

**Longitude:** -118.18501016

**Ellipsoidal Height:** 2684.114'

**Coordinate System:** NAD 83, CA CS Z5

**Epoch:** 2010.00 ("2011, MA11, PA11")

**Northing:** 1995161.534

**Easting:** 6505907.795

**Combined Scale Factor:** 0.99980529

**Alt. Coord. System:** N/A

**Northing:** N/A

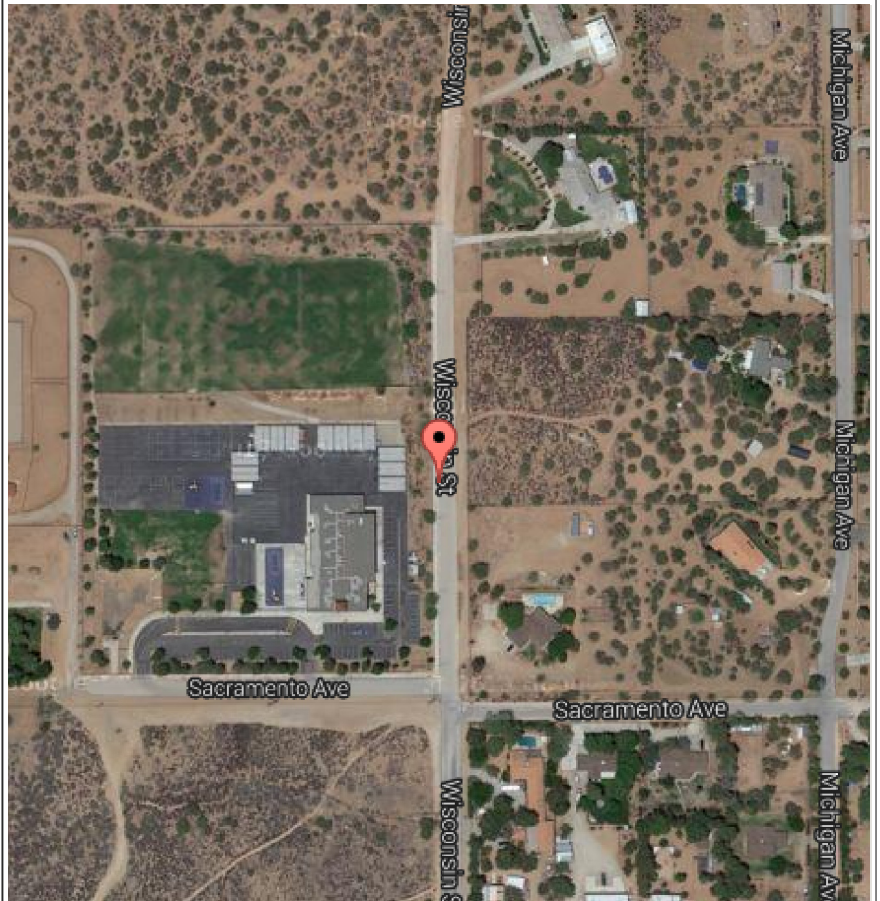
**Easting:** N/A

**Combined Scale Factor:** N/A

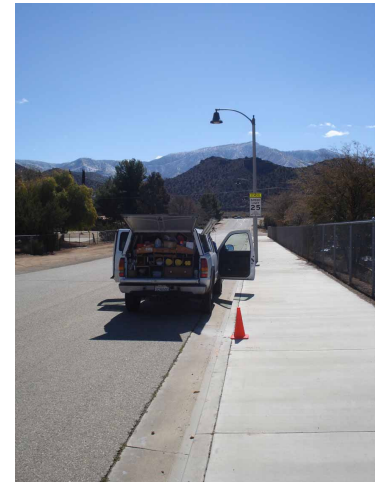
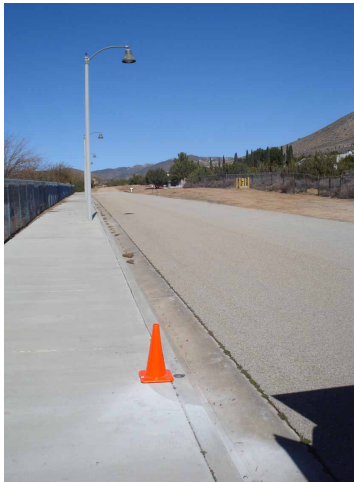
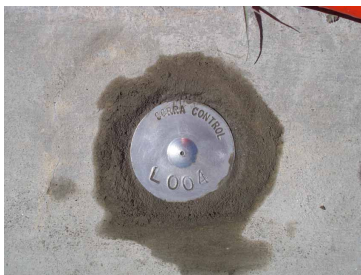
**Vertical Datum:** GPS-Derived

**Geoid Height Model:** GEOID12A

**Orthometric Height:** 2788.963'



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**Description:** 2" aluminum disk stamped "SCRR CONTROL L004", set atop the west curb Wisconsin St, +/-375' northerly of Sacramento St, +/-900' northerly of Soledad Canyon Rd, +/-65' northerly of light pole 4335759E, +/-150' southerly of a fire standpipe on east side of the street.





Rail Surveyors and Engineers, Inc.  
Control Recovery Form

[www.rsecorp.com](http://www.rsecorp.com)

**Control Point ID: L005**

**RSE Control Network:** MetroCON

**Type:** Local

**Set Date:** 02/25/13

**Set by:** RKC & JD

**City:** Acton

**Station:** RR East of Vincent Grade/ Acton

**Subdivision:** Valley

**Milepost:** 48.08

**Distance from Track:** 0.12 miles' SE of Track

**Reference Ellipsoid:** WGS84

**Latitude:** 34.4402771

**Longitude:** -118.30941059

**Ellipsoidal Height:** 1961.332'

**Coordinate System:** NAD 83, CA CS Z5

**Epoch:** 2010.00 ("2011, MA11, PA11")

**Northing:** 1982750.733

**Easting:** 6468377.259

**Combined Scale Factor:** 0.99984292

**Alt. Coord. System:** N/A

**Northing:** N/A

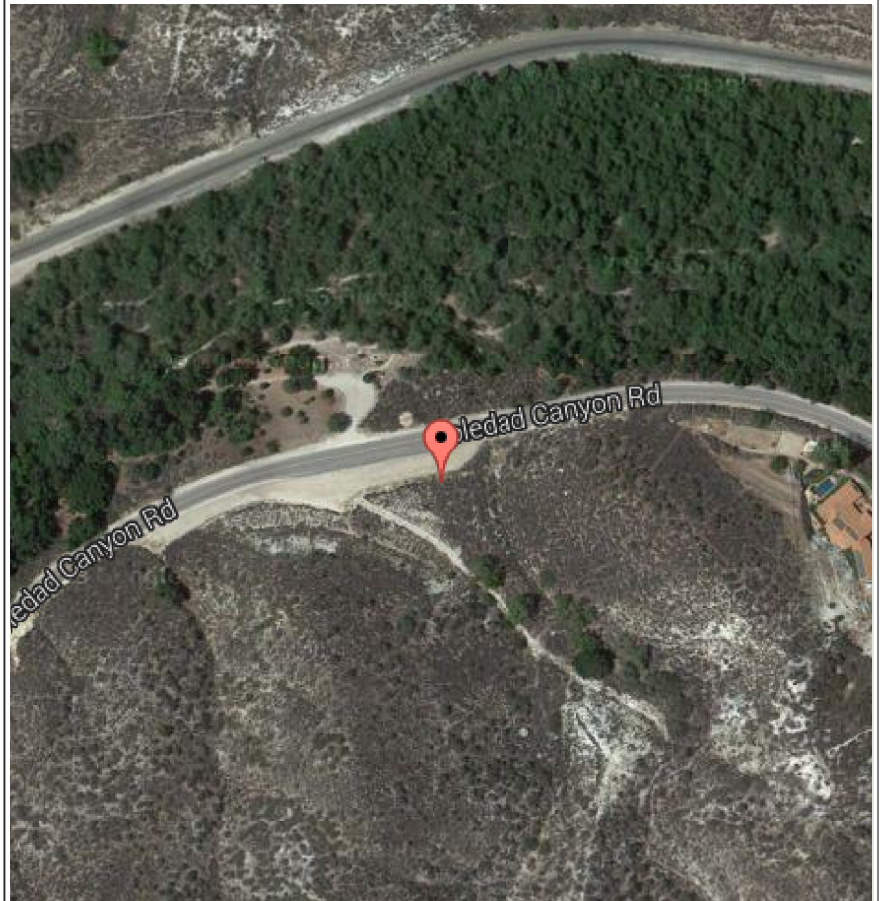
**Easting:** N/A

**Combined Scale Factor:** N/A

**Vertical Datum:** GPS-Derived

**Geoid Height Model:** GEOID12A

**Orthometric Height:** 2067.697'



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**Description:** 1/2" (No. 4) rebar with drill hole set vertically in a 2' x 2' concrete foundation at ground level, adjacent tag stamped "L005" also set in concrete, 8 miles westerly of Acton, 65' southerly of the south edge of Soledad Canyon Rd, southerly of a 4' tall dirt berm in a turnout area, opposite day camp, +/-110' westerly of Soledad Canyon Rd milepost marker 15.24, at culvert beneath road, 30' easterly of power pole 794755E on north side of Soledad Canyon Rd.



Rail Surveyors and Engineers, Inc.  
Control Recovery Form

[www.rsecorp.com](http://www.rsecorp.com)

**Control Point ID: L006**

**RSE Control Network:** MetroCON

**Type:** Local

**Set Date:** 02/25/13

**Set by:** RKC & JD

**City:** Canyon Country

**Station:** RR West of Via Princessa

**Subdivision:** Valley

**Milepost:** 38.80

**Distance from Track:** 0.47 miles' N of Track

**Reference Ellipsoid:** WGS84

**Latitude:** 34.41632843

**Longitude:** -118.45411212

**Ellipsoidal Height:** 1334.748'

**Coordinate System:** NAD 83, CA CS Z5

**Epoch:** 2010.00 ("2011, MA11, PA11")

**Northing:** 1974201.525

**Easting:** 6424709.634

**Combined Scale Factor:** 0.99987524

**Alt. Coord. System:** N/A

**Northing:** N/A

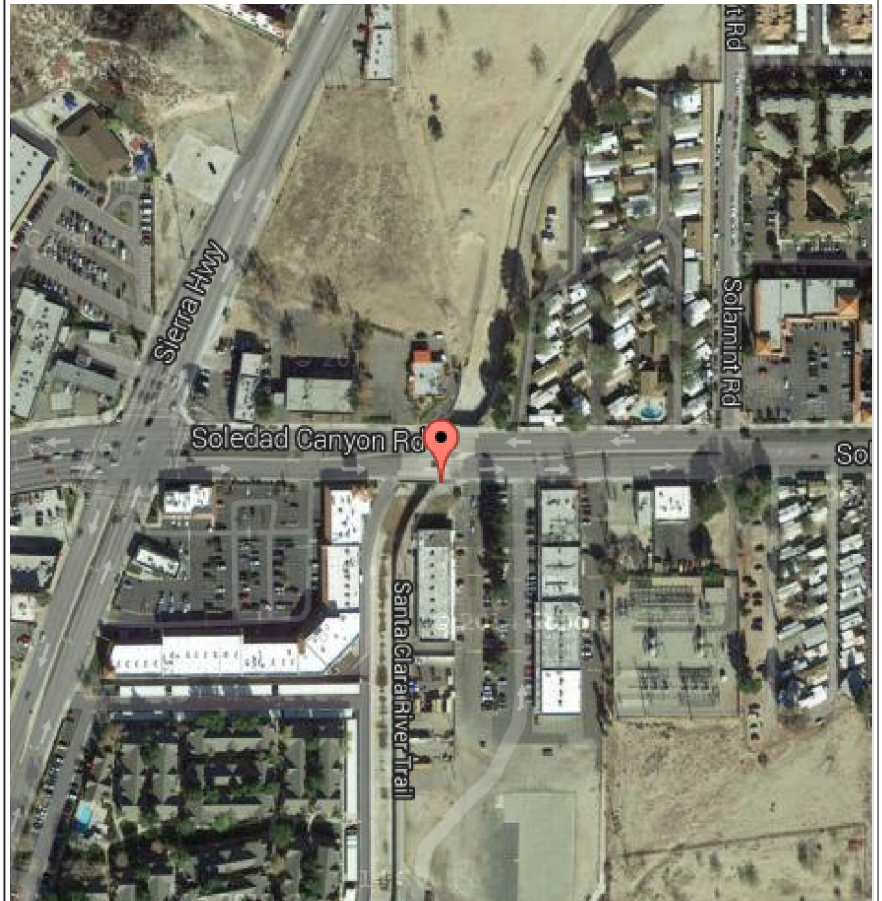
**Easting:** N/A

**Combined Scale Factor:** N/A

**Vertical Datum:** GPS-Derived

**Geoid Height Model:** GEOID12A

**Orthometric Height:** 1444.388'



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**Description:** 2" aluminum disk stamped "SCRRRA CONTROL L006", set atop the south sidewalk of Soledad Canyon Rd, at Address Nos. 18336-18366 and opposite No. 18401, above the east abutment of the bridge over an open channel, +/-450' easterly of Sierra Hwy.



Rail Surveyors and Engineers, Inc.  
**Control Recovery Form**

[www.rsecorp.com](http://www.rsecorp.com)

**Control Point ID: L007**

**RSE Control Network:** MetroCON

**Type:** Local

**Set Date:** 02/22/13

**Set by:** RKC & JD

**City:** San Fernando

**Station:** RR East of Newhall

**Subdivision:** Valley

**Milepost:** 26.45

**Distance from Track:** 0.12 miles' NE of Track

**Reference Ellipsoid:** WGS84

**Latitude:** 34.33446503

**Longitude:** -118.50444863

**Ellipsoidal Height:** 1343.057'

**Coordinate System:** NAD 83, CA CS Z5

**Epoch:** 2010.00 ("2011, MA11, PA11")

**Northing:** 1944482.762

**Easting:** 6409379.108

**Combined Scale Factor:** 0.99988414

**Alt. Coord. System:** N/A

**Northing:** N/A

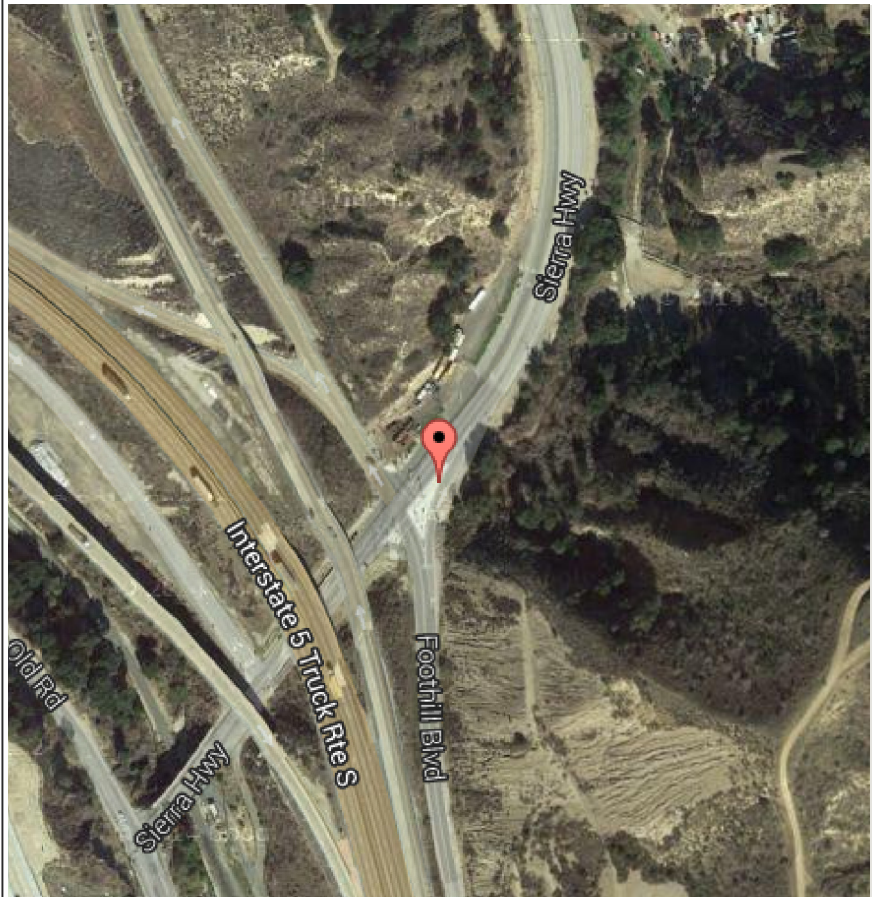
**Easting:** N/A

**Combined Scale Factor:** N/A

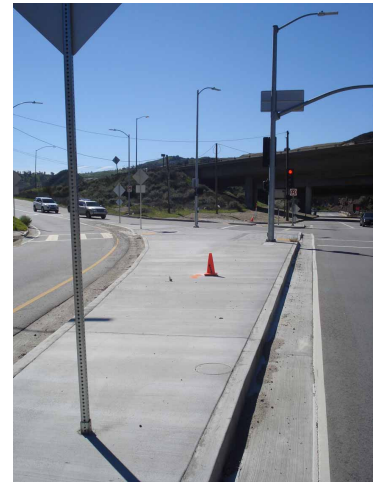
**Vertical Datum:** GPS-Derived

**Geoid Height Model:** GEOID12A

**Orthometric Height:** 1454.774'



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**Description:** 2" aluminum disk stamped "SCRRA CONTROL L007", set atop the concrete median in the east quadrant of the intersection of Sierra Hwy and Foothill Blvd (also the on-ramp for I-5 Northbound and Hwy 14 Northbound).



Rail Surveyors and Engineers, Inc.  
Control Recovery Form

[www.rsecorp.com](http://www.rsecorp.com)

**Control Point ID: L008**

**RSE Control Network:** MetroCON

**Type:** Local

**Set Date:** 1946

**Set by:** USCGS

**City:** Sun Valley

**Station:** RR West of Sun Valley

**Subdivision:** Valley

**Milepost:** 16.28

**Distance from Track:** +/-40" SW of Track

**Reference Ellipsoid:** WGS84

**Latitude:** 34.23093796

**Longitude:** -118.38476307

**Ellipsoidal Height:** 758.688'

**Coordinate System:** NAD 83, CA CS Z5

**Epoch:** 2010.00 ("2011, MA11, PA11")

**Northing:** 1906647.446

**Easting:** 6445366.458

**Combined Scale Factor:** 0.99992675

**Alt. Coord. System:** N/A

**Northing:** N/A

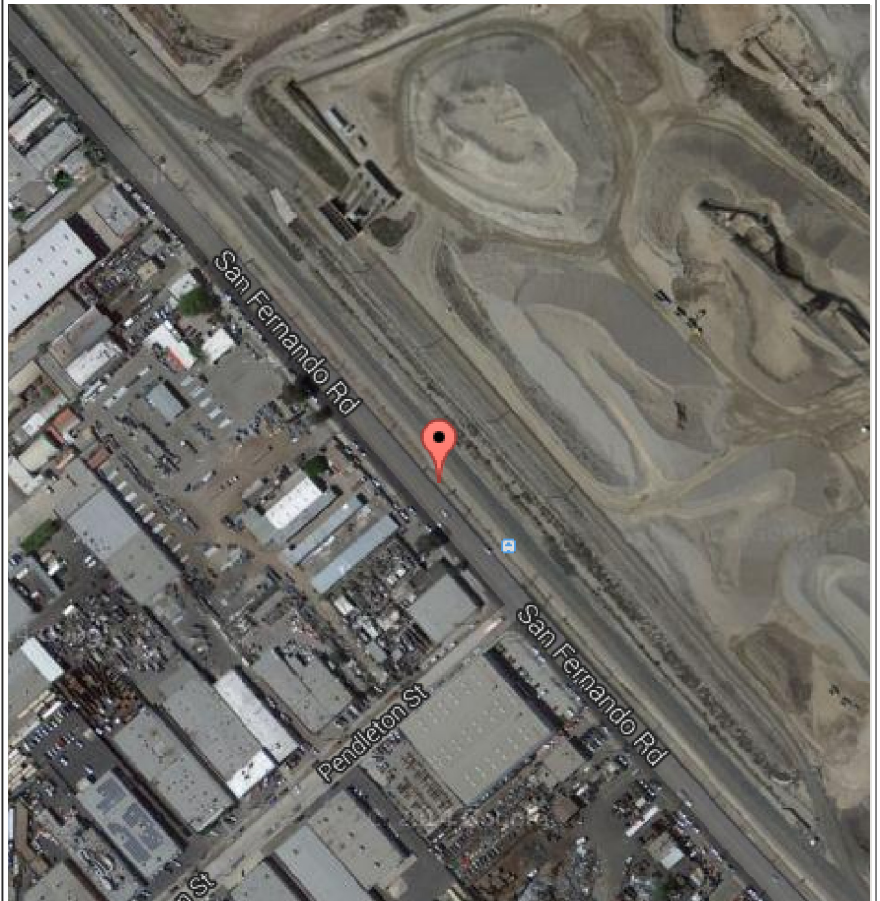
**Easting:** N/A

**Combined Scale Factor:** N/A

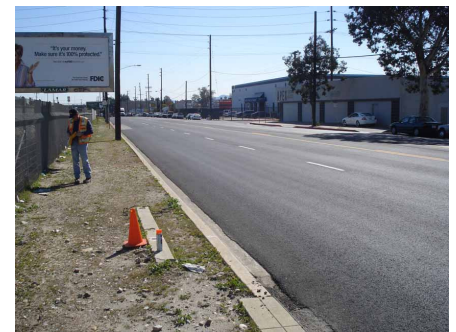
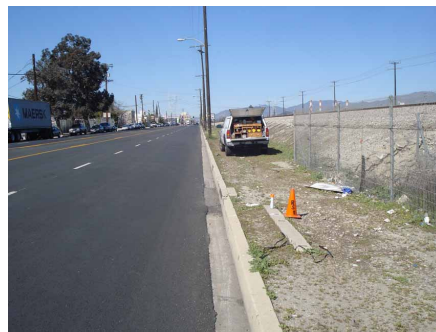
**Vertical Datum:** GPS-Derived

**Geoid Height Model:** GEOID12A

**Orthometric Height:** 870.975'



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**Description:** 3.5" brass disk stamped "W 786 1946" (NGS PID EW2359), set atop a concrete headwall on the northeast side of San Fernando Rd, 2.6' easterly of curb, +/-225' from the north curb line of Pendleton St, 32' southerly of the end of a no-climb fence, 46' westerly of the railroad tracks, 12' southerly of a 24" culvert beneath tracks.



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Control Recovery Form

[www.rsecorp.com](http://www.rsecorp.com)

**Control Point ID: L009**

**RSE Control Network:** MetroCON

**Type:** Local

**Set Date:** 02/22/13

**Set by:** RKC & JD

**City:** Glendale

**Station:** RR East of Glendale

**Subdivision:** Valley

**Milepost:** 5.60

**Distance from Track:** 0.36 miles' NE of Track

**Reference Ellipsoid:** WGS84

**Latitude:** 34.12550735

**Longitude:** -118.25301716

**Ellipsoidal Height:** 337.203'

**Coordinate System:** NAD 83, CA CS Z5

**Epoch:** 2010.00 ("2011, MA11, PA11")

**Northing:** 1868152.801

**Easting:** 6485091.879

**Combined Scale Factor:** 0.99996517

**Alt. Coord. System:** N/A

**Northing:** N/A

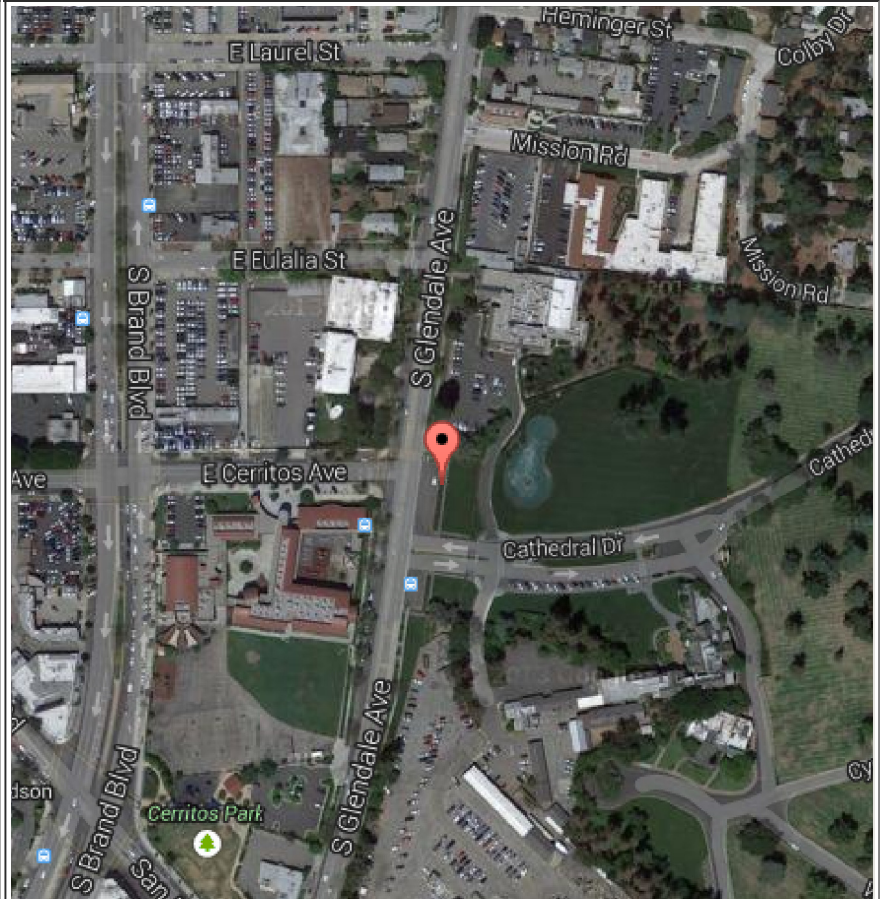
**Easting:** N/A

**Combined Scale Factor:** N/A

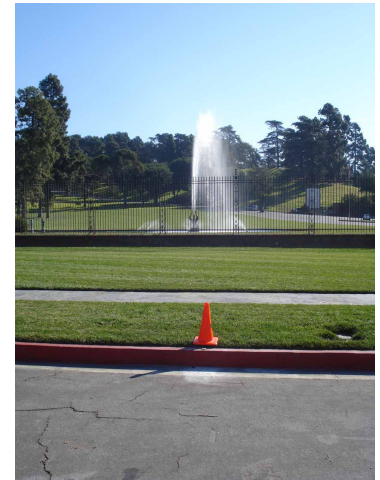
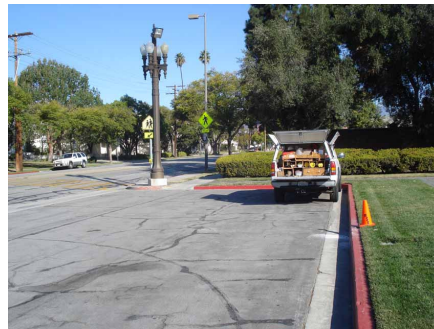
**Vertical Datum:** GPS-Derived

**Geoid Height Model:** GEOID12A

**Orthometric Height:** 450.145'



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**Description:** 2" aluminum disk stamped "SCRRRA CONTROL L009", set atop the east curb of Glendale Ave, 30' southerly of the north curb return, at the intersection of the prolongation of the south curb of Cerritos Ave, +/-100' northerly of the entrance to Forest Lawn Memorial Park Cemetery.



Rail Surveyors and Engineers, Inc.  
Control Recovery Form

[www.rsecorp.com](http://www.rsecorp.com)

**Control Point ID: L010**

**RSE Control Network:** MetroCON

**Type:** Local

**Set Date:** 02/22/13

**Set by:** RKC & JD

**City:** Los Angeles

**Station:** RR West of Commerce

**Subdivision:** San Bernardino (BNSF)

**Milepost:** 145.4

**Distance from Track:** 0.71 miles' NE of Track

**Reference Ellipsoid:** WGS84

**Latitude:** 34.0161705

**Longitude:** -118.18612025

**Ellipsoidal Height:** 72.794'

**Coordinate System:** NAD 83, CA CS Z5

**Epoch:** 2010.00 ("2011, MA11, PA11")

**Northing:** 1828318.557

**Easting:** 6505264.300

**Combined Scale Factor:** 1.00000028

**Alt. Coord. System:** N/A

**Northing:** N/A

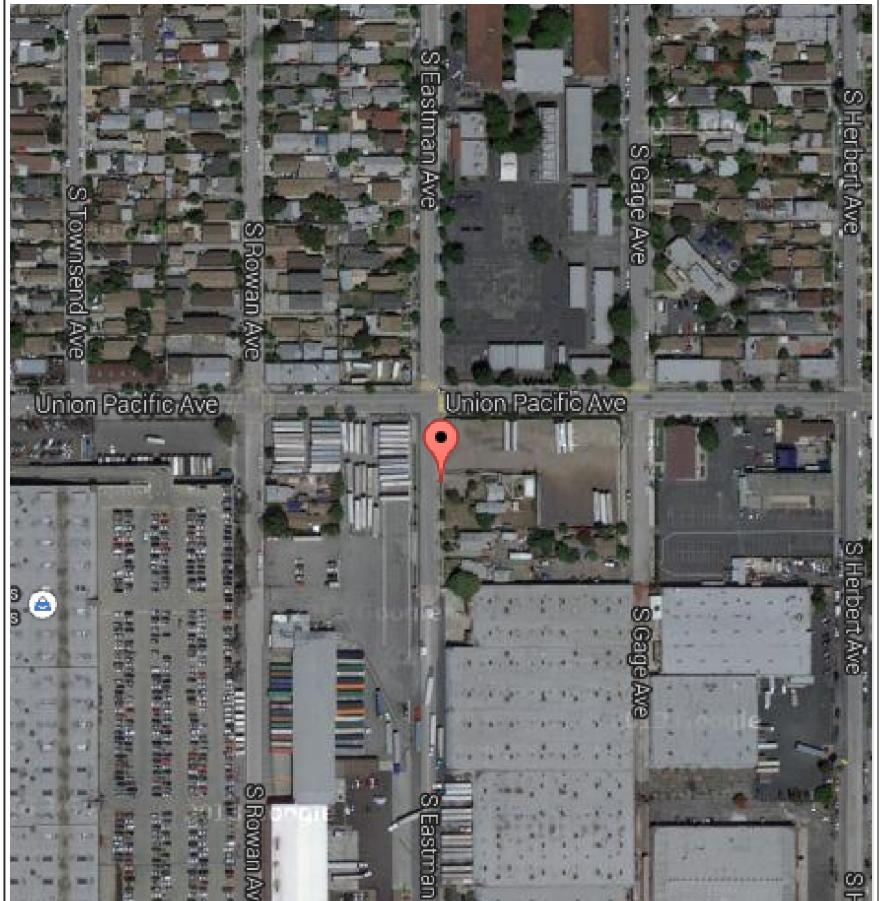
**Easting:** N/A

**Combined Scale Factor:** N/A

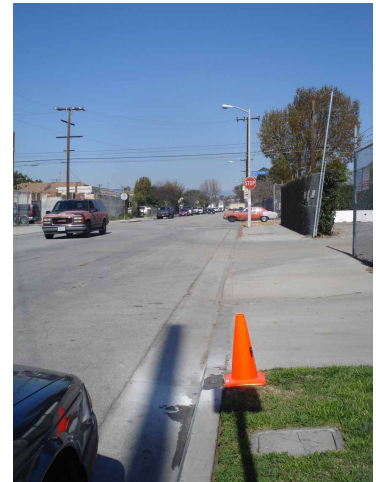
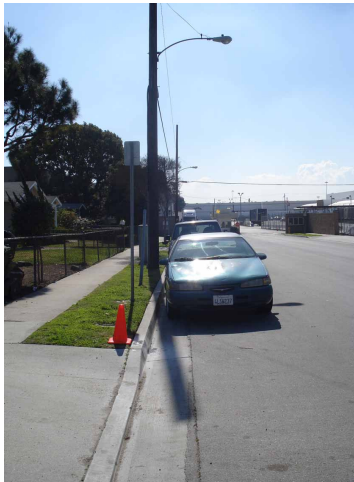
**Vertical Datum:** GPS-Derived

**Geoid Height Model:** GEOID12A

**Orthometric Height:** 188.482'



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**Description:** 2" aluminum disk stamped "SCRR CONTROL L010", set atop the east curb of South Eastman Ave, at the south edge of the driveway to Address Nos. 1318 and 1320, +/-115' southerly of the south curb line of Union Pacific Ave.



Rail Surveyors and Engineers, Inc.  
Control Recovery Form

[www.rsecorp.com](http://www.rsecorp.com)

**Control Point ID: L011**

**RSE Control Network:** MetroCON

**Type:** Local

**Set Date:** 02/22/13

**Set by:** RKC & JD

**City:** Santa Fe Springs

**Station:** RR West of Norwalk/ Santa Fe Springs

**Subdivision:** San Bernardino (BNSF)

**Milepost:** 153.00

**Distance from Track:** +/-90" NE of Track

**Reference Ellipsoid:** WGS84

**Latitude:** 33.95853043

**Longitude:** -118.07137994

**Ellipsoidal Height:** 41.661'

**Coordinate System:** NAD 83, CA CS Z5

**Epoch:** 2010.00 ("2011, MA11, PA11")

**Northing:** 1807298.744

**Easting:** 6540020.599

**Combined Scale Factor:** 1.00001506

**Alt. Coord. System:** NAD 83, CA CS Z6

**Northing:** 2297237.703

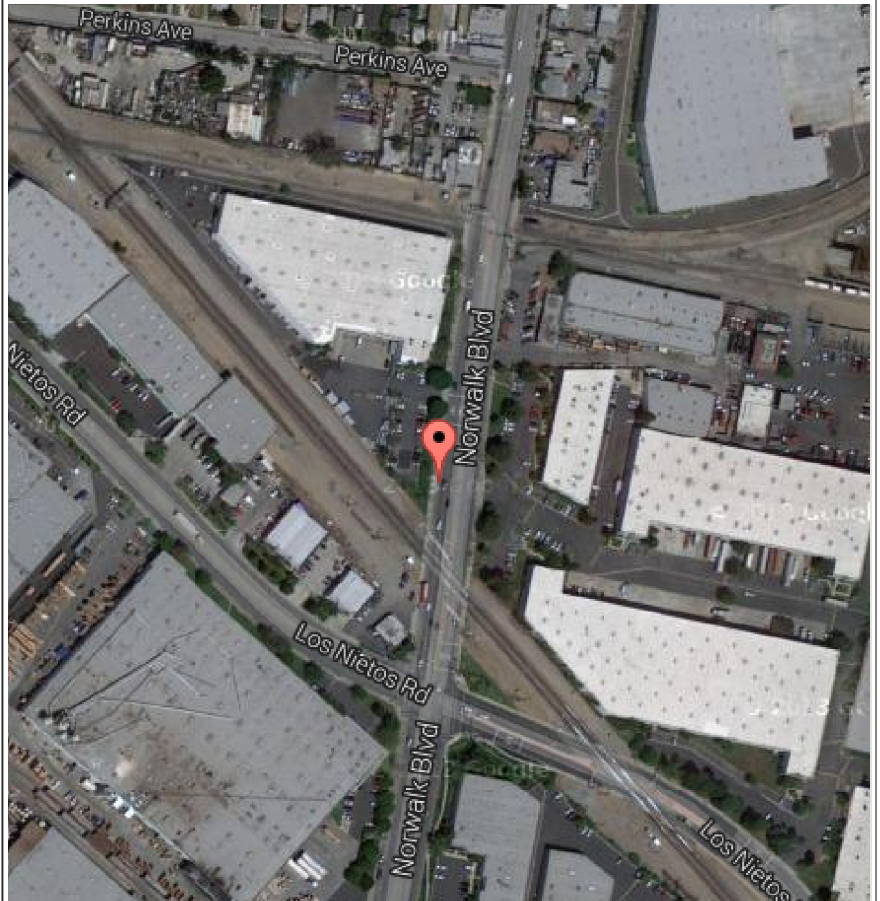
**Easting:** 6009360.639

**Combined Scale Factor:** 1.00001144

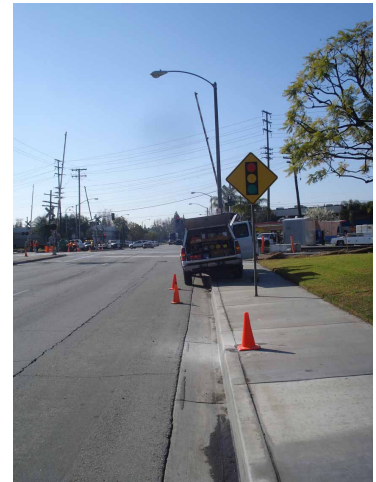
**Vertical Datum:** GPS-Derived

**Geoid Height Model:** GEOID12A

**Orthometric Height:** 157.500'



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**Description:** 2" aluminum disk stamped "SCRR CONTROL L011", set atop the west curb Norwalk Blvd, adjacent to Address No. 9023, 19' northerly of a Signal Ahead sign, +/-105' northerly of the BNSF tracks.



Rail Surveyors and Engineers, Inc.  
**Control Recovery Form**

[www.rsecorp.com](http://www.rsecorp.com)

**Control Point ID: L012**

**RSE Control Network:** MetroCON

**Type:** Local

**Set Date:** 02/22/13

**Set by:** RKC & JD

**City:** Simi Valley

**Station:** RR East of Moorpark

**Subdivision:** Ventura

**Milepost:** 431.81

**Distance from Track:** +/-360" SW of Track

**Reference Ellipsoid:** WGS84

**Latitude:** 34.2820282

**Longitude:** -118.80335565

**Ellipsoidal Height:** 602.153'

**Coordinate System:** NAD 83, CA CS Z5

**Epoch:** 2010.00 ("2011, MA11, PA11")

**Northing:** 1925987.123

**Easting:** 6318991.375

**Combined Scale Factor:** 0.99992661

**Alt. Coord. System:** N/A

**Northing:** N/A

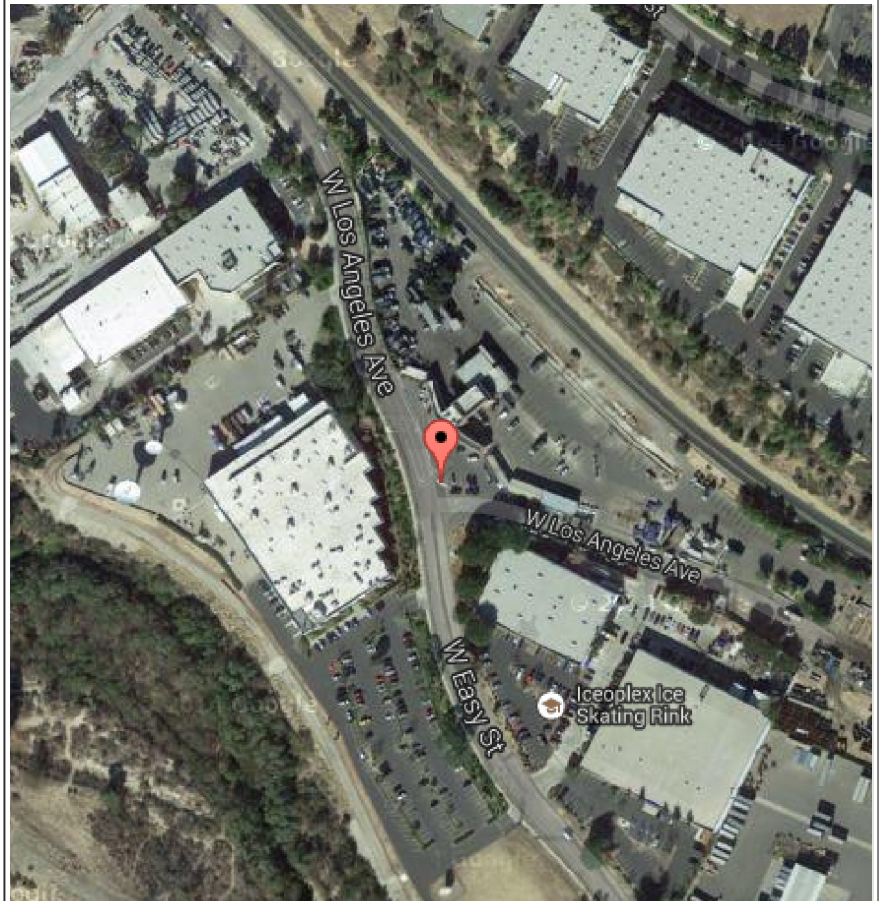
**Easting:** N/A

**Combined Scale Factor:** N/A

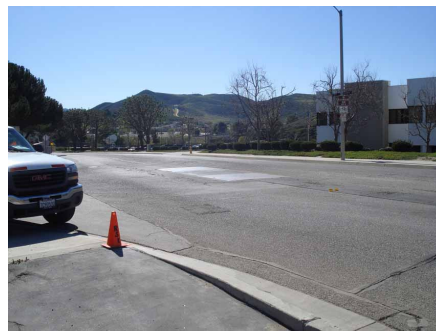
**Vertical Datum:** GPS-Derived

**Geoid Height Model:** GEOID12A

**Orthometric Height:** 716.503'



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**Description:** 2" aluminum disk stamped "SCRRA CONTROL L012", set atop the north curb of West Los Angeles Blvd at the west edge of a handicap ramp, at Address No. 195, at the transition of West Los Angeles Blvd to West Easy St.





Rail Surveyors and Engineers, Inc.  
Control Recovery Form

[www.rsecorp.com](http://www.rsecorp.com)

**Control Point ID: L013**

**RSE Control Network:** MetroCON

**Type:** Local

**Set Date:** Unknown

**Set by:** Ventura Co. Surveyor

**City:** Simi Valley

**Station:** RR East of Simi Valley

**Subdivision:** Ventura

**Milepost:** 440.24

**Distance from Track:** +/-40" S of Track

**Reference Ellipsoid:** WGS84

**Latitude:** 34.26089478

**Longitude:** -118.66079781

**Ellipsoidal Height:** 1009.295'

**Coordinate System:** NAD 83, CA CS Z5

**Epoch:** 2010.00 ("2011, MA11, PA11")

**Northing:** 1917982.870

**Easting:** 6362003.577

**Combined Scale Factor:** 0.99991019

**Alt. Coord. System:** N/A

**Northing:** N/A

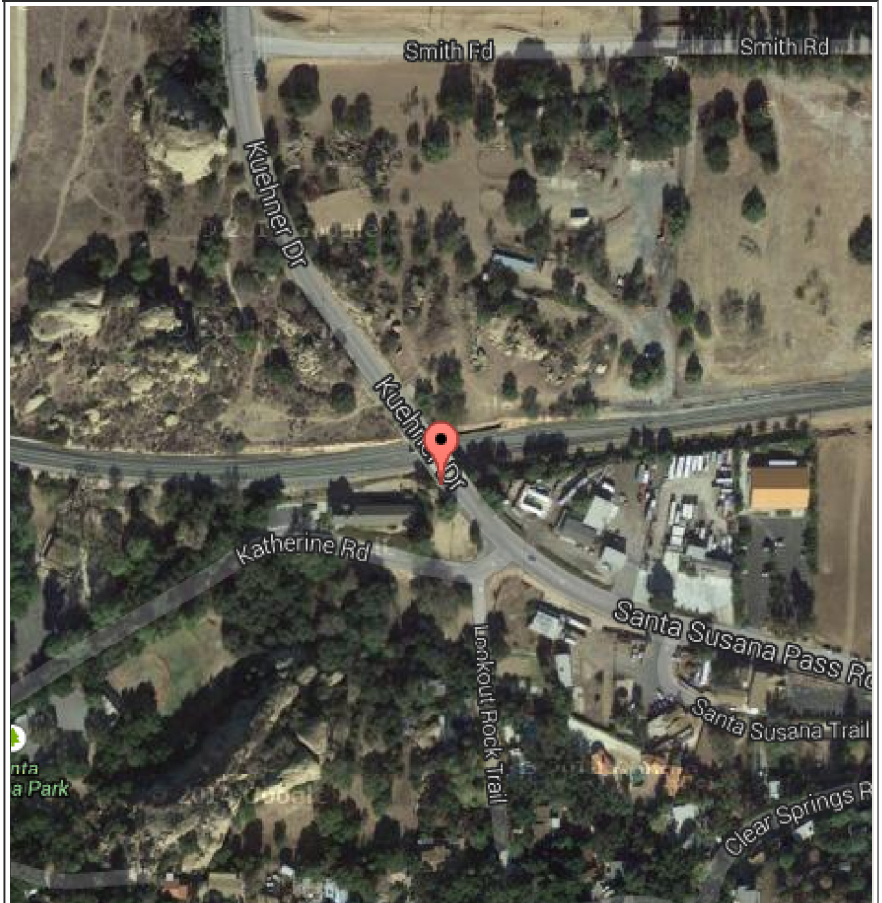
**Easting:** N/A

**Combined Scale Factor:** N/A

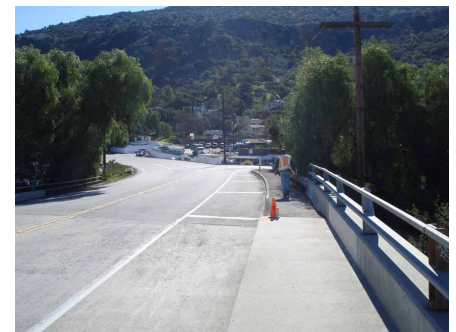
**Vertical Datum:** GPS-Derived

**Geoid Height Model:** GEOID12A

**Orthometric Height:** 1122.659'



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**Description:** 3.5" brass disk stamped "VENTURA COUNTY SURVEYOR H 1295" set atop the west curb of Santa Susana Pass Rd/ Kuehner Dr, at the south end of the bridge crossing over the SCRRA tracks, +/-180' westerly of Katherine Rd, northerly of the historic Santa Susana Railroad Depot.



Rail Surveyors and Engineers, Inc.  
Control Recovery Form

[www.rsecorp.com](http://www.rsecorp.com)

**Control Point ID: L014**

**RSE Control Network:** MetroCON

**Type:** Local

**Set Date:** 1992

**Set by:** CADT

**City:** Northridge

**Station:** RR West of Northridge

**Subdivision:** Ventura

**Milepost:** 447.69

**Distance from Track:** +/-60" N of Track

**Reference Ellipsoid:** WGS84

**Latitude:** 34.23283768

**Longitude:** -118.55519627

**Ellipsoidal Height:** 711.543'

**Coordinate System:** NAD 83, CA CS Z5

**Epoch:** 2010.00 ("2011, MA11, PA11")

**Northing:** 1907580.030

**Easting:** 6393854.819

**Combined Scale Factor:** 0.99992871

**Alt. Coord. System:** N/A

**Northing:** N/A

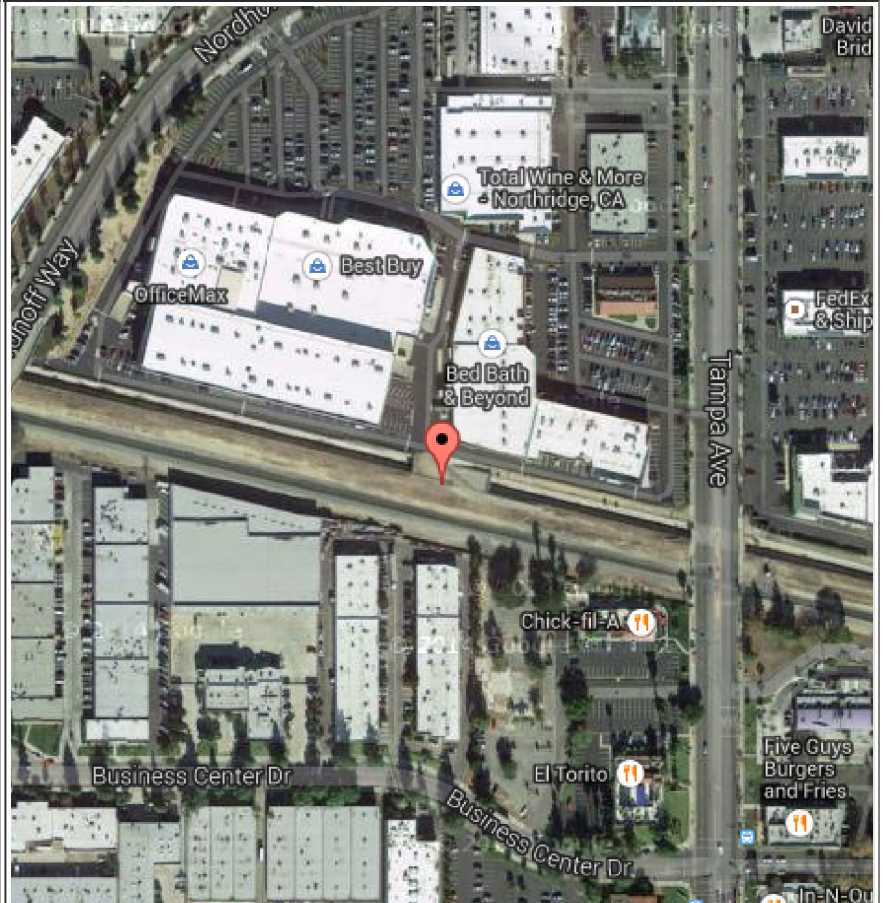
**Easting:** N/A

**Combined Scale Factor:** N/A

**Vertical Datum:** GPS-Derived

**Geoid Height Model:** GEOID12A

**Orthometric Height:** 825.266'



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**Description:** 2.5" brass disk stamped "NORTHRIDGE LS6172 1992", set atop concrete headwall, adjacent to and southwesterly of a former spur/ industrial track, +/-60' northerly of SCRRA track, +/-60' westerly of MP 468.7 marked on track, +/-490' westerly of the centerline of Tampa Ave, +/-1,050' southerly of Nordhoff Way, southeasterly of and access via a Bed Bath & Beyond store.



Rail Surveyors and Engineers, Inc.  
**Control Recovery Form**

[www.rsecorp.com](http://www.rsecorp.com)

**Control Point ID: L015**

**RSE Control Network:** MetroCON

**Type:** Local

**Set Date:** 02/22/13

**Set by:** RKC & JD

**City:** Burbank

**Station:** RR West of Burbank - Bob Hope Airport

**Subdivision:** Ventura

**Milepost:** 459.06

**Distance from Track:** +/-160" N of Track

**Reference Ellipsoid:** WGS84

**Latitude:** 34.19838333

**Longitude:** -118.3789495

**Ellipsoidal Height:** 619.930'

**Coordinate System:** NAD 83, CA CS Z5

**Epoch:** 2010.00 ("2011, MA11, PA11")

**Northing:** 1894793.490

**Easting:** 6447079.020

**Combined Scale Factor:** 0.99993867

**Alt. Coord. System:** N/A

**Northing:** N/A

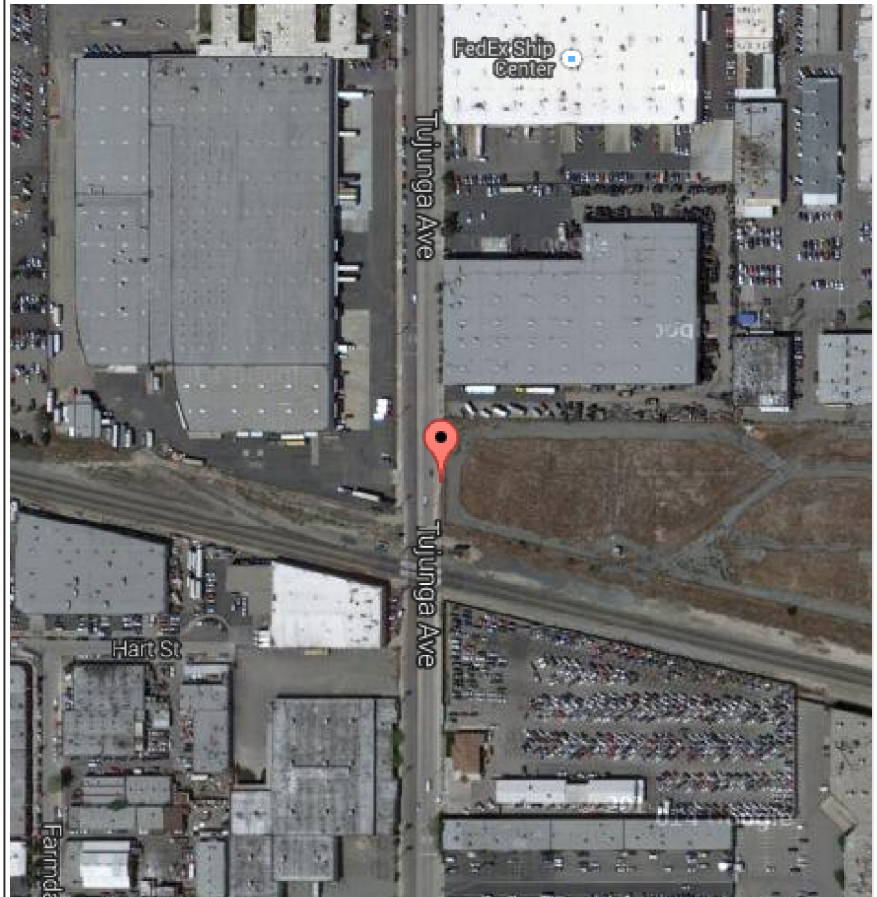
**Easting:** N/A

**Combined Scale Factor:** N/A

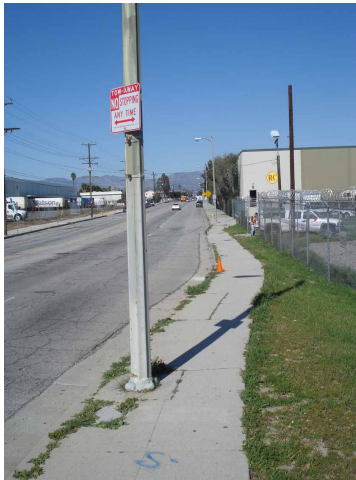
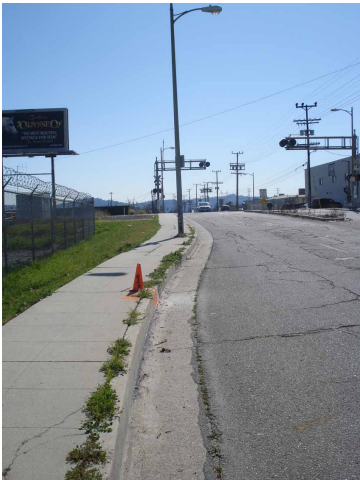
**Vertical Datum:** GPS-Derived

**Geoid Height Model:** GEOID12A

**Orthometric Height:** 732.663'



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**Description:** 2" aluminum disk stamped "SCRR CONTROL L015", set atop the east curb Tujunga Ave, opposite the driveway of 7131 Tujunga Ave, +/-150' northerly of the SCRR tracks, 40' northerly of a light pole.



Rail Surveyors and Engineers, Inc.  
**Control Recovery Form**

[www.rsecorp.com](http://www.rsecorp.com)

**Control Point ID: L016**

**RSE Control Network:** MetroCON

**Type:** Local

**Set Date:** 02/05/14

**Set by:** JD & LR

**City:** Temple City

**Station:** Northwesterly of El Monte

**Subdivision:** San Gabriel

**Milepost:** 10.76

**Distance from Track:** 1.10 miles' N of Track

**Reference Ellipsoid:** WGS84

**Latitude:** 34.0882988

**Longitude:** -118.06487717

**Ellipsoidal Height:** 219.879'

**Coordinate System:** NAD 83, CA CS Z5

**Epoch:** 2010.00 ("2011, MA11, PA11")

**Northing:** 1854521.779

**Easting:** 6542023.051

**Combined Scale Factor:** 0.99997803

**Alt. Coord. System:** N/A

**Northing:** N/A

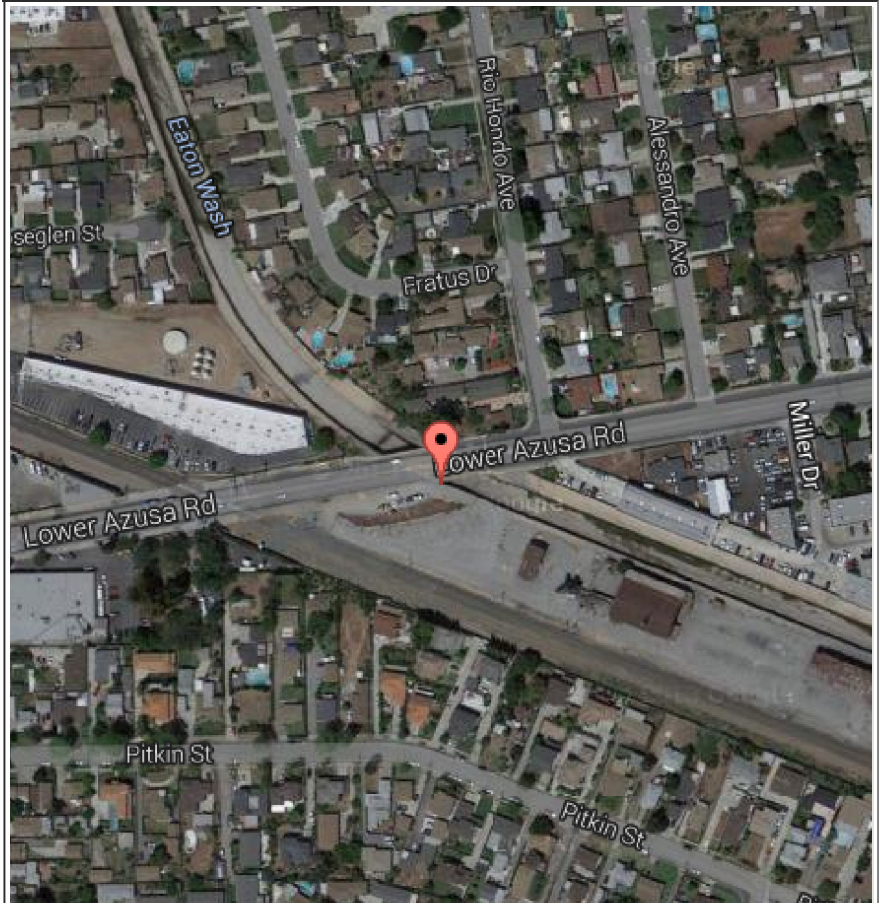
**Easting:** N/A

**Combined Scale Factor:** N/A

**Vertical Datum:** GPS-Derived

**Geoid Height Model:** GEOID12A

**Orthometric Height:** 332.677'



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**Description:** 2" aluminum disk stamped "SCRRA CONTROL L016", set at the back of the south sidewalk of Lower Azusa Rd, atop the southwest backwall of the bridge over the concreted Eaton Wash culvert.



Rail Surveyors and Engineers, Inc.  
**Control Recovery Form**

[www.rsecorp.com](http://www.rsecorp.com)

**Control Point ID: L017**

**RSE Control Network:** MetroCON

**Type:** Local

**Set Date:** 02/06/14

**Set by:** JD & LR

**City:** San Dimas

**Station:** Northeastly of Covina

**Subdivision:** San Gabriel

**Milepost:** 26.18

**Distance from Track:** 0.72 miles' N of Track

**Reference Ellipsoid:** WGS84

**Latitude:** 34.11169052

**Longitude:** -117.83526155

**Ellipsoidal Height:** 730.510'

**Coordinate System:** NAD 83, CA CS Z5

**Epoch:** 2010.00 ("2011, MA11, PA11")

**Northing:** 1863069.983

**Easting:** 6611532.470

**Combined Scale Factor:** 0.99994899

**Alt. Coord. System:** N/A

**Northing:** N/A

**Easting:** N/A

**Combined Scale Factor:** N/A

**Vertical Datum:** GPS-Derived

**Geoid Height Model:** GEOID12A

**Orthometric Height:** 840.548'



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**Description:** 2" aluminum disk stamped "SCRRRA CONTROL L017", set atop a curb, at the tip of the triangular cutout between the handicap and non-handicap parking stalls of the parking lot immediately to the west of the tennis courts on the west side of Lone Hill Park, +/-40' easterly of the east edge of North Shellman Ave.



Rail Surveyors and Engineers, Inc.  
Control Recovery Form

[www.rsecorp.com](http://www.rsecorp.com)

**Control Point ID: L018**

**RSE Control Network:** MetroCON

**Type:** Local

**Set Date:** 02/07/14

**Set by:** CF & TS

**City:** Upland

**Station:** RR West of Upland

**Subdivision:** San Gabriel

**Milepost:** 36.26

**Distance from Track:** 27.4" S of Track

**Reference Ellipsoid:** WGS84

**Latitude:** 34.0943222

**Longitude:** -117.66087075

**Ellipsoidal Height:** 1114.000'

**Coordinate System:** NAD 83, CA CS Z5

**Epoch:** 2010.00 ("2011, MA11, PA11")

**Northing:** 1856881.484

**Easting:** 6664341.185

**Combined Scale Factor:** 0.99993405

**Alt. Coord. System:** N/A

**Northing:** N/A

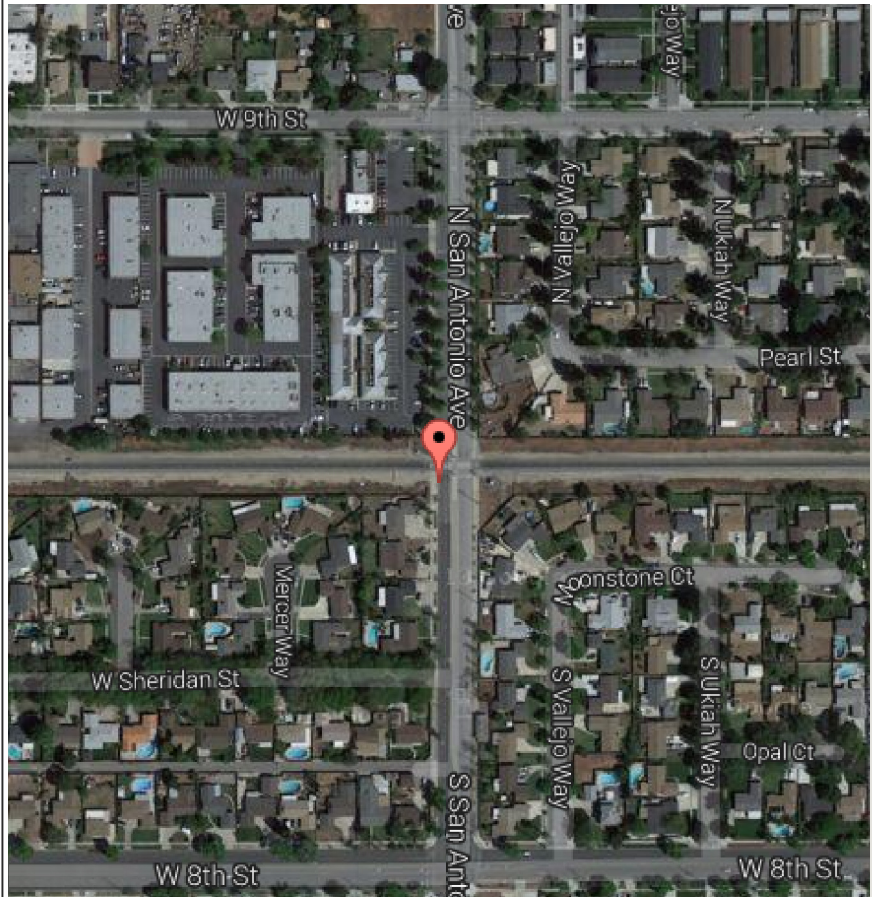
**Easting:** N/A

**Combined Scale Factor:** N/A

**Vertical Datum:** GPS-Derived

**Geoid Height Model:** GEOID12A

**Orthometric Height:** 1222.987'



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**Description:** 2" aluminum disk stamped "SCRR CONTROL L018", set atop the west curb of South San Antonio Ave, at the southwest quadrant of the grade crossing with SCRR's Main Track, 27.4" southerly of the centerline of the track, 32.5' westerly of the centerline of San Antonio Ave.



Rail Surveyors and Engineers, Inc.  
**Control Recovery Form**

[www.rsecorp.com](http://www.rsecorp.com)

**Control Point ID: L019**

**RSE Control Network:** MetroCON

**Type:** Local

**Set Date:** 02/07/14

**Set by:** CF & TS

**City:** Rancho Cucamonga

**Station:** RR East of Rancho Cucamonga

**Subdivision:** San Gabriel

**Milepost:** 43.32

**Distance from Track:** 0.42 miles' S of Track

**Reference Ellipsoid:** WGS84

**Latitude:** 34.08645248

**Longitude:** -117.53784899

**Ellipsoidal Height:** 987.803'

**Coordinate System:** NAD 83, CA CS Z5

**Epoch:** 2010.00 ("2011, MA11, PA11")

**Northing:** 1854165.999

**Easting:** 6701600.101

**Combined Scale Factor:** 0.99994165

**Alt. Coord. System:** N/A

**Northing:** N/A

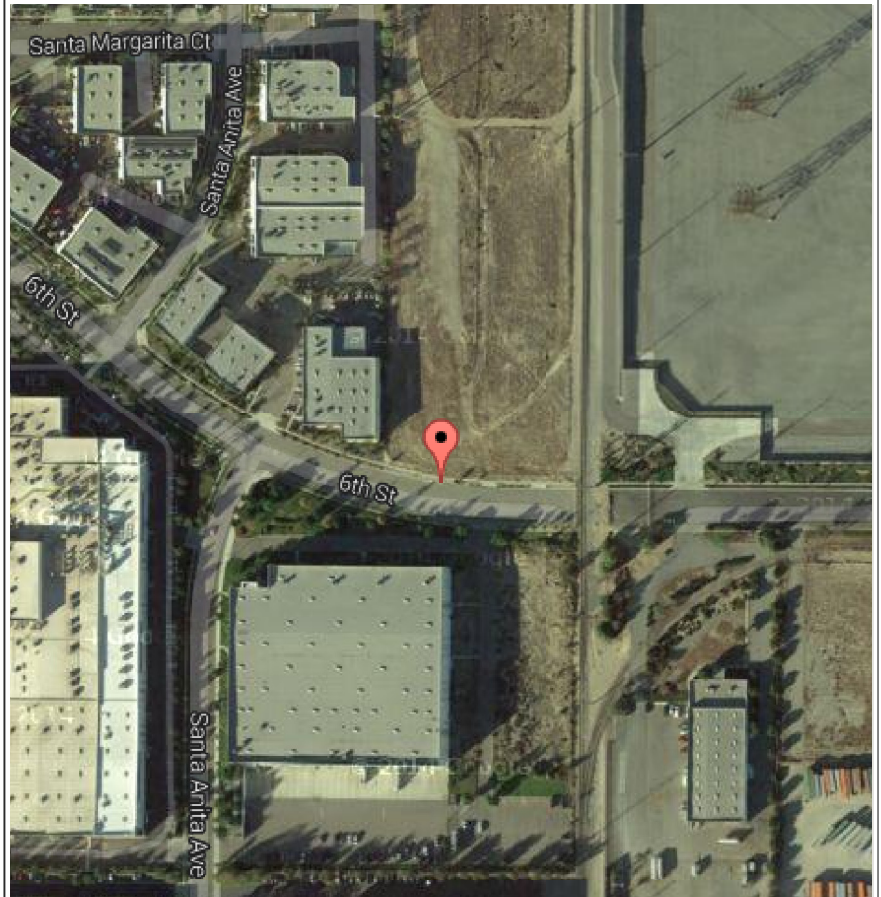
**Easting:** N/A

**Combined Scale Factor:** N/A

**Vertical Datum:** GPS-Derived

**Geoid Height Model:** GEOID12A

**Orthometric Height:** 1096.183'



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**Description:** 2" aluminum disk stamped "SCRRRA CONTROL L019", set atop and at the northeast corner of the concrete structure of a catch basin on the north side of 6th St, 5' easterly of the manhole of the catch basin, 35' northerly of the centerline of 6th St, +/-125' southeasterly of the southeast corner of Building No. 12228.



Rail Surveyors and Engineers, Inc.  
**Control Recovery Form**

[www.rsecorp.com](http://www.rsecorp.com)

**Control Point ID: L020**

**RSE Control Network:** MetroCON

**Type:** Local

**Set Date:** 02/07/14

**Set by:** CF & TS

**City:** Fontana

**Station:** RR East of Fontana

**Subdivision:** San Gabriel

**Milepost:** 49.44

**Distance from Track:** +/-50" N of Track

**Reference Ellipsoid:** WGS84

**Latitude:** 34.09541702

**Longitude:** -117.43129715

**Ellipsoidal Height:** 1149.480'

**Coordinate System:** NAD 83, CA CS Z5

**Epoch:** 2010.00 ("2011, MA11, PA11")

**Northing:** 1857592.935

**Easting:** 6733843.878

**Combined Scale Factor:** 0.99993213

**Alt. Coord. System:** N/A

**Northing:** N/A

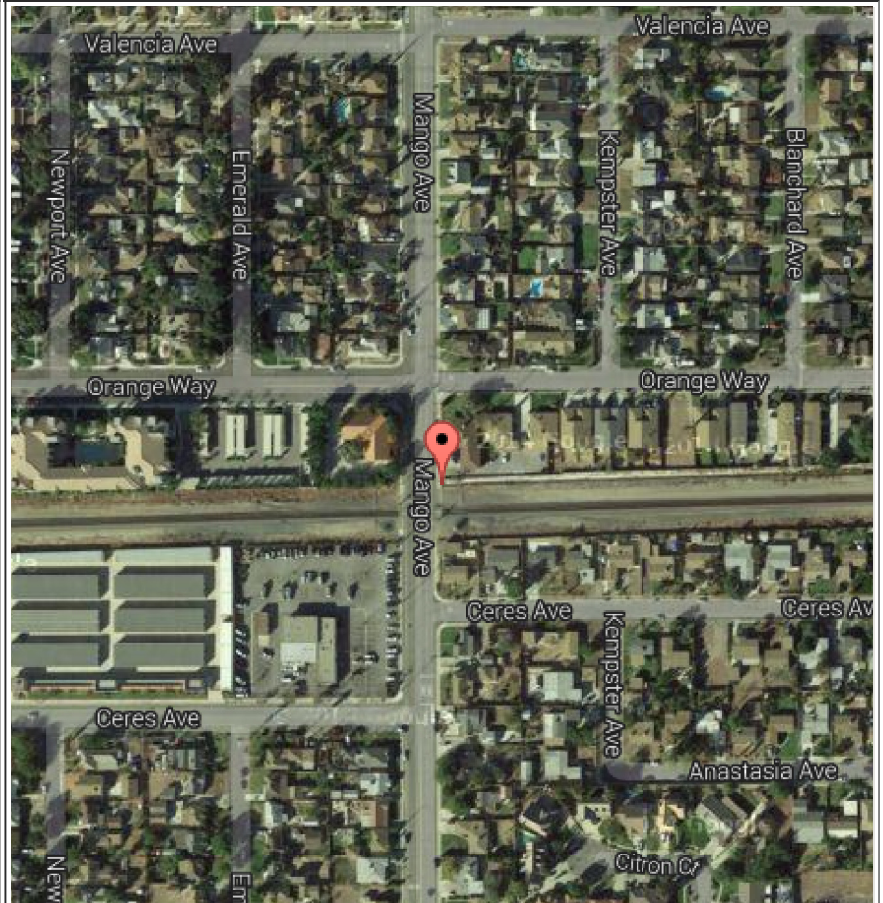
**Easting:** N/A

**Combined Scale Factor:** N/A

**Vertical Datum:** GPS-Derived

**Geoid Height Model:** GEOID12A

**Orthometric Height:** 1257.330'



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**Description:** 2" aluminum disk stamped "SCRR CONTROL L020", set atop the concrete structure of a catch basin on the east side of Mango Ave, 26' southerly of the south edge of House No. 8711, 31' easterly of the centerline of Mango Ave, 51.5' northerly of the centerline of the SCRR Main Track.





Rail Surveyors and Engineers, Inc.  
**Control Recovery Form**

[www.rsecorp.com](http://www.rsecorp.com)

**Control Point ID: L021**

**RSE Control Network:** MetroCON

**Type:** Local

**Set Date:** 02/07/14

**Set by:** GW & LR

**City:** Colton

**Station:** Southwesterly of San Bernardino

**Subdivision:** San Gabriel

**Milepost:** 54.75

**Distance from Track:** 1.22 miles' SE of Track

**Reference Ellipsoid:** WGS84

**Latitude:** 34.08701706

**Longitude:** -117.32716331

**Ellipsoidal Height:** 954.063'

**Coordinate System:** NAD 83, CA CS Z5

**Epoch:** 2010.00 ("2011, MA11, PA11")

**Northing:** 1854731.712

**Easting:** 6765390.861

**Combined Scale Factor:** 0.99994315

**Alt. Coord. System:** N/A

**Northing:** N/A

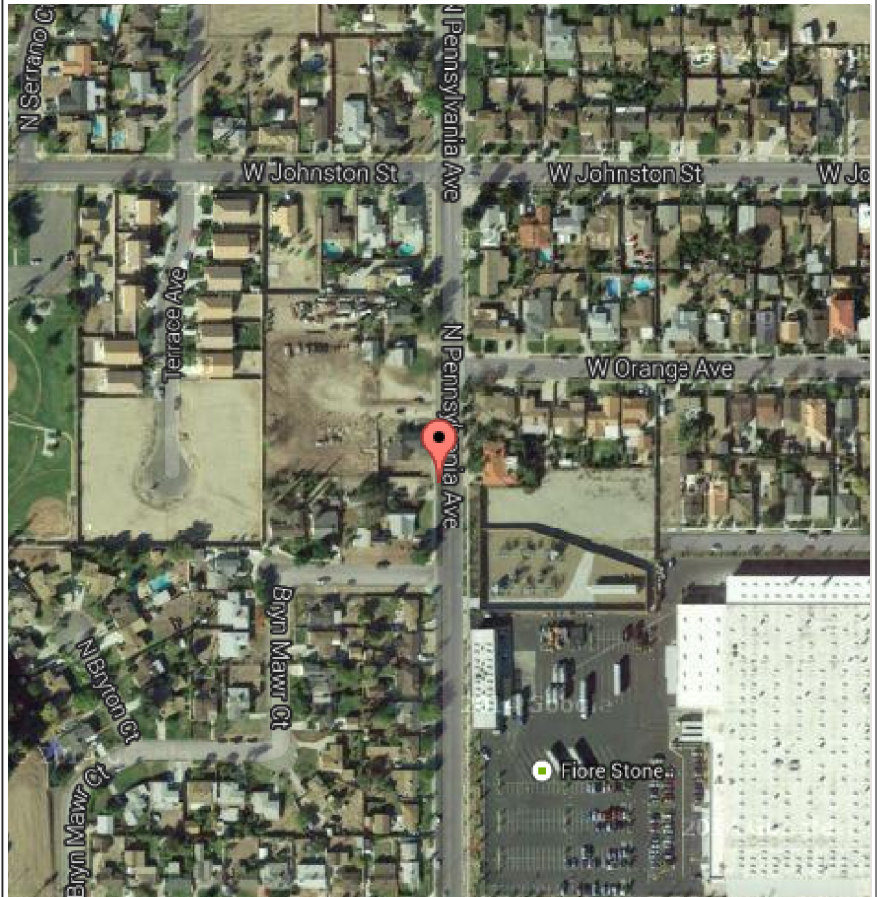
**Easting:** N/A

**Combined Scale Factor:** N/A

**Vertical Datum:** GPS-Derived

**Geoid Height Model:** GEOID12A

**Orthometric Height:** 1062.009'



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**Description:** 2" aluminum disk stamped "SCRRRA CONTROL L021", set atop the west curb of North Pennsylvania Ave, between House Nos. 1701 and 1723, +/-200' southerly of the centerline of West Orange Ave.



Rail Surveyors and Engineers, Inc.  
**Control Recovery Form**

[www.rsecorp.com](http://www.rsecorp.com)

**Control Point ID: L023**

**RSE Control Network:** MetroCON

**Type:** Local

**Set Date:** 1956

**Set by:** USCGS

**City:** Redlands

**Station:** Southeastery of San Bernardino

**Subdivision:** N/A

**Milepost:** N/A

**Distance from Track:** N/A

**Reference Ellipsoid:** WGS84

**Latitude:** 34.04618073

**Longitude:** -117.18607613

**Ellipsoidal Height:** 1291.689'

**Coordinate System:** NAD 83, CA CS Z5

**Epoch:** 2010.00 ("2011, MA11, PA11")

**Northing:** 1840187.065

**Easting:** 6808229.285

**Combined Scale Factor:** 0.99993544

**Alt. Coord. System:** N/A

**Northing:** N/A

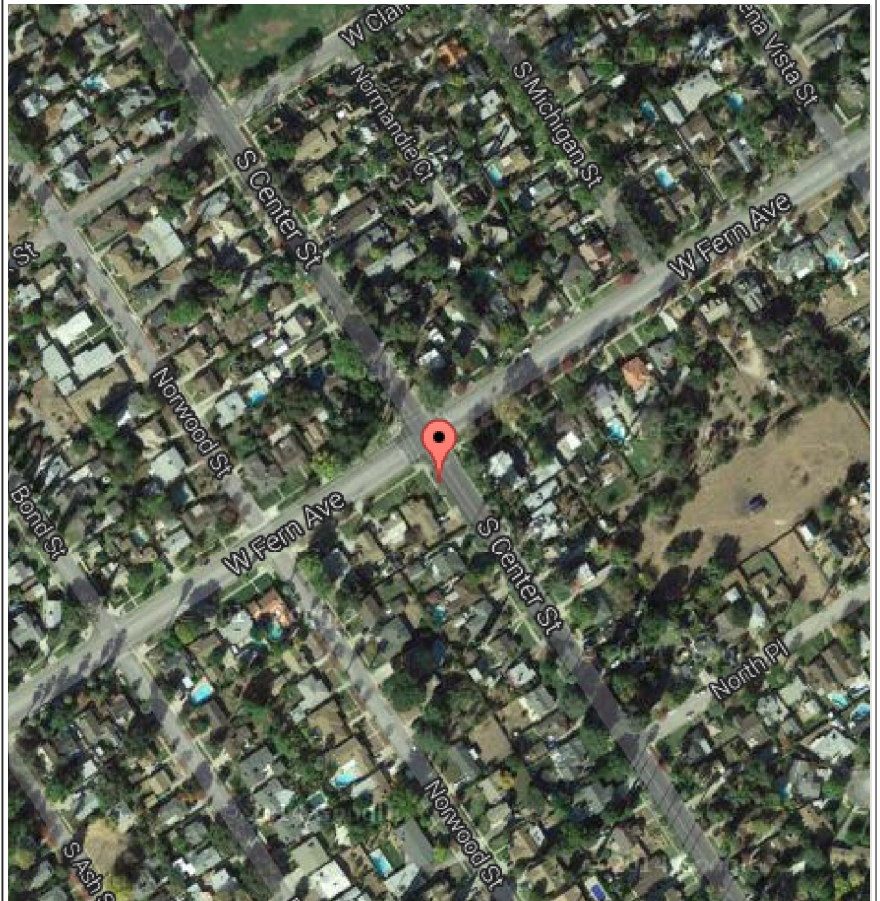
**Easting:** N/A

**Combined Scale Factor:** N/A

**Vertical Datum:** GPS-Derived

**Geoid Height Model:** GEOID12A

**Orthometric Height:** 1398.766'



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**Description:** 3.75" brass disk stamped "J 525 1956" (NGS BM PID EV0999), set in an 11" square concrete pillar that stubs 0.7' up from the ground, 4' southwesterly of the southwest curb of South Center St, 45' southeasterly of the southeast curb of West Fern Ave.



Rail Surveyors and Engineers, Inc.  
Control Recovery Form

[www.rsecorp.com](http://www.rsecorp.com)

**Control Point ID: L024**

**RSE Control Network:** MetroCON

**Type:** Local

**Set Date:** Unknown

**Set by:** RCE 7872

**City:** Buena Park

**Station:** Westerly of Buena Park

**Subdivision:** San Bernardino (BNSF)

**Milepost:** 159.75

**Distance from Track:** 1.02 miles' SW of Track

**Reference Ellipsoid:** WGS84

**Latitude:** 33.87351608

**Longitude:** -118.01844077

**Ellipsoidal Height:** -51.339'

**Coordinate System:** NAD 83, CA CS Z5

**Epoch:** 2010.00 ("2011, MA11, PA11")

**Northing:** 1776351.709

**Easting:** 6556068.800

**Combined Scale Factor:** 1.00004093

**Alt. Coord. System:** NAD 83, CA CS Z6

**Northing:** 2266026.624

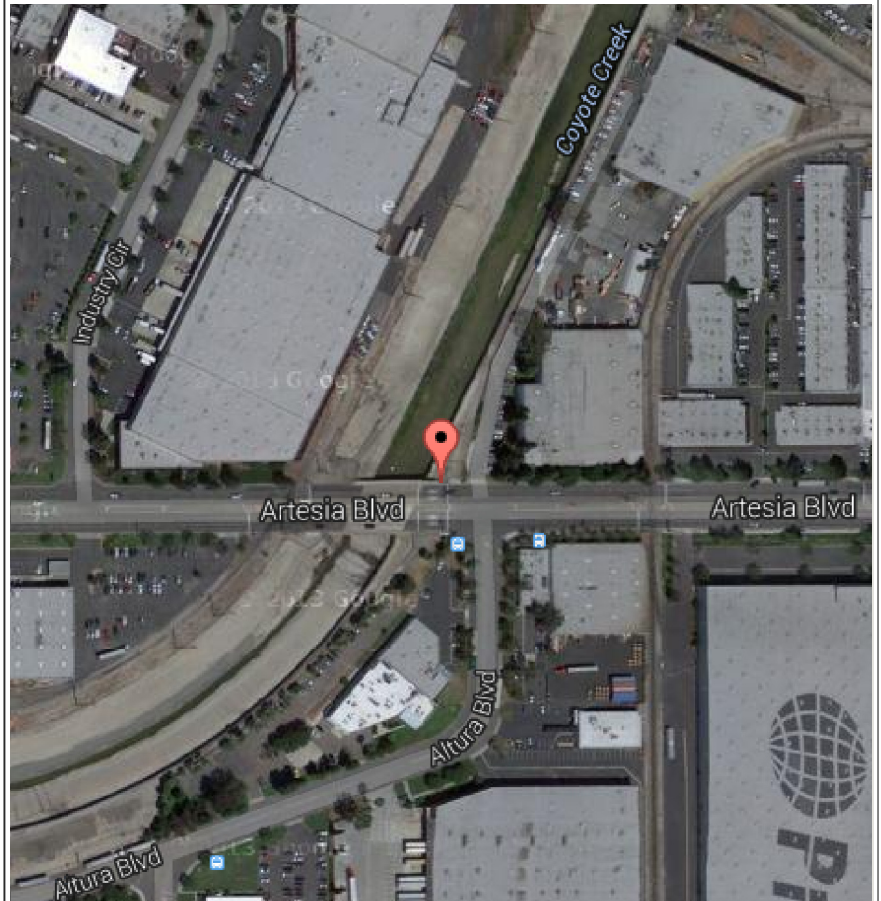
**Easting:** 6024887.342

**Combined Scale Factor:** 1.00000083

**Vertical Datum:** GPS-Derived

**Geoid Height Model:** GEOID12A

**Orthometric Height:** 64.818'



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**Description:** 1.25" brass disk stamped "COUNTY SURVEYOR ORANGE CO. BM RCE 7872" set on the north side of Artesia Blvd, at northeast corner of Bridge No. 3145 over a flood control channel, at the northwest quadrant of the intersection Artesia and Altura Blvds, 0.6 miles easterly of Valley View Ave.



Rail Surveyors and Engineers, Inc.  
Control Recovery Form

[www.rsecorp.com](http://www.rsecorp.com)

**Control Point ID: L025**

**RSE Control Network:** MetroCON

**Type:** Local

**Set Date:** 02/03/14

**Set by:** JD

**City:** Anaheim

**Station:** RR West of Anaheim

**Subdivision:** Orange

**Milepost:** 169.36

**Distance from Track:** +/-250" E of Track

**Reference Ellipsoid:** WGS84

**Latitude:** 33.81492996

**Longitude:** -117.89807864

**Ellipsoidal Height:** 42.981'

**Coordinate System:** NAD 83, CA CS Z6

**Epoch:** 2010.00 ("2011, MA11, PA11")

**Northing:** 2244111.611

**Easting:** 6061081.045

**Combined Scale Factor:** 0.99998723

**Alt. Coord. System:** NAD 83, CA CS Z5

**Northing:** 1755046.656

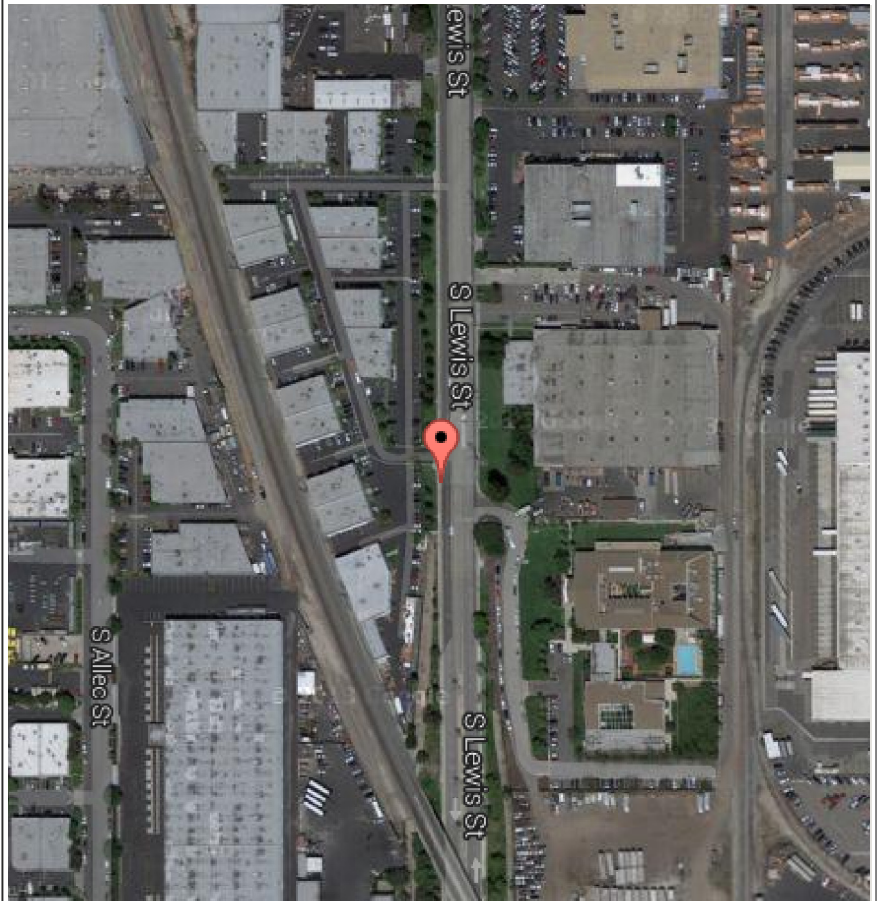
**Easting:** 6592627.454

**Combined Scale Factor:** 1.00005244

**Vertical Datum:** GPS-Derived

**Geoid Height Model:** GEOID12A

**Orthometric Height:** 158.015'



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**Description:** 2" aluminum disk stamped "SCRRA CONTROL L025", set in the sidewalk on the west side of South Lewis St, at the southwest corner of a drain inlet, +/-625' northerly along Lewis St from the north edge of the SCRRA bridge over Lewis St, immediately south of the driveway to Building No. 1357/ 1363 Lewis St.



Rail Surveyors and Engineers, Inc.  
Control Recovery Form

[www.rsecorp.com](http://www.rsecorp.com)

**Control Point ID: L026**

**RSE Control Network:** MetroCON

**Type:** Local

**Set Date:** 02/04/14

**Set by:** JD

**City:** Tustin

**Station:** Southerly of Tustin

**Subdivision:** Orange

**Milepost:** 179.75

**Distance from Track:** 0.24 miles' SW of Track

**Reference Ellipsoid:** WGS84

**Latitude:** 33.70330811

**Longitude:** -117.80568673

**Ellipsoidal Height:** -53.103'

**Coordinate System:** NAD 83, CA CS Z6

**Epoch:** 2010.00 ("2011, MA11, PA11")

**Northing:** 2203066.155

**Easting:** 6088535.890

**Combined Scale Factor:** 0.99997740

**Alt. Coord. System:** N/A

**Northing:** N/A

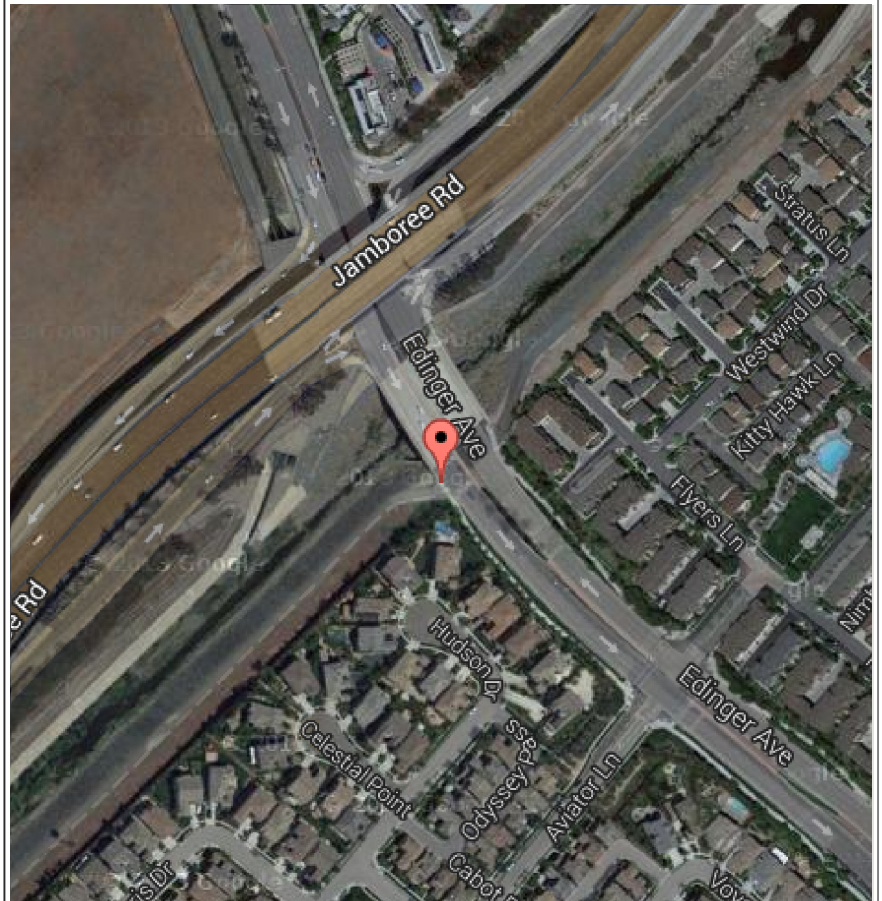
**Easting:** N/A

**Combined Scale Factor:** N/A

**Vertical Datum:** GPS-Derived

**Geoid Height Model:** GEOID12A

**Orthometric Height:** 60.476'



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**Description:** 2" aluminum disk stamped "SCRRRA CONTROL L026", set atop the southwest curb of Edinger Ave, between bridge over Peters Canyon Wash and driveway to Peters Canyon Trail, +/-315' southwesterly of the southeast edge of the Jamboree Rd Overpass.



Rail Surveyors and Engineers, Inc.  
Control Recovery Form

[www.rsecorp.com](http://www.rsecorp.com)

**Control Point ID: L027**

**RSE Control Network:** MetroCON

**Type:** Local

**Set Date:** 02/04/14

**Set by:** JD

**City:** Lake Forest

**Station:** Southeastery of Irvine

**Subdivision:** Orange

**Milepost:** 187.21

**Distance from Track:** 0.81 miles' SW of Track

**Reference Ellipsoid:** WGS84

**Latitude:** 33.62839127

**Longitude:** -117.71434502

**Ellipsoidal Height:** 202.115'

**Coordinate System:** NAD 83, CA CS Z6

**Epoch:** 2010.00 ("2011, MA11, PA11")

**Northing:** 2175405.438

**Easting:** 6115930.895

**Combined Scale Factor:** 0.99995764

**Alt. Coord. System:** N/A

**Northing:** N/A

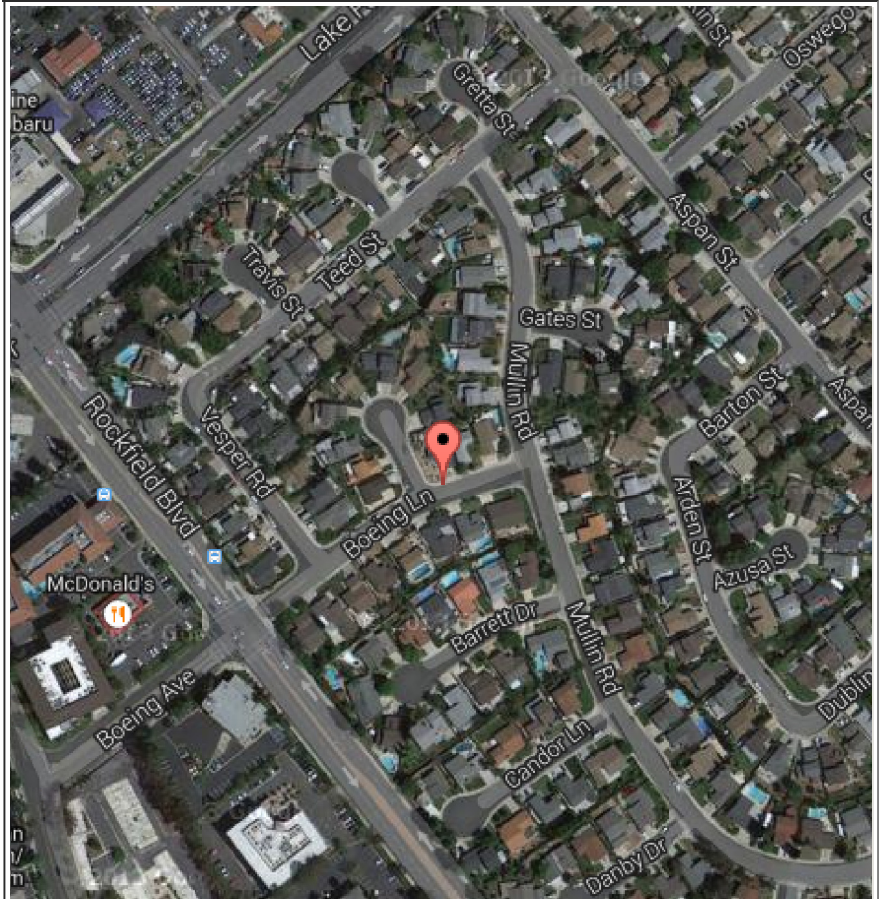
**Easting:** N/A

**Combined Scale Factor:** N/A

**Vertical Datum:** GPS-Derived

**Geoid Height Model:** GEOID12A

**Orthometric Height:** 314.763'



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**Description:** 2" aluminum disk stamped "SCRRRA CONTROL L026", set atop the north curb of Boeing Ln, at the northeast quadrant of the Boeing Ln and Starbuck Rd intersection, immediately westerly of the west edge of the driveway to House No. 23821.



Rail Surveyors and Engineers, Inc.  
**Control Recovery Form**

[www.rsecorp.com](http://www.rsecorp.com)

**Control Point ID: L028**

**RSE Control Network:** MetroCON

**Type:** Local

**Set Date:** Unknown

**Set by:** Unknown

**City:** San Juan Capistrano

**Station:** RR West of San Juan Capistrano

**Subdivision:** Orange

**Milepost:** 195.40

**Distance from Track:** 0.20 miles' E of Track

**Reference Ellipsoid:** WGS84

**Latitude:** 33.52679443

**Longitude:** -117.66997592

**Ellipsoidal Height:** 90.729'

**Coordinate System:** NAD 83, CA CS Z6

**Epoch:** 2010.00 ("2011, MA11, PA11")

**Northing:** 2138252.073

**Easting:** 6128932.199

**Combined Scale Factor:** 0.99995545

**Alt. Coord. System:** N/A

**Northing:** N/A

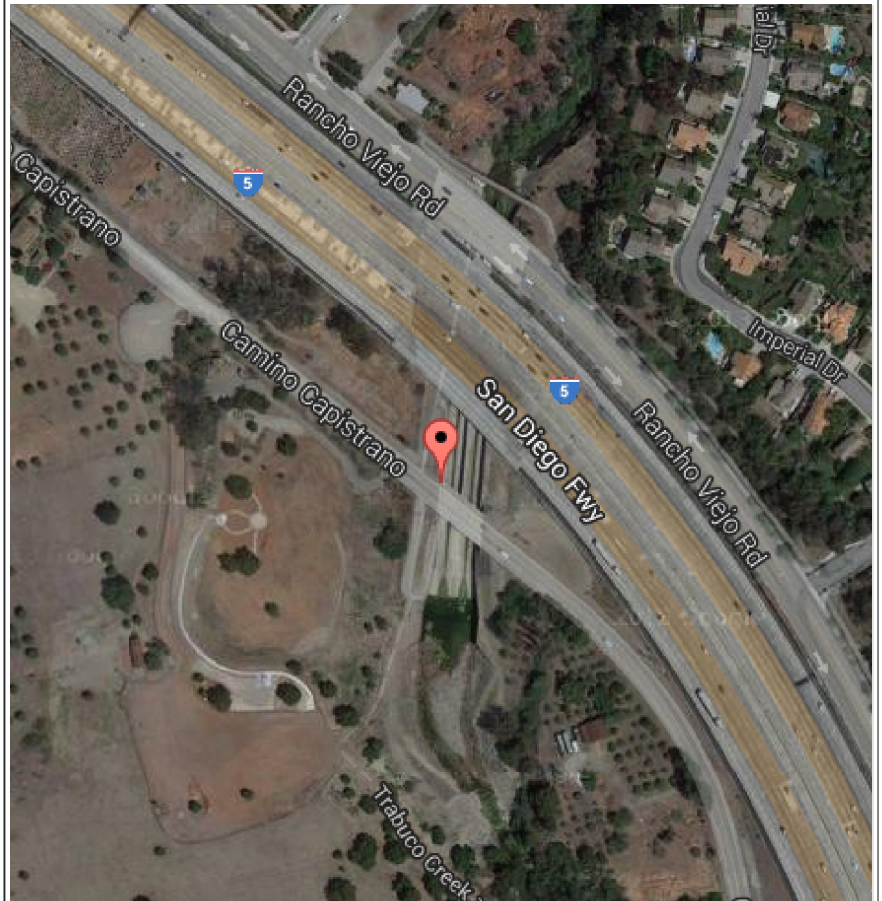
**Easting:** N/A

**Combined Scale Factor:** N/A

**Vertical Datum:** GPS-Derived

**Geoid Height Model:** GEOID12A

**Orthometric Height:** 204.101'



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**Description:** 2.5" brass disk stamped "S.J.C. BM-11", set atop the northeast curb of Camino Capistrano at the northwest corner of the bridge over San Juan Creek, 0.5 miles northerly of Camino Capistrano's intersection with Junipero Serra Rd.



Rail Surveyors and Engineers, Inc.  
**Control Recovery Form**

[www.rsecorp.com](http://www.rsecorp.com)

**Control Point ID: L029**

**RSE Control Network:** MetroCON

**Type:** Local

**Set Date:** 02/05/14

**Set by:** JD & LR

**City:** San Clemente

**Station:** Northeasterly of San Clemente Pier

**Subdivision:** Orange

**Milepost:** 204.59

**Distance from Track:** 3.75 miles' NE of Track

**Reference Ellipsoid:** WGS84

**Latitude:** 33.45618057

**Longitude:** -117.57143533

**Ellipsoidal Height:** 130.447'

**Coordinate System:** NAD 83, CA CS Z6

**Epoch:** 2010.00 ("2011, MA11, PA11")

**Northing:** 2112166.086

**Easting:** 6158634.935

**Combined Scale Factor:** 0.99995017

**Alt. Coord. System:** N/A

**Northing:** N/A

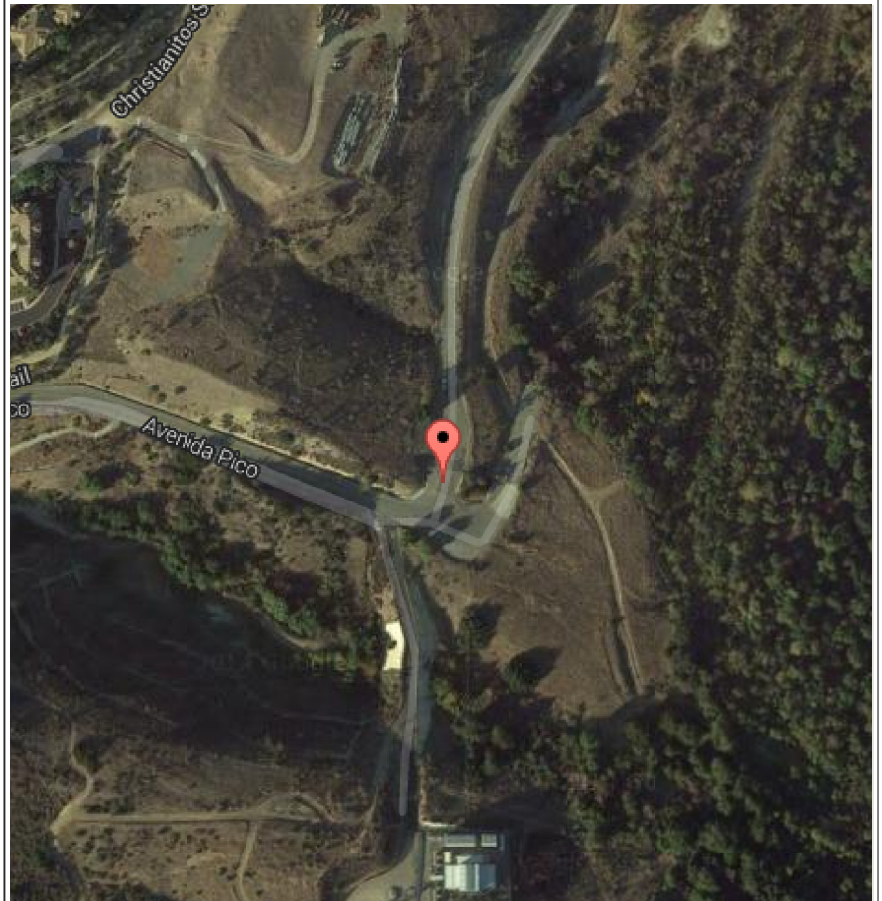
**Easting:** N/A

**Combined Scale Factor:** N/A

**Vertical Datum:** GPS-Derived

**Geoid Height Model:** GEOID12A

**Orthometric Height:** 243.336'



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**Description:** 2" aluminum disk stamped "SCRRA CONTROL L029", set atop the west curb of the median immediately south of the entrance gate and kiosk to the TRW site, at the intersection of Avenida Pico and Camino La Pedriza.





Rail Surveyors and Engineers, Inc.  
**Control Recovery Form**

[www.rsecorp.com](http://www.rsecorp.com)

**Control Point ID: L030**

**RSE Control Network:** MetroCON

**Type:** Local

**Set Date:** 02/05/14

**Set by:** JD & LR

**City:** San Clemente

**Station:** RR East of San Clemente Pier

**Subdivision:** Orange

**Milepost:** 208.17

**Distance from Track:** 0.17 miles' NE of Track

**Reference Ellipsoid:** WGS84

**Latitude:** 33.38512421

**Longitude:** -117.58327695

**Ellipsoidal Height:** -26.615'

**Coordinate System:** NAD 83, CA CS Z6

**Epoch:** 2010.00 ("2011, MA11, PA11")

**Northing:** 2086359.111

**Easting:** 6154692.881

**Combined Scale Factor:** 0.99995581

**Alt. Coord. System:** N/A

**Northing:** N/A

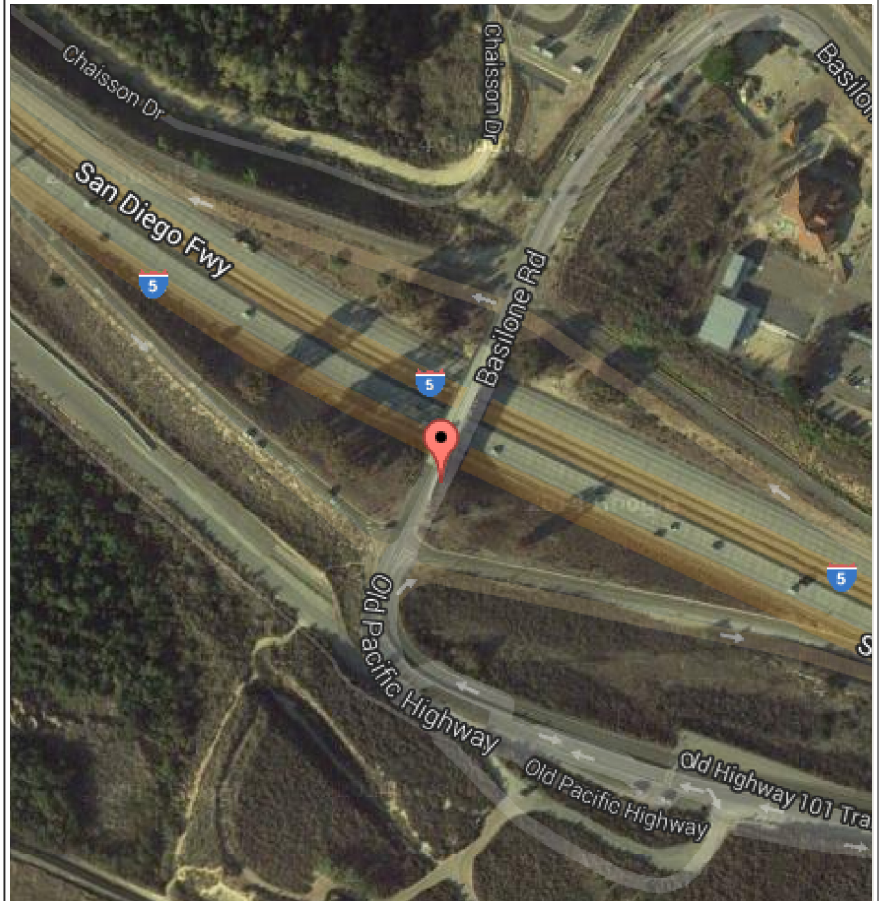
**Easting:** N/A

**Combined Scale Factor:** N/A

**Vertical Datum:** GPS-Derived

**Geoid Height Model:** GEOID12A

**Orthometric Height:** 87.437'



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**Description:** 2" aluminum disk stamped "SCRRA CONTROL L030", set in the sidewalk on the southeast side of Basilone Rd, at the southeast corner of the bridge over the San Diego Fwy (I-5).



Rail Surveyors and Engineers, Inc.  
Control Recovery Form

[www.rsecorp.com](http://www.rsecorp.com)

**Control Point ID: L031**

**RSE Control Network:** MetroCON

**Type:** Local

**Set Date:** 02/05/14

**Set by:** JD & LR

**City:** Los Angeles

**Station:** Northwesterly of Cal State LA

**Subdivision:** San Gabriel

**Milepost:** 4.47

**Distance from Track:** 1.79 miles' NW of Track

**Reference Ellipsoid:** WGS84

**Latitude:** 34.08494568

**Longitude:** -118.18643119

**Ellipsoidal Height:** 353.676'

**Coordinate System:** NAD 83, CA CS Z5

**Epoch:** 2010.00 ("2011, MA11, PA11")

**Northing:** 1853348.123

**Easting:** 6505216.496

**Combined Scale Factor:** 0.99997230

**Alt. Coord. System:** N/A

**Northing:** N/A

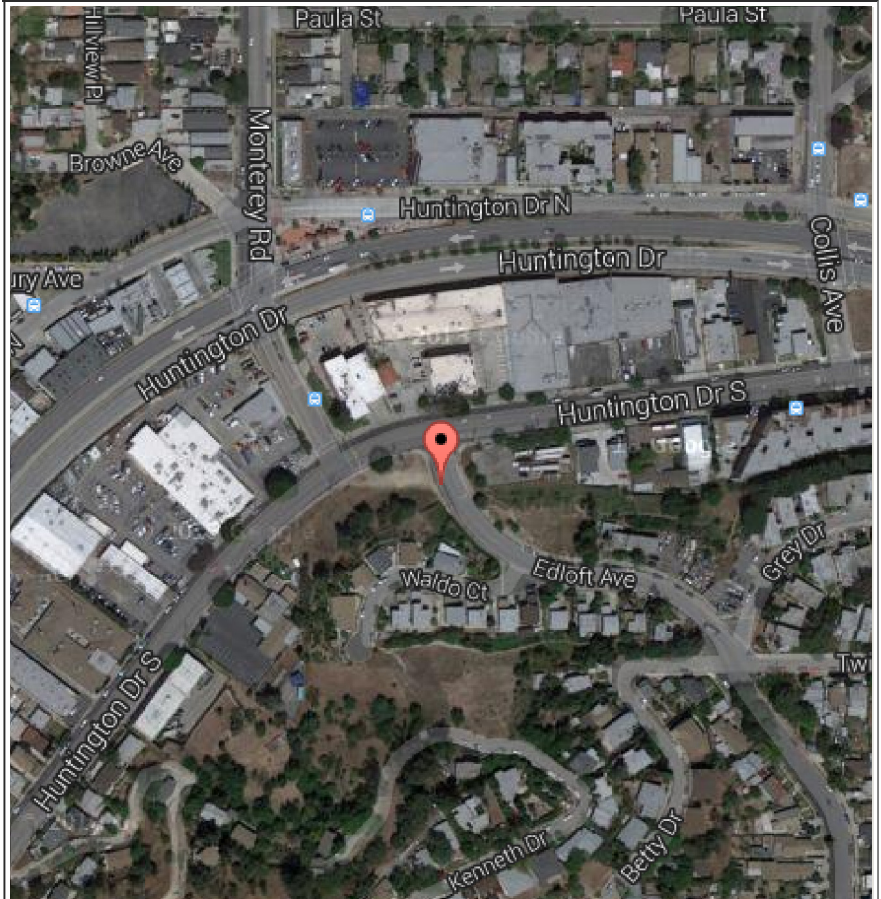
**Easting:** N/A

**Combined Scale Factor:** N/A

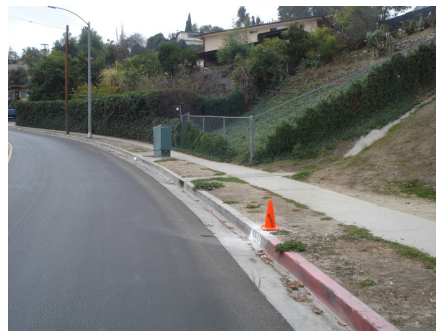
**Vertical Datum:** GPS-Derived

**Geoid Height Model:** GEOID12A

**Orthometric Height:** 467.292'



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Report a map error



**Description:** 2" aluminum disk stamped "SCRRA CONTROL L031", set atop the southwest curb of Edloft Ave, +/-65' southerly of the south edge of Huntington Dr South.



Rail Surveyors and Engineers, Inc.  
**Control Recovery Form**

[www.rsecorp.com](http://www.rsecorp.com)

**Control Point ID: L032**

**RSE Control Network:** MetroCON

**Type:** Local

**Set Date:** 1992

**Set by:** MWDSC

**City:** Yucaipa

**Station:** Southeasterly of San Bernardino

**Subdivision:** N/A

**Milepost:** N/A

**Distance from Track:** N/A

**Reference Ellipsoid:** WGS84

**Latitude:** 34.01952744

**Longitude:** -117.07644384

**Ellipsoidal Height:** 2191.723'

**Coordinate System:** NAD 83, CA CS Z5

**Epoch:** 2010.00 ("2011, MA11, PA11")

**Northing:** 1830773.930

**Easting:** 6841528.533

**Combined Scale Factor:** 0.99989817

**Alt. Coord. System:** NAD 83, CA CS Z6

**Northing:** 2315603.486

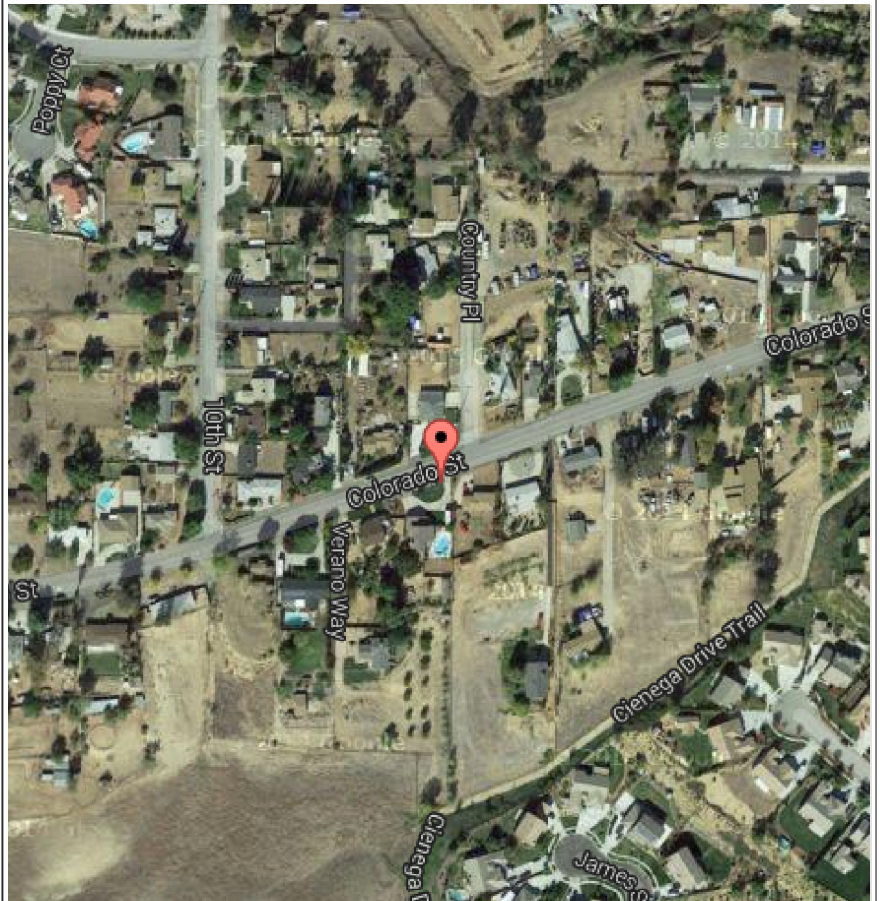
**Easting:** 6311225.838

**Combined Scale Factor:** 0.99992073

**Vertical Datum:** GPS-Derived

**Geoid Height Model:** GEOID12A

**Orthometric Height:** 2297.254'



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**Description:** 2" brass disk stamped "IVF 14 1992 MWD" (NGS BM PID EV9310), set atop the south curb of Colorado St, at the west edge of the east driveway to House No. 33365.

## **Appendixes**

Appendix A – CORS

Appendix B – Control Point Height Analysis

Appendix C – Control Point Cohesion Analysis 2013 (CTO 004) to 2014 (CTO 007)

Appendix D – Real Time Kinematic Quality Checks

## APPENDIX A – CORS

Datasheets of the Continuously Operating Reference Stations (CORS) are not included in this report. Instead, they can be accessed and reviewed via the National Geodetic Survey (NGS)'s website - <http://geodesy.noaa.gov/CORS/>; listed below are the station-specific identifiers (CORS ID):

Site ID	Latitude (N)	Longitude (W)	Ellipsoidal Height *
FMTF	34-24-35.499630	118-53-38.867380	363.466
TOST	34-14-52.629700	118-50-11.944510	275.029
LAPC	34-10-54.906820	118-34-28.694430	208.484
SKYB	34-26-19.033420	118-28-43.016460	520.92
WMAP	34-15-33.915050	118-24-51.401550	268.797
CAT2	33-18-41.808450	118-20-01.690170	477.952
LEEP	34-08-04.552310	118-19-18.269380	485.742
ELSC	34-01-47.029630	118-12-30.309590	61.896
LINJ	34-39-43.266100	118-08-21.074270	721.926
CIT1	34-08-12.139800	118-07-38.179660	216.032
VNPS	34-30-05.319400	118-07-16.120360	962.581
CVHS	34-04-55.228350	117-54-06.133990	119.811
CCCS	33-51-45.861950	117-51-53.745290	32.544
LORS	34-07-59.964930	117-45-14.604420	449.594
SBCC	33-33-10.788520	117-39-41.302930	89.398
EWPP	34-06-15.101330	117-31-32.058570	331.182
MLFP	33-55-06.240800	117-19-04.601760	473.692
SIO5	32-50-26.632690	117-14-58.834110	186.275
P474	33-21-18.680990	117-14-55.242020	183.645
CRFP	34-02-20.574650	117-05-58.809570	689.515

\* Ellipsoidal heights are expressed in meters.

## APPENDIX B – CONTROL POINT HEIGHT ANALYSIS

Below are control point orthometric heights and the corresponding heights derived from leveling from NGS NAVD88 benchmarks.

METRO ID / NGS PID	METRO HEIGHT	NGS ELEV	$\Delta$
P009 / EV9167	437.32	437.72	-0.39
P010 / EV3225	1159.95	1160.09	-0.14
P011 / EV9079	2610.97	2610.85	0.12
S015 / EV9175	323.13	323.60	-0.47
S016 / AB8242	1064.60	1064.76	-0.16
S018 / EV3223	1213.23	1213.34	-0.11
S020 / AH2685	1837.46	1837.45	0.01
S022 / AB8652	107.82	108.46	-0.64
S024 / DX1477	18.36	18.57	-0.21
L020 / AH2685	1257.33	1257.48	-0.15
L023 / EV0999	1398.77	1398.78	-0.01
L024 / DY0090	64.82	65.33	-0.51
L031 / AH3350	467.29	467.64	-0.35
L032 / EV9310	2297.25	2297.19	0.06

**APPENDIX C – CONTROL POINT COHESION ANALYSIS 2013(CTO004) to 2014(CTO007)**

Below are control point positions and the corresponding deltas in relationship to the initial 2013 control campaign and the recent 2014 campaign.

2014 Control				2013 Control			Δ		
Point ID	Northing	Easting	Height	Northing	Easting	Height	N	E	H
L001	2115736.602	6515594.465	2303.893	2115736.643	6515594.337	2303.817	-0.041	0.128	0.076
L002	2073381.724	6521852.573	2380.902	2073381.751	6521852.480	2380.873	-0.027	0.093	0.029
L003	2026034.584	6526976.631	2747.829	2026034.597	6526976.577	2747.854	-0.013	0.054	-0.025
L004	1995161.534	6505907.795	2788.963	1995161.525	6505907.789	2788.884	0.009	0.006	0.079
L005	1982750.733	6468377.259	2067.697	1982750.725	6468377.249	2067.681	0.008	0.010	0.016
L006	1974201.525	6424709.634	1444.388	1974201.517	6424709.666	1444.428	0.008	-0.032	-0.040
L007	1944482.762	6409379.108	1454.774	1944482.743	6409379.128	1454.741	0.019	-0.020	0.033
L008	1906647.446	6445366.458	870.975	1906647.428	6445366.464	870.938	0.018	-0.006	0.037
L009	1868152.801	6485091.879	450.145	1868152.785	6485091.881	450.193	0.016	-0.002	-0.048
L010	1828318.557	6505264.300	188.482	1828318.541	6505264.310	188.503	0.016	-0.010	-0.021
L011	1807298.744	6540020.599	157.500	1807298.703	6540020.611	157.518	0.041	-0.012	-0.018
L012	1925987.123	6318991.375	716.503	1925987.086	6318991.393	716.483	0.037	-0.018	0.020
L013	1917982.870	6362003.577	1122.659	1917982.851	6362003.588	1122.602	0.019	-0.011	0.057
L014	1907580.030	6393854.819	825.266	1907580.021	6393854.829	825.228	0.009	-0.010	0.038
L015	1894793.490	6447079.020	732.663	1894793.469	6447079.032	732.663	0.021	-0.012	0.000
P001	2136927.122	6513745.135	2336.963	2136927.163	6513744.999	2336.901	-0.041	0.136	0.062
P002	2001230.432	6523096.693	3208.074	2001230.420	6523096.688	3208.056	0.012	0.005	0.018
P003	1983077.218	6379518.464	1016.613	1983077.203	6379518.474	1016.580	0.015	-0.010	0.033
P004	1887156.433	6468894.627	569.935	1887156.419	6468894.638	569.968	0.014	-0.011	-0.033
P005	1792283.599	6542415.944	113.031	1792283.578	6542415.973	113.092	0.021	-0.029	-0.061
P006	1927120.405	6295431.570	512.618	1927120.375	6295431.580	512.625	0.030	-0.010	-0.007
P007	1917262.646	6378177.122	967.053	1917262.638	6378177.127	967.018	0.008	-0.005	0.035
S001	2096835.110	6517733.138	2305.122	2096835.155	6517733.035	2305.039	0.045	0.103	0.083
S004	1980736.017	6444973.661	1686.377	1980736.005	6444973.674	1686.375	0.012	-0.013	0.002
S005	1973920.254	6403086.411	1205.834	1973920.253	6403086.432	1205.852	0.001	-0.021	-0.018
S006	1924638.784	6431670.869	1073.319	1924638.765	6431670.872	1073.273	0.019	-0.003	0.046
S007	1843860.749	6490033.734	283.007	1843860.730	6490033.740	283.060	0.019	-0.006	-0.053
S009	1922038.414	6337339.818	911.089	1922038.388	6337339.828	911.058	0.026	-0.010	0.031
S010	1899862.848	6425900.365	778.806	1899862.822	6425900.381	778.775	0.026	-0.016	0.031

## APPENDIX D – REAL TIME KINEMATIC QUALITY CHECKS

Below are control point positions and the corresponding deltas performed as part of a quality control plan to ensure relative accuracy within the GCN. Comparison ( $\Delta$ ) is below

Point ID	Adjusted Coordinates			Surveyed Coord. with Established Control			$\Delta$		
	Northing (Adj.)	Easting (Adj.)	Ortho Height (Adj)	Northing (Surveyed)	Easting (Surveyed)	Ortho Height Surveyed	$\Delta E$	$\Delta N$	$\Delta$
L003	2026034.589	6526976.628	2747.888	2026034.584	6526976.631	2747.829	0.005	0.003	0.059
L004	1995161.522	6505907.760	2788.851	1995161.534	6505907.795	2788.963	-0.012	-0.035	-0.112
L007	1944482.821	6409379.102	1454.820	1944482.762	6409379.108	1454.774	0.059	-0.006	0.046
L008	1906647.406	6445366.461	871.030	1906647.446	6445366.458	870.975	-0.040	0.003	0.055
L013	1917982.863	6362003.592	1122.609	1917982.870	6362003.577	1122.659	-0.007	0.015	-0.050
L017	1863069.955	6611532.502	840.535	1863069.983	6611532.470	840.548	-0.028	0.032	-0.013
L018	1856881.517	6664341.222	1222.923	1856881.484	6664341.185	1222.987	0.033	0.037	-0.064
L020	1857592.935	6733843.852	1257.351	1857592.935	6733843.878	1257.330	0.000	-0.026	0.021
L023	1840187.047	6808229.298	1398.775	1840187.065	6808229.285	1398.766	-0.018	0.013	0.009
L026	1714465.619	6620771.973	60.416	1714465.638	6620771.968	60.476	-0.019	0.005	-0.060
L027	1687267.401	6648633.299	314.794	1687267.477	6648633.281	314.763	-0.076	0.018	0.031
P004	1887156.406	6468894.621	570.022	1887156.433	6468894.627	569.935	-0.027	-0.006	0.087
P010	1856212.744	6716863.318	1159.886	1856212.802	6716863.300	1159.950	-0.058	0.018	-0.064
P014	1587834.327	6705089.838	155.140	1587834.310	6705089.853	155.048	0.017	-0.015	0.092
S003	1981927.878	6492738.137	2462.746	1981927.893	6492738.196	2462.739	-0.015	-0.059	0.007
S004	1980736.023	6444973.671	1686.439	1980736.017	6444973.661	1686.377	0.006	0.010	0.062
S007	1843860.737	6490033.688	282.996	1843860.749	6490033.734	283.007	-0.012	-0.046	-0.011
S008	1817310.952	6521036.013	162.521	1817310.961	6521036.038	162.535	-0.009	-0.025	-0.014
S009	1922038.441	6337339.844	911.041	1922038.414	6337339.818	911.089	0.027	0.026	-0.048
S015	1850617.834	6561809.454	323.146	1850617.856	6561809.456	323.129	-0.022	-0.002	0.017
S017	1856028.368	6683122.643	1100.471	1856028.365	6683122.603	1100.422	0.003	0.040	0.049
S019	1848377.309	6781528.798	1024.447	1848377.293	6781528.811	1024.353	0.016	-0.013	0.094
S021	1771147.055	6567156.686	99.953	1771147.008	6567156.656	100.078	0.047	0.030	-0.125
S022	1733595.546	6596649.772	107.888	1733595.562	6596649.754	107.816	-0.016	0.018	0.072
S023	1674084.502	6660949.580	349.143	1674084.500	6660949.600	349.177	0.002	-0.020	-0.034