Surveyed by K. Reimers Date Jan 2009 F.B. 41234 Pg. 1

Reviewed by N. Turner Date Jan 2010

Type of Survey Horizontal and Vertical Control Network W.O. E1800490

Job Number 90977 Title Page 1 Sheet 1 of 17

LAX Horizontal and Vertical Control Network

Horizontal Control Was Established Using GPS

Vertical Control Was Established Using Diferential Leveling

Survey Crew
K. REIMERS
R. HOLME
N. TURNER
L. BURKE
E.CHING
K.WERETKA
J. BAWAYAN
C. ZAMORA
M. JOYCE
C. PRIETO

Vertical Control: NAVD88
NGS Benches DY1315, DY1310,DY1296 DY1304
City BPM 17–19900
Horizontal Control:
CSRC CGPS Stations UCLP, TORP, DSHS, and LASC
California Zone 5 Coordinates
NAD83, National Special Reference System 2007 (NSRS2007)
Epoch 2007.0

Purpose: The purpose of this project is to establish horizontal and vertical control values for current and future projects at Los Angeles International Airport.

Datums: The vertical datum for this project is the same as the NGS bench marks, whose orthometric heights were derived from differential leveling; NAVD 88, 1995 adjustment. Leveling was performed using the Federal Geodetic Control Subcommittee (FGCS) specification for Second Order Class II Geodetic Leveling as defined in the publication "FGCS Specifications and Procedures to Incorporate Electronic Digital / Bar-Code Leveling systems", adopted June 14, 1995, with modifications as set forth in the document "Specifications and Procedures for Second Order, Class II Geodetic Leveling to Establish Elevation on CORS" as published by the California Spatial Reference Center (CSRC), March 10, 2003. All level lines were double run.

The horizontal control is California Zone V Coordinates, North American Datum of 1983 (NAD83), National Special Reference System 2007 (NSRS2007), California Special Reference System (CSRS) Epoch 2007.00, as supplied by the California Special Reference Center. Superseded control can be found in Appendix A

Horizontal Control: Primary control stations were CSRC continuously operating GPS reference sites (CGPS) UCLP, TORP, DSHS, and LASC.

Array: SCIGN
Name: UCLA
SOPAC Site ID: UCLP

Array: SCIGN
Name: Torrance Ariport
SOPAC Site ID: TORP

Array: PBO
Name: DSHS_SCGN_CS1999
SOPAC Site ID: DSHS

Array: SCIGN
Name: LASC_SCGN_CS1998
SOPAC Site ID: LASC

Station	North	East
TORP	1748959.858	6461222.724
LASC	1796299.020	6468688.999
DSHS	1831273.115	6456057.891
UCLP	1847829.439	6427838.469

A total of 38 stations were observed, which includes the four CSRC CGPS stations. The static GPS survey was done in compliance with NOAA Technical Memorandum NOS NGS-58, Guidelines For Establishing GPS-Derived Ellipsoid Heights (Standards: 2 Cm and 5 Cm), Version 4.3

Processing: All data for the static survey was processed using Trimble Geomatic Office, Version 1.63. The network adjustment was completed using this same software.

A minimally constrained adjustment was performed to check the internal consistency of the network, detect blunders or ill-fitting observations; and obtain accurate observation error estimates. The average vector residual was 0.02 feet. Vector weighting was established with fixed centering and height estimates set to 3mm.
A constrained network adjustment was preformed to establish control values that fit coordinate values established and published by the CSRC. The stations fixed for this adjustment were LASC, DSHS, and UCLP. TORP was not fixed but was used as a check. A variance factor of 1.09 was produced. A scalar value of 3.98 was applied to the vector covariances.

The final adjusted coordinates were rotated, translated, and scaled to fit existing local airport coordinates found in CEFB 43071, Page 1028. The established airport coordinates were verified using RTK , and following procedures prescribed in “National Geodetic Survey User Guidelines for Classical Real Time GNSS Positioning” . All points fell within the estimated accuracy for Class RT1 .

Origin North, 1801390.089 , Translation North, -1805665.142
Origin East, 6435488.816 , Translation East, -6446317.891
Rotation angle, 6°46'03", Scale Factor, 0.99999844

GPS Equipment
Unit 1:
Trimble 5700, SN 440103753, with Zephyer Geodetic Antenna, SN 41249-00,
Unit 2:
Trimble 5700, SN 220272556, with Zephyer Antenna, SN 11909734
Unit 3:
Trimble 5700, SN 220272473, with Zephyer Antenna, SN 12235208
Unit 4:
Trimble R8/5800, SN 4588158267 with TRM TSCR 2, SN SCS17A3748
Unit 5:
Trimble R8/5800, SN 4588158978 with TRM TSCR 2, SN SCS17A3748

California Coordinate System Zone V Epoch 2007.0 NAD83(NSRS2007)
Elevations NAVD 1988

	Northing	Easting	Elev	Desc.
30	1797928.691	6433844.709	127.479	PSO#30, 1"IP W/ CAP
241010	1805460.989	6440757.143	107.051	241010, S&W
241018	1805135.953	6436242.988	119.908	PSO#1018, S&W
241020	1805436.902	6438181.782	120.507	241020, BR DISK
241040	1804865.977	6433940.954	116.074	241040, SSDM
241050	1804409.599	6429461.900	114.218	241050, S&W
481010	1801809.661	6437274.766	121.134	481010, BR DISK
961010	1803999.682	6441551.521	104.166	961010, S&W
6R1020	1803943.572	6440421.016	113.558	6R1020, S&W
6R1025	1802723.112	6429773.849	102.602	6R1025, SPK
6R1026	1802909.103	6431701.631	106.862	6R1026, SPK
6R1027	1803233.436	6434017.737	113.718	6R1027, SPK
6R1030	1803542.836	6436531.053	118.676	6R1030, SSDM
6R1040	1803264.545	6434773.712	115.190	6R1040, S&W
7L1000	1801241.107	6446411.367	92.500	7L1000 , SSDM
7L1005	1801436.618	6445563.365	96.277	7L1005, SPK
7L1010	1800893.166	6441551.581	108.965	7L1010, S&W
7L1020	1800158.084	6437322.577	127.662	7L1020, S&W
7L1030	1799921.838	6435119.570	121.170	7L1030, S&W
7R1003	1798002.510	6435059.078	114.974	7R1003, S&W
7R1004	1798344.916	6437898.273	120.900	7R1004, S&W
7R1005	1798706.310	6441535.653	110.748	7R1005, S&W
7R1006	1799374.920	6446439.531	95.471	PSO#5 SPK
SA1020	1799172.117	6432322.983	102.731	SA1020, SSDM
SA1030	1801273.386	6431897.923	104.931	SA1030, S&W
SA1059	1798517.355	6433148.699	89.399	SA1059, S&W
WP1046	1805390.143	6447172.193	101.025	WP1046, S&W
WP1047	1805410.435	6444484.629	102.944	WP1047, S&W
WP1049	1805998.850	6438390.359	112.524	WP1049, S&W
WP1050	1805805.557	6436375.518	135.592	WP1050, S&W
WP1051	1805526.102	6434047.318	109.994	WP1051, S&W
WW1000	1801040.761	6429938.421	106.343	WW1000, S&W
WW1001	1801414.257	6432879.485	101.832	WW1001, S&W
WW1002	1801527.806	6434246.252	105.925	WW1002, S&W
WW1004	1801728.760	6435518.745	110.718	WW1004, SPK

LAX Coordinates

Station	Adj. North	Adj. East
241010	-853.346	-5117.746
241018	-644.166	-9638.744
241020	-573.783	-7677.998
241040	-640.988	-11956.549
241050	-566.371	-16458.169
481010	-4068.862	-9006.129
961010	-2398.079	-4501.105
6R1020	-2320.578	-5630.344
6R1025	-2277.865	-16347.130
6R1026	-2320.341	-14410.866
6R1027	-2271.200	-12072.681
6R1030	-2260.126	-9540.421
6R1040	-2329.392	-11318.309
7L1000	-5710.116	-0.200
7L1005	-5416.038	-819.253
7L1010	-5482.952	-4867.119
7L1020	-5714.563	-9153.274
7L1030	-5689.560	-11368.767
7R1003	-7588.383	-11655.012
7R1004	-7582.936	-8795.254
7R1005	-7652.691	-5140.637
7R1006	-7566.616	-192.145
SA1010	-7518.586	-12869.617
SA1020	-6104.504	-14234.212
SA1030	-3967.790	-14408.695
SA1059	-6852.006	-13491.408
WP1046	-1679.651	1244.249
WP1047	-1342.796	-1422.194
WP1049	-40.330	-7404.654
WP1050	5.154	-9428.231
WP1051	2.003	-11773.137
WW1000	-3967.885	-16381.954
WW1001	-3943.568	-13417.374
WW1002	-3991.871	-12046.751
WW1004	-3942.269	-10759.445

Station Descriptions

30	FD 1" IRON PIPE WITH CAP DESIGNATED "GPS 30", 3M SOUTH OF TOP OF SLOPE SOUTH OF SERVICE RD. "A", 67M EAST OF RED & WHITE COMMUNICATION SHACK ON THE SOUTH SIDE OF SERVICE RD. "A".
1990	
241010	SET SPIKE & WASHER IN DWPWS MONUMENT PILE, 6.9M WEST OF EASTERLY PERIMETER FENCE, EAST OF RUNWAY 24R, 4.6M EAST OF SIDEWALK, 14M NORTHEAST OF SERVICE RD CURVE, CONCAVE TO SOUTHWEST.
241018	FD SPIKE & WASHER IN CENTER OF SERVICE RD NORTH OF RUNWAY 24R, 9M EAST OF CENTERLINE PRODUCED OF GEORGETOWN AVE., 0.56km WEST OF NGS COLIN. IN CENTER OF AERIAL TARGET.
241020	FD BRASS DISK 29M NORTH OF SERVICE RD NORTH OF RUNWAY 24R, .77km WEST OF EASTERLY SERVICE RD. LOCATED IN NORTHEAST CORNER OF CONC. VAULT FOR CONTROL, NORTH OF O.9M HIGH AND 1.3M WIDE CONC. PILE FOR CABLE RACE.
241040	SET STD. SURVEY MONUMENT ON NORTH SIDE OF SERVICE RD NORTH OF RUNWAY 24R, 1.12km WEST OF NGS COLIN.
241050	SET SPIKE & WASHER IN DWPWS MONUMENT PILE, NORTH SIDE OF SERVICE RD NORTH OF RUNWAY 24R, AT BEG. OF CURVE CONCAVE TO SOUTHEAST. NEAR WESTERLY END OF RUNWAY 24R.
481010	FD BRASS DISK 3.4M WEST OF WEST EDGE OF SERVICE RD "Q", EAST OF TAXIWAY "Q", WEST OF BRADLEY TERMINAL. LOCATED IN SOUTHEAST CORNER CONC. VAULT FOR FUEL.
961010	SET SPIKE & WASHER IN WEST CURB ISLAND EAST OF SEPULVEDA BLVD., 0.8M SOUTH OF NOSE OF ISLAND, 0.3M NORTH OF NORTH CURB PRODUCED 96TH ST. CITY OF LOS ANGELES.
6R1020	SET SPIKE & WASHER IN CONC. PIER 0.4M X 0.4M SQ., 29M SOUTH OF CENTERLINE STRIPE OF SERVICE RD "E", NEAR LAX GATE #3, EAST OF TAXIWAY E7.
6R1025	FD SPIKE & WASHER 1.5M SOUTH OF NORTH EDGE SERVICE RD "AA", 5M WEST OF SIGN "^{a}E17 E". NORTH OF REMOTE GATES.

6R1026	FD SPIKE & WASHER 1M NORTH OF NORTH EDGE SERVICE RD. "E", 60M EAST OF EAST EDGE OF FUEL FARM TANKS.
6R1027	FD SPIKE & WASHER 1M NORTH OF NORTH EDGE SERVICE RD. "E", 60M EAST OF EAST EDGE OF FUEL FARM TANKS.
6R1030	FD NAIL; RESET STD SURVEY MON., 4.5M NORTH OF NORTH EDGE SERVICE RD. "E", ON CENTERLINE PRODUCED OF TAXIWAY "S". 10M WEST OF SIGN "SªE?"
6R1040	SET SPIKE & WASHER 4.2M SOUTH OF SOUTH EDGE SERVICE RD."E" IN CONC. VAULT FOR TEL MH. 66M EAST OF CENTERLINE TAXIWAY E-13 (COAST GUARD HELI CROSSING).
7L1000	FD SPIKE, RESET STANDARD SURVEY DISK MONUMENT. 5.4M SOUTH OF SERVICE RD C, NORTH OF EAST END RUNWAY 7L. 25M NORTH NORTHEAST OF SIGN "B1 B?".
7L1005	FD SPIKE 10cm DOWN IN 3" IRON CASING FLUSH WITH SURFACE CONC. 60M NORTHEAST OF NORTHEAST EDGE SERVICE RD C" CURVE, CONCAVE TO SOUTHWEST. SOUTH OF ASIANA CARGO BLDG. 12M WEST OF CHAIN LINK FENCE, DESIGNATED "GPS 10"
7L1010	SET SPIKE & WASHER 0.9M SOUTH OF K-RAIL ON NORTH SIDE OF OVERPASS OVER SEPULVEDA BLVD., 0.75M WEST OF EASTERLY EXPANSION JOINT, 21M NORTH OF N EDGE TAXIWAY "C"
7L1020	SET SPIKE & WASHER 2.7M NORTH OF NORTH EDGE SERVICE RD "C", 9.5M WEST OF CENTERLINE TAXIWAY "Q". LOCATED IN THE SOUTHEAST CORNER OF CONC. VAULT FOR "LOW FUEL POINT DRAIN"
7L1030	SET SPIKE & WASHER 9M NORTH OF SERVICE RD "C', WEST OF AMERICAN AIRLINES HANGER. LOCATED ON SOUTHWEST CORNER OF CONC. PAD FOR SIGN "C C14?"
7R1003	SET SPIKE & WASHER ON CONC. SLAB OF TAXIWAY SIGN "DEPARTURES MONITOR 120.95 NOW". 8M NORTH OF NORTH EDGE SERVICE RD "A", SOUTH OF TAXIWAY U7R.

7R1004	SET SPIKE & WASHER ON CONC. SLAB OF TAXIWAY SIGN "DEPARTURES MONITOR 120.95 NOW". 8M NORTH OF NORTH EDGE SERVICE RD "A", SOUTH OF TAXIWAY U7R.
7R1005	SET SPIKE & WASHER 0.8M SOUTH OF CURB SERVICE RD A, ON BRIDGE OVER SEPULVEDA BLVD. O.4M EAST OF EAST ABUTMENT EXPANSION JOINT. 6.9M SOUTH OF CENTERLINE OF SERVICE RD "A".
7R1006	FD SPIKE DESIGNATED "PSO #5" (PSOMAS) 1.4M NORTH OF SERVICE RD A AND W OF SERVICE RD F ON CURVE, 3M EAST OF GUARD RAIL. 9.5M WEST OF CENTERLINE OF CULVERT UNDER SERVICE RD. EAST END OF RUNWAY 7R.
SA1020	SET STD. SURVEY MONUMENT 0.7M NORTH OF SOUTH EDGE SERVICE RD. "AA" IN CURVE CONCAVE NORTHEAST, 28M WEST OF CENTERLINE PRODUCED OF TAXIWAY AA, 275M WEST OF INTERSECTION WITH SERVICE RD "A".
SA1030	FD LEAD & TACK, RESET SPIKE & WASHER 1.5M EAST OF WEST K-RAIL OF SERVICE RD "AA" ON OVERPASS OF WORLD WAY WEST. LOCATED ON CENTERLINE OF WORLD WAY WEST, DESIGNATED "S 39+67.50, W 6+50
SA1059	FD SPIKE & WASHER 3.5M EAST OF CENTERLINE STRIPE OF SERVICE RD "A", ON CURVE CONCAVE TO EAST, 220M SOUTH OF INTERSECTION WITH SERVICE RD "AA"

WP1046	SET SPIKE & WASHER IN NORTH CURB ARBOR VITAE ST., 29M WEST OF BEG CURB RETURN WEST OF AVIATION BLVD., 2.55M EAST OF PP#41162385. LABLED "WP1046"
WP1047	SET SPIKE & WASHER IN NORTH CURB WESTCHESTER PARKWAY, 28M WEST OF BEG CURB RETURN WEST OF AIRPORT BLVD., 16M EAST OF LIGHT STANDARD. LABLED "WP1047"
WP1049	SET SPIKE & WASHER IN SOUTH CURB WESTCHESTER PARKWAY, 0.16 km WEST OF EMERSON AVE., SIGNED AS "FIRE STATION", 13.8M WEST OF FIRE PLUG. LABLED "WP1049"
WP1050	SET SPIKE & WASHER 12.3M NORTH OF SOUTH CURB WESTCHESTER PARKWAY ON WEST BULKHEAD OF BRIDGE OVERPASS OVER LINCOLN AVE.
WP1051	SET SPIKE & WASHER 1.8M NORTH OF NORTH CURB WESTCHESTER PARKWAY 1.1 km EAST OF FALMOUTH AVE. 12 M WEST OF FIRE PLUG. LOCATED IN NORTHEAST COR OF WESTERLY MOST OF TWO CATCH BASINS.
WW1000	FOUND LEAD & TACK; RESET SPIKE & WASHER ON CENTER LINE INTERSECTION OF WORLD WAY WEST AND PERSHING DR. LOCATED ON MEDIAN ISLAND ON OVERPASS BRIDGE.
WW1001	SET SPIKE & WASHER ON NORTH CURB OF WORLD WAY WEST, 0.3M EAST OF BEG CURB RETURN EAST OF MAINTENANCE RD., SOUTH OF LAX BLDG. #7333 WORLD WAY WEST.
WW1002	SET SPIKE & WASHER IN SOUTH FLOW LINE OF 1.22M GUTTER OF WORLD WAY WEST. 3.83M WEST OF SPANDREL EAST OF CONTINENTAL AIRLINES ENTRANCE GATE #5, 6 54.86M WEST OF CENTER LINE OF COAST GUARD WAY.
WW1004	FOUND SPIKE IN NORTH CURB OF WORLD WAY WEST, 3.28M EAST OF BEG CURB RETURN IN CURVE. LOCATED IN SOUTH WEST CORNER OF CONCRETE CATCH BASIN AT THE WEST END OF TERMINAL LOOP OF WORLD WAY WEST.

VERTICAL CONTROL REPORT

GEODETIC LEVELING FOR
LOS ANGELES WORLD AIRPORTS, LAX

2ND ORDER CLASS II LEVELING

RECON OPERATIONS COMBINED WITH
FIELD LEVELING:

JULY 01, 2008 TO JANUARY 29, 2009

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

LOS ANGELES COUNTY, CALIFORNIA

LEVELS COORDINATOR; ROBERT N HOLME

Location:

The project was located wholly in Los Angeles County, California, including the areas of Los Angeles International Airport (LAX), Westchester, Inglewood, and Playa Del Rey. The area bounded was approximately 3.7 mi. in northing and 4.7 mi. in easting.

Scope:

Purpose: The purpose of the survey was to provide precise level elevations for the LAX Midfield Improvements project as well as future projects. The procedure involved using NGS Bench Marks and running 2nd Order, Class II leveling through fifty two Temporary Bench Marks (TBM); 28 located within the Security Identification Display Area (SIDA) of LAX and 24 TBMs in the surrounding areas. It is also intended to include these levels within a Bluebook project to be published by the NGS.

Specifications: Leveling was performed using the Federal Geodetic Control Subcommittee (FGCS) specification for Second Order Class II Geodetic Leveling as defined in the publication *"FGCS Specifications and Procedures to Incorporate Electronic Digital / Bar-Code Leveling Systems"*, adopted June 14, 1995, with modifications as set forth in the document *"Specifications and Procedures for Second Order, Class II Geodetic Leveling to Establish Elevation on CORS"* as published by the California Spatial Reference Center (CSRC), March 10, 2003. All level lines were double run.

Datum: The datum for this project is the same as the NGS bench marks, whose orthometric heights were derived from differential leveling; NAVD 88, 1995 Adjustment.

Monumentation: The only monuments that were established on this project were TBMs set at intervals along each level circuit. They were either a 2" MAG nail with L.A.C.E. washer set in existing concrete structures or 3" brass caps in concrete, set 12" down in well monument with iron cover (SSDM). All found marks were per NGS data sheets.

Instrumentation: For the differential level measurements used in this project, the following equipment was used:

Leica Model DNA-03, Serial No. 330614
Leica 3 Meter Invar rod, Type No. GPCL3, Serial No. 23050
Leica 3 Meter Invar rod, Type No. GPCL3, Serial No. 22644

In addition to the primary equipment listed above, both rods were equipped with fixed telescoping stays (Leica part 555-638), a fixed tripod (Leica GST-40) for the level, a set of solid turning pucks (similar to Leica part 197 000) and a digital thermometer / anemometer.

The same equipment was used on the entire project.

Comments:

Reconnaissance: The NGS bench marks, existing marks and potential sites for new TBMs, were reconnoitered previous to leveling for each individual level run. The proposed route would not be finalized until a successful validation run from one NGS BM to a closer BM was made. Once the route was established, new TBM's were set.

Proposed leveling plan map: This was a map prepared on a ledger size sheet showing the NGS benches used, the TBMs set, as well as the leveling route used. The map is attached at the end of this report.

Specifications: The specifications circa 2005 set forth by the NGS and those modified by the CSRC publication cited were used and no deviations were made from those specifications.

Lines:

LAX-001: Aug 15, 2008, Oct 06, 2008 to Oct16, 2008; Nov 20, 2008 to Dec. 04, 2008

Location: City of Los Angeles, LAX, and City of Inglewood; TG 702, 703, 673. The validation runs, one along Vista Del Mar, between DY1315 and DY1310 and the other between W 64th St and La Cienega Blvd to W Fairview Blvd and Beach St from AE1738 to AE1739 were within specifications and accepted. All validation circuits were double run. The primary level run began at DY1315 near the intersection of Vista Del Mar and Imperial Hwy, proceeding along Imperial Hwy to Main St (City of El Segundo); thence North through gate 361B into the **Security Identification Display Area** (SIDA) of LAX; thence Easterly along the North side of Service Rd. A, to Service Rd F, thence Northerly along Service Rd F to gate 263B, exiting SIDA LAX and proceeding Northerly along fire access rd to the intersection of Aviation Blvd. and 104th St.; thence Northerly along Aviation Blvd. to Century Blvd; thence Easterly along Century Blvd to La Cienega Blvd; thence Northerly along La Cienega Blvd entering the City of Inglewood, to W 64th St and AE1738.

LAX-002: Oct 20, 2008 to Oct 24, 2008

Location: City of Los Angeles, Westchester; TG 702, 703. The validation run along Vista Del Mar, between DY1296 and DY1304 was within specifications and accepted. All validation circuits were double run. The secondary level run began near the intersection of Arbor Vitae and La Cienega at LAX-001 TBM LC1030, thence Westerly along Arbor Vitae St, the name changing to Westchester Parkway, to Pershing Dr; thence Northerly along Pershing Dr to Waterview St; thence Westerly along Waterview St to Vista Del Mar and DY1296.

LAX-003: Oct 29, 2008 to Oct 28, 2008

Location: City of Los Angeles, LAX; TG 702. The closing level run began near the intersection of Imperial Blvd and Pershing Dr at LAX-001 TBM 7R1000, thence Northerly along Pershing Dr to Westchester Parkway and line LAX002TBM WP1100.

LAX-004: Oct 24, 2008 to Nov 04, 2008, Dec 11, 2008 (Night)

Location: City of Los Angeles, LAX; TG 702. The closing level run began near the intersection of Airport Blvd and Arbor Vitae at LAX-002 TBM WP2047, thence Southerly along Airport Blvd to 96th St; thence Westerly along 96th St to El Manor Av; thence Northerly along El Manor Av to an airport entry rd; thence Westerly along an airport entry road through Post 3, entering SIDA LAX; thence Westerly along the North side of Service Rd E through Gate 437B exiting SIDA LAX to Pershing Dr and LAX003 TBM 6R1100.

LAX-005: Nov 05, 2008 to Nov 07, 2008

Location: City of Los Angeles, LAX; TG 702. The closing level run began at LAX-001 TBM 7R1003, thence North-Westerly along Service Rd A to Service Rd AA; thence Northerly along Service Rd AA to Service Rd E and LAX004 TBM PSO 1026. The entire line was within SIDA LAX.

LAX-006: Nov 07, 2008 to Nov 10, 2008, Jan 29, 2009 (Night)

Location: City of Los Angeles, LAX; TG 702. The closing level run began at East end of Service Rd C at LAX-001 TBM 7L1000, thence Westerly along Service Rd C to Service Rd AA; thence Southerly along Service Rd AA to LAX005 TBM SA1020. The entire line was within SIDA LAX.

LAX-007: Nov 17, 2008 to Nov 19, 2008

Location: City of Los Angeles, LAX; TG 702. The closing level run began at Service Rd E at LAX-004 TBM 6R1020, thence Northerly along Perimeter Rd to curve Westerly; thence Westerly along Perimeter Rd to curve Southerly; thence Southerly to Service Rd E and LAX004 TBM 6R1060. The entire line was within SIDA LAX.

LAX-008: Nov 17, 2008 to Nov 19, 2008

Location: City of Los Angeles, LAX; TG 702. The closing level run began at Service Rd C at LAX-006 TBM 7L1020, thence Northerly along Easterly edge of Service Rd Q to Service Rd E and LAX004 TBM 6R1030. The entire line was within SIDA LAX.

Line LAX-009: Nov 12, 2008 to Nov 17, 2008

Location: City of Los Angeles, LAX; TG 702. The closing level run began near the intersection of Pershing Dr and World Way West at LAX-003 TBM 17-19900, thence Easterly along North side of World Way West to Post 5, entering SIDA LAX; thence Northerly along West edge of Service Rd S to Service Rd E and LAX004 TBM 6R1030.

Problems:

There were 5 reaches between TBMs 1003 – 1008 that were re-leveled later in the project; Nov 20, 2008 to Dec. 04, 2008. Although the original runs met specifications for 2nd order, class II precision, they were marginal for 2nd order, class I work. Since the equipment and procedures were designed to meet 1st order, class I precision, and all the other work done up to Nov 20th 2008 met or exceeded 1st order, class I precision (when calculated without corrections), it was determined that there were procedural or natural errors introduced into those level loops. Therefore the aforementioned reaches were releveled. After the re-leveling, line LAX-001 also met 1st order, class I precision.

Due to high volume of aircraft taxing on the North side of the Bradley terminal (crossing Service Rd E) and the South side of the Bradley terminal (crossing Service Rd C) during normal day time hours, it was required by LAX Operations for the survey crew to work at night to avoid the peak traffic. Due to problems with the battery powered light source, only 1 ½ hours were actually done at night; the remainder of the work was performed after sunrise during daylight hours.

The following 5 points established by Subcontractor Psomas were spike and washers set flush or below paving grade and therefore required 20mm spacers; Line LAX-004 6R1025, 6R1026 and 6R1027; Line LAX-005 SA1059; Line LAX-007 PSOMAS 1018.

Apendix A
Superseded Survey Control
NAD83 Cal. Zone 5, 1991.35 Epoch

LEVEL #	Desc.	Northing	Easting
5010	PSO # 30, 1"IP W/ CAP	1797927.001	6433846.179
7010	241010, S&W	1805459.299	6440758.613
7018	241018, S&W	1805134.263	6436244.458
7020	241020, BR DISK	1805435.212	6438183.252
7040	241040, SSDM	1804864.287	6433942.424
7050	241050, S&W	1804407.909	6429463.37
8010	481010, BR DISK	1801807.971	6437276.236
4010	961010, S&W	1803997.992	6441552.991
4020	6R1020, S&W	1803941.882	6440422.486
4025	6R1025, SPK	1802721.422	6429775.319
4026	6R1026, SPK	1802907.413	6431703.101
4027	6R1027, SPK	1803231.746	6434019.207
4030	6R1030, SSDM	1803541.146	6436532.523
4040	6R1040, S&W	1803262.855	6434775.182
1007	7L1000 , SSDM	1801239.417	6446412.837
600	7L1005, SPK	1801434.928	6445564.835
6010	7L1010, S&W	1800891.476	6441553.051
6020	7L1020, S&W	1800156.394	6437324.047
6030	7L1030, S&W	1799920.148	6435121.040
1003	7R1003, S&W	1798000.820	6435060.548
1004	7R1004, S&W	1798343.226	6437899.743
1005	7R1005, S&W	1798704.620	6441537.123
1006	7R1006 SPK	1799373.230	6446441.001
5020	SA1020, SSDM	1799170.427	6432324.453
5030	SA1030, S&W	1801271.696	6431899.393
5015	SA1059, S&W	1798515.665	6433150.169
2046	WP1046, S&W	1805388.453	6447173.663
2047	WP1047, S&W	1805408.745	6444486.099
2049	WP1049, S&W	1805997.160	6438391.829
2050	WP1050, S&W	1805803.867	6436376.988
2051	WP1051, S&W	1805524.412	6434048.788
9000	WW1000, S&W	1801039.071	6429939.891
9001	WW1001, S&W	1801412.567	6432880.955
9002	WW1002, S&W	1801526.116	6434247.722
9004	WW1004, SPK	1801727.070	6435520.215
DY9308	HPGN CA 07-01, DY9308	1821364.690	6439418.520
DY9342	HPGN D CA-07-CG, DY9342	17965410	6430349.060

NAD27 Cal Zone 7

Point	Northing	Easting
30	4087692.216	4160262.198
241010	4095247.125	4167149.383
241018	4094907.130	4162636.449
241020	4095214.498	4164574.182
241040	4094629.525	4160335.384
241050	4094158.295	4155857.989
481010	4091584.400	4163679.245
961010	4093788.512	4167948.588
6R1020	4093728.656	4166818.305
6R1025	4092472.914	4156175.536
6R1026	4092665.299	4158102.637
6R1027	4092997.307	4160417.590
6R1030	4093315.034	4162929.798
6R1040	4093030.924	4161173.438
7L1000	4091046.159	4172817.433
7L1005	4091238.853	4171968.810
7L1010	4090682.128	4167958.963
7L1020	4089933.052	4163732.541
7L1030	4089689.507	4161530.392
7R1003	4087770.063	4161476.280
7R1004	4088121.874	4164314.240
7R1005	4088495.314	4167950.296
7R1006	4089180.147	4172851.789
SA1020	4088930.536	4158736.391
SA1030	4091030.303	4158304.360
SA1059	4088278.544	4159564.255
WP1046	4095197.541	4173564.468
WP1047	4095208.929	4170876.920
WP1049	4095777.115	4164780.886
WP1050	4095577.146	4162766.750
WP1051	4095289.976	4160439.551
WW1000	4090791.181	4156345.696
WW1001	4091174.426	4159285.422
WW1002	4091292.507	4160651.766
WW1004	4091497.676	4161923.550

Elevations NGVD29 1985 ADJ

LEVEL #	METERS	US FT
DY1315	13.441	44.098
DY1296	16.629	54.557
1315	13.441	44.098
1296	16.629	54.557
1000	24.26584	79.612
1001	30.40769	99.763
1002	33.01865	108.329
1003	34.32345	112.610
1004	36.12909	118.534
1005	33.03413	108.379
1006	28.37663	93.099
1007	27.47043	90.126
1008	27.73727	91.001
1010	28.14304	92.333
1020	27.62284	90.626
1030	28.96942	95.044
2046	30.06747	98.646
2047	30.65321	100.568
2048	31.84463	104.477
2049	33.57359	110.149
2050	40.60491	133.218
2051	32.80268	107.620
2052	30.10654	98.775
2100	23.97354	78.653
7900	22.69279	74.451
3990	24.54787	80.537
3828	25.83173	84.750
3100	26.64384	87.414
4010	31.02648	101.793
4020	33.88965	111.186
4030	35.45014	116.306
4040	34.38795	112.821
4027	33.93926	111.349
4026	31.84963	104.493
4025	30.55121	100.233
4060	29.94083	98.231
5010	38.13469	125.114
5015	26.52742	87.032
5020	30.59086	100.364
5030	31.26108	102.562
6000	28.62181	93.903
6010	32.4897	106.593
6020	38.18908	125.292
6030	36.21073	118.801

LEVEL #	METERS	US FT
7010	31.90629	104.679
7020	36.00808	118.137
7018	35.82563	117.538
7040	34.65694	113.704
7050	34.09143	111.848
8010	36.19946	118.764
9000	31.69239	103.977
9001	30.31692	99.465
9002	31.56446	103.558
9004	33.02515	108.350

LAX-GPS PRECISE LEVELS

LAX AND ADJACENT AREAS

LOS ANGELES CALIFORNIA

CITY OF LOS ANGELES, PUBLIC WORKS, BUREAU OF ENGINEERING, SURVEY DIVISION

PROJECT MANAGER ROBERT HOLME