

INDEX NO: 343350, 1195550

LEGEND

- ▲ FOUND HPGN STATION AS DESCRIBED IN STATION DESCRIPTIONS
- ⊙ SET 3/4" REBAR W/ALUM. CAP STAMPED "REINHARDT MN&S LS 6392"
- FOUND CALTRANS POST MILE MARKER AS DESCRIBED IN STATION DESCRIPTIONS
- FOUND 2" BRASS CAP AT RIGHT OF WAY STAMPED "CALIF DIVISION HIGHWAYS RT10 106+37.74" STA. #100
- PID PERMANENT IDENTIFIER: THE UNIQUE SIX-CHARACTER CODE THAT IDENTIFIES A CONTROL POINT IN THE NATIONAL GEODETIC REFERENCE SYSTEM.
- (USF) UNITED STATES SURVEY FEET
- (M) INTERNATIONAL METERS
- (IP) IRON PIPE
- (PP) PLASTIC PLUG

BASIS OF BEARINGS

THE BEARING OF S 63° 43' 26" E BETWEEN POINTS 797 ("JACKIE") AND 1655 (HPGN D 05 BR) IS THE BASIS OF THIS MAP. STATIONS ARE FIRST ORDER PER NATIONAL GEODETIC SURVEY.

Overview

MNS Inc. performed a survey in December, 1997 within the corridor of SB154 from post mile 2.96 to 31.34 in Santa Barbara County, California. The purpose of the survey was to replace the monuments destroyed by construction and utilize the Global Positioning System (GPS) to link all the project sites together on one common basis. In addition, the survey was to generally follow the guidelines for Second Order Horizontal GPS Surveys as indicated by Caltrans survey manual section 6-16 to 6-18.

Project Datums and Reference Systems

Horizontal positions and ellipsoid heights are referenced to the North American Datum of 1983, 1991.35 epoch adjustment of the High Precision Geodetic Network (HPGN) Caltrans monuments as published by the National Geodetic Survey (NGS). The stations used to reference this survey to NAD83(1991.35) are as follows: #6263 = HPGN D 05 DQ, #797 = Jackie, #1655 = HPGN D 05 BR, #1991 = HPGN D 05 AS. Said stations used are classified as First Order (1:100,000).

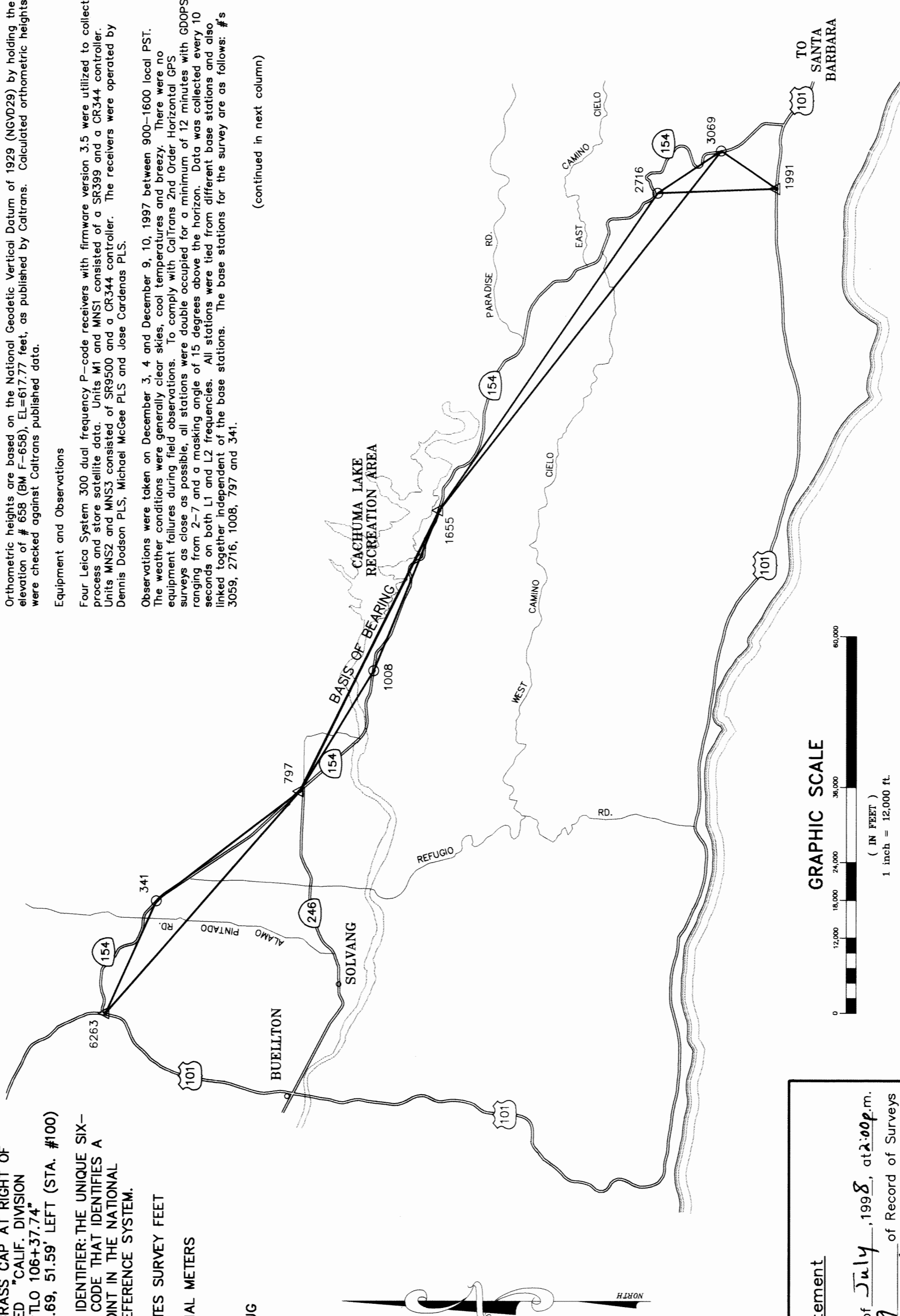
Orthometric heights are based on the National Geodetic Vertical Datum of 1929 (NGVD29) by holding the elevation of # 658 (BM F-658), EL=617.77 feet, as published by Caltrans. Calculated orthometric heights were checked against Caltrans published data.

Equipment and Observations

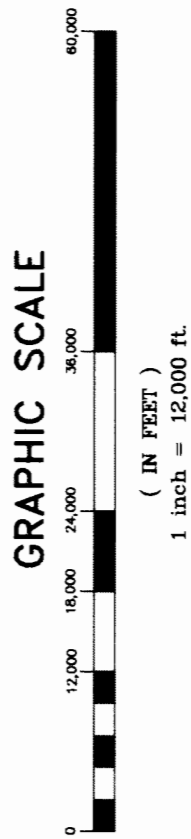
Four Leica System 300 dual frequency P-code receivers with firmware version 3.5 were utilized to collect, process and store satellite data. Units M1 and MNS consisted of a SR559 and a CR344 controller. Units MNS2 and MNS3 consisted of SR500 and a CR344 controller. The receivers were operated by Dennis Dodson PLS, Michael McCreel PLS and Jose Cardenas PLS.

Observations were taken on December 3, 4 and December 9, 10, 1997 between 900-1600 local PST. The weather conditions were generally clear skies, cool temperatures and breezy. There were no equipment failures during field observations. Copy with Caltrans 2nd Order Horizontal GPS surveys as close as possible, all stations were double occupied for a minimum of 12 collected data ranging from 2-7 and a crossing angle of 15 degrees above the horizon. Data was collected every 10 seconds on both L1 and L2 frequencies. All stations were tied from different base stations and also linked together independent of the base stations. The base stations for the survey are as follows: # 3059, 2716, 1008, 797 and 341.

(continued in next column)



GRAPHIC SCALE (IN FEET) 1 inch = 12,000 ft



Recorder's Statement

Filed this 30th day of July, 1998, at 2:00 p.m. in book 149 of Record of Surveys at page(s) 35-47, at the request of Martin, Northart & Spencer, Inc.

Fee: \$ 32.00

Kenneth A. Petit County Clerk-Assessor-Recorder By: Anna Butke Deputy

County Surveyor's Statement

This map has been examined in accordance with Section 8766 of the Land Surveyor's Act this 21st day of July, 1998.



Michael B. Emmons County Surveyor P.L.S. No. 5899 License Expiration Date: 12/31/2000

Surveyor's Statement

This map correctly represents a survey made by me or under my direction in conformance with the requirements of the Land Surveyor's Act at the request of Santa Barbara County Association of Governments in February, 1998.

Mark E. Reinhardt P.L.S. No. 6392 License Expiration Date: 12/31/98



Processing Baselines and Adjustments

Baseline data was processed on a Pentium 133 Gateway computer using the Leica 'SKI' post processing software version 2.2 running on Windows 95. Baselines in this survey were processed with a cutoff vertical angle of 15 degrees above the horizon using the computed ionospheric model and broadcast ephemeris.

In Adjustment #1 (Minimally Constrained) HPGN D OSBR # 1655 was fixed for its NAD83(1991.35) epoch coordinates to verify the integrity of the baseline measurements and the positions of the other HPGN stations. Baseline 682-708 was removed from the adjustment due to being invalid. Also the second vector from baseline 3059-2677 was removed due to high residuals. The results of the check on other HPGN stations are as follows:

Point #	N. Latitude	W. Longitude	Ellipsoid Ht.
1991	34°26'32.95986"	119°47'12.47388"	calculated
	34°26'32.96037"	119°47'12.47401"	to record
	N 0.016 m	W 0.003 m	
797	34°36'42.09304"	120°03'24.51668"	calculated
	34°36'42.09292"	120°03'24.51685"	to record
	S 0.004 m	W 0.004 m	
6263	34°40'50.60320"	120°09'24.57706"	calculated
	34°40'50.60252"	120°09'24.57631"	to record
	S 0.021 m	W 0.018 m	

In Adjustment #2 the network was constrained to all four HPGN stations #'s 1655, 797, 6263 and 1991 to establish geodetic positions and ellipsoid heights. Standard deviations from this adjustment are discussed hereafter under accuracy.

In Adjustment #3, (Minimally Constrained) the network was constrained horizontally to # 658 (BM F-658), based on its calculated position from adjustment #2 and also constrained vertically based on a pseudo ellipsoid height for the purpose of determining estimated orthometric heights only. The pseudo ellipsoid height was determined by shifting the calculated ellipsoid height at station #658 by 2.895 feet to obtain a pseudo ellipsoid height corresponding to record NGVD29 elevation at station # 656.

Elevations on the remaining stations were calculated from adjustment #3, then exported to a spread sheet for comparison with record NGVD29 elevations published by Caltrans. The elevations were compared on a site by site basis thus the NGVD29 elevations were shifted to one common point at each site so trends and differences could be determined. The following are the results of the elevations checks:

Station:	Calc. GPS Elev.	Rec. Caltrans Elev.	Diff.	Sites
658	617.771	617.771	0.00	B
3059	561.99	562.05	-0.06	A
3068	520.55	520.60	-0.05	A
3101	435.06	435.17	-0.11	A
2750	1235.61	1235.69	-0.07	D
2677	1386.03	1385.96	0.07	D
2544	1801.90	1801.74	0.16	E
2469	2081.59	2081.37	0.22	E
1118	583.02	583.02	0.00	H
1031	534.10	534.14	-0.04	H
733	705.16	705.16	0.00	I
708	674.83	674.87	-0.05	I
399	659.94	659.92	0.02	I
371	803.52	803.52	0.00	J, K
341	826.93	826.97	-0.04	J, K
	850.03	850.08	-0.05	J, K
	842.99	843.05	-0.05	J, K

Overall using Geoid 96 & the pseudo NGVD29 ellipsoid provided a good check on the record elevations. The stations with zero difference were the held stations at each site. Thus, all remaining stations were shifted to compare elevations with the record Plane Coordinate Parameters.

The plane coordinates are listed as NAD83(1991.35) zone 5. The average grid factor is 0.99992941 and the average elevation factor is 0.999996111.

Accuracy

The Standard Deviations (68% level of confidence) of the horizontal coordinates resulting from the constrained adjustment are estimated at 0.5 centimeters and ellipsoid heights at 1.2 centimeters on the average. Baseline precision's (95% level of confidence) average 4 ppm for vectors greater than 1000 meters. The relative distance errors at the 95% level of confidence in this network vary from 0.7 to 1.3 centimeters and average 1.0 centimeters. A First Order survey per the FCCS requirements would allow one centimeter + 10 ppm of a lines length which is equivalent to 1.4 centimeters for a 1000 meter line.

RECORD OF SURVEY

OF A CONTROL NETWORK ALONG SB 154 POST MILE 2.97 TO 31.34 COUNTY OF SANTA BARBARA STATE OF CALIFORNIA

SCALE: N/A FEBRUARY, 1998

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