Contractor's Workshop

Survey Adjustments, Starnet and Reporting

CCSF Primary Coordinate Survey System

Traverse Adjustment Software

Traverse Adjustment / Closure Expectations

Survey Reports

Presented June 13, 2018 Revised 06/20/18

Survey Adjustments and Reporting

CCSF Primary Coordinate Survey Systems:

CCSF-CS13

NAD83(2011) Epoch 2010.00, GRS-83 Ellipsoid.

Transverse Mercator, "Low Distortion Projection.

Grid coordinates (plane coordinates).

Scale is not 1.

CCSF-VD13

Realization, (Recovery), of the NAVD88 Datum in 2013 from leveling surveys.

Survey Adjustments and Reporting

Horizontal Datum Parameters

NAD83(2011)		Ellipsoid: GRS-80
Epoch 2010.00		Equatorial (Semi Major): 6378137.0 m
		Polar (Semi Minor): 6356752.31414

Horizontal Projection Parameters

	Projection:	Transverse Mercator
	Scale:	1.000007
CCSF-CS13	Latitude of Origin:	37º 45' 00"
	Central Meridian:	-122º 27 '00"
	False Northing:	24,000 m
	False Easting:	48,000 m

Survey Adjustments and Reporting

CCSF Primary Coordinate Survey System

Best way to develop CCSF-CS13 Coordinates for your projects is to utilize a survey adjustment application that accommodates datums and projections.

BSM uses MicroSurvey's STAR*NET software application.

Vendors can use any adjustment software it chooses provided the adjustment software accommodates the datum and projection parameters for CCSF-CS13 outlined in the previous slide.

Survey Adjustments and Reporting

Traverse Adjustment Software

The “Guide-StarNet v8-CS13 Install Instructions-082617” document outlines how to set the CCSF-CS13 projection in STAR*NET. Works with STAR*NET v9.

The datum and projection parameters are listed above in Slide 4 and they are also listed in the “Guide.”

A sample data set is listed at the bottom of the “Guide.”

If you use STAR*NET and are unable to set up the CCSF-CS13 projection correctly in STAR*NET contact us and we will make every effort to get you up and running.

Survey Adjustments and Reporting

Traverse Adjustment Software

If you use a different adjustment application let BSM know what you are using.

Should we need to review in detail or advise with respect to your adjustment we will need your project work files.

BSM can assist in producing results consistent with BSM procedures if you provide a copy of the following StarNet files:

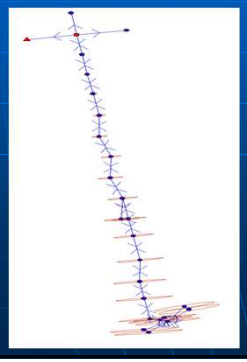
*.pts (plane coordinates and elevations),
*.pos (geodetic coordinates),
*.lst (listing),
*.snproj (StarNet project file) and the
*.dat (StarNet constraints and observations files).

Survey Adjustments and Reporting

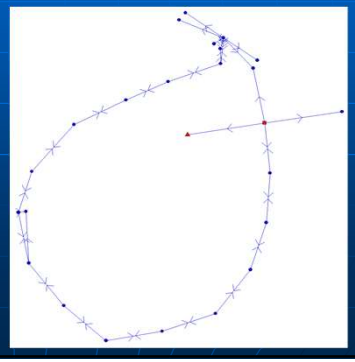
Traverse Adjustment Software

In any adjustment the point ID must be correct other wise funny things happen and it is very hard to debug.

Correct Point ID’S



Incorrect Point ID’s



Traverse Adjustments using Least Squares

To Least Squares or Not To Least Squares?

If a traverse is not required and only a Short Form Survey Report is necessary then there is no adjustment

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Step One: Minimally Constrained Adjustment

- Fix one horizontal point and a bearing (called the constraints), or fix two horizontal points (for a backsight). Fix one point for elevation and run a 3D adjustment (always) for redundancy and integrity. The vertical constraint does not have to be the same as the horizontal. Set other known points free in their n, e & elevation.
- The least squares adjustment will best fit all observations mathematically so as to minimize the residuals (note, multiple redundant observations or points with redundant occupations will result in residuals. The traverse is treated like a solid object anchored to the fixed coordinate(s) and the differences between the calculated positions and the known coordinates at other 'set free' points are listed.
- If the residuals and closures on the other known points are acceptable then compute the Constrained Adjustment to develop final coordinates. If the residuals are not acceptable, then go into blunder detection mode and try to identify the problem observations or control points.

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Step Two: Free-Weighted Constrained Adjustment

- Free-Weighted Constrained Adjustment is very useful for blunder detection. All known horizontal & vertical control points (constraints) are assigned an arbitrary weight of 1 foot i.e. n=1, e=1, elv=1.
- The computed solution attempts to best fit the traverse to all the known points as opposed to holding or fixing any points. This results in differences at all points.
- Because least squares attempts to minimize the sum of the square of the residuals, larger difference will likely appear at or near the problem. These larger than expected differences may indicate a problem with a control point's position or a traverse observation. The problem may be using the wrong coordinate, or the wrong point number. Additional analysis is necessary to identify the problem.

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Step Three: Constrained Adjustment

- After any bad observations are identified and removed, re-run the 'Minimally Constrained Adjustment' as previously described to demonstrate and document the acceptable closures on other know control points.
- Once an acceptable 'Minimally Constrained Adjustment' is determined, process the 'Constrained Adjustment' fixing all acceptable known control points to develop the final coordinates for publishing.

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Survey Adjustments and Reporting

Traverse Adjustment / Closure Expectations

Example: Mission Street Traverse:

Octavia St to the Embarcadero, over 2 miles of traversing.

8 HPND CCSF-CS13 and 9 CCSF VD-13 Control Points

60 setups

All angles measured 3 times direct and reverse

Survey Adjustments and Reporting

Traverse Adjustment / Closure Expectations

Example: Mission Street Traverse

STAR*NET Instrument Standard Error Settings

Project Default Instrument Leica MS 60

Distances (Constant)	:	0.003 FeetUS
Distances (PPM)	:	1.000
Angles	:	2.000 Seconds
Directions	:	2.000 Seconds
Azimuths & Bearings	:	2.000 Seconds
Zeniths	:	4.000 Seconds
Elevation Differences (Constant)	:	0.050 FeetUS
Elevation Differences (PPM)	:	0.000
Centering Error Instrument	:	0.005 FeetUS
Centering Error Target	:	0.005 FeetUS
Centering Error Vertical	:	0.005 FeetUS

Survey Adjustments and Reporting

Traverse Adjustment / Closure Expectations

Example: Mission Street Traverse

	Minimally Constrained 3D			Free Weighted Constrained 3D		
Station	dN	dE	dZ	dN	dE	dZ
238	0.000	0.000	0.000	-0.016	0.024	-0.015
239	0.010	-0.007	0.015	-0.007	0.013	0.000
265	-0.002	-0.013	-0.016	-0.027	0.009	-0.031
266	0.000	0.000	0.022	-0.024	0.023	0.007
267	-0.035	-0.031	0.021	-0.058	-0.007	0.006
361	0.022	-0.051	0.038	-0.003	-0.023	0.023
364	0.035	-0.035	0.039	0.009	-0.007	0.024
10100	n/a	n/a	0.025	n/a	n/a	0.010
10312	n/a	n/a	0.010	n/a	n/a	-0.005
10314	n/a	n/a	0.032	n/a	n/a	0.017
11770	-0.006	0.000	0.013	-0.026	0.021	-0.003
11771	-0.017	-0.013	0.000	-0.039	0.007	-0.015
11777	-0.013	-0.001	0.002	-0.035	0.022	-0.013

Survey Adjustments and Reporting

Survey Reports

Are a minimum requirement for all projects going forward.

They are to contain the information of the who, what, where, when and how.

They are to contain the results of the survey.

They are to contain the Quality of the survey.

They Supply the retracement of Your Survey.

Survey Adjustments and Reporting

Survey Reports

Primary Importance for a Report:

Allows *BSM* to following in the foot steps of your survey.

Allows *The Client* to following in the foot steps of your survey.

Allows the down stream *Design Consultants* to following in the foot steps of your survey.

Survey Adjustments and Reporting

Survey Reports

Two Types of Reports:

Short Form

Long Form

BSM will specify what type is required for each specific project.

Survey Adjustments and Reporting

Survey Reports

Short Form:

The "Short Form" Survey Report identifies the horizontal control points and the vertical control points with their coordinate values and the points and/or line(s) held for the basis of bearings.

The differences between the published measured values are listed with a brief narrative of the methods employed for the survey.

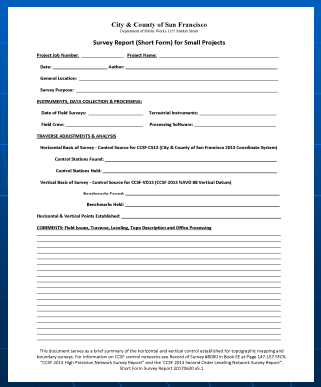
Retracement.

(see "Form-SurveyRpt-ShortForm-Traverse")

Survey Adjustments and Reporting

Survey Reports

Short Form:



City & County of San Francisco

Department of Public Works 1155 Market Street

Survey Report (Short Form) for Small Projects

Project Job Number: _____ **Project Name:** _____

Date: _____ **Author:** _____

General Location: _____

Survey Purpose: _____

INSTRUMENTS, DATA COLLECTION & PROCESSING:

Date of Field Surveys: _____ **Terrestrial Instruments:** _____

Field Crew: _____ **Processing Software:** _____

TRAVERSE ADJUSTMENTS & ANALYSIS

Horizontal Basis of Survey - Control Source for CCSF-CS13 (City & County of San Francisco 2013 Coordinate System)

Control Stations Found: _____

Control Stations Held: _____

Vertical Basis of Survey - Control Source for CCSF-VD13 (CCSF 2013 NAVD 88 Vertical Datum)

Benchmarks Found: _____

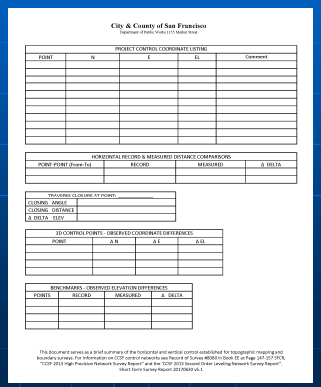
Benchmarks Held: _____

Horizontal & Vertical Points Established: _____

COMMENTS: Field Issues, Traverse, Leveling, Tape Description and Office Processing

This document serves as a brief summary of the horizontal and vertical control established for topographic mapping and boundary surveys. For information on CCSF control networks see Record of Survey #8083 in Book EE at Page 147-157 SFCR, "CCSF 2013 High Precision Network Survey Report" and the "CCSF 2013 Second Order Leveling Network Survey Report".

Short Form Survey Report 2017060 v1.1



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PROJECT CONTROL COORDINATE LISTING

POINT	N	E	EL	Comment

HORIZONTAL RECORD & MEASURED DISTANCE COMPARISONS

POINT-POINT (From-To)	RECORD	MEASURED	Δ DELTA

TRAVERSE CLOSURE AT POINT: _____

CLOSING	ANGLE
CLOSING	DISTANCE
Δ DELTA	ELEV

3D CONTROL POINTS - OBSERVED COORDINATE DIFFERENCES

POINT	Δ N	Δ E	Δ EL

BENCHMARKS - OBSERVED ELEVATION DIFFERENCES

POINTS	RECORD	MEASURED	Δ DELTA

This document serves as a brief summary of the horizontal and vertical control established for topographic mapping and boundary surveys. For information on CCSF control networks see Record of Survey #8083 in Book EE at Page 147-157 SFCR, "CCSF 2013 High Precision Network Survey Report" and the "CCSF 2013 Second Order Leveling Network Survey Report".

Short Form Survey Report 2017060 v1.1

Survey Adjustments and Reporting

Survey Reports

Long Form

The "Long Form" Survey Report is a more detailed version of the Short Report and includes a StarNet (preferred) minimally constrained adjustment and constrained adjustment listing (see "Guide-Traverse Adjustment-Analysis").

The Report must employ the CCSF-CS13 Projection with the correct projection parameters, show what survey control point(s) were held, and how the field traverse fit the positions and elevations on control points and benchmarks.

This information is essential for BSM to QA/QC the survey results and integrate into the BSM system.

Survey Adjustments and Reporting

Survey Reports

Long Form continued

The Survey Report will list all CCSF-CS13 Horizontal and CCSF-VD13 Vertical Control Points with their coordinate values and a map of the control network.

Please provide the adjustment without the numerous topo side shots.

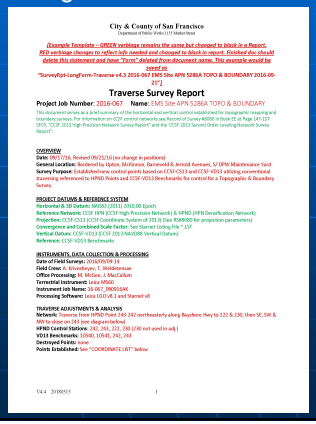
Retracement.

(see "Form-SurveyRpt-Long Form-Traverse").

Survey Adjustments and Reporting

Survey Reports

Long Form continued



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[Example Template – GREEN verbiage remains the same but changed to black in a Report. RED verbiage changes to reflect info needed and changed to black in report. Finished doc should delete this statement and have "Form" deleted from document name. This example would be named as

"SurveyRpt-Long form-Traverse v4.3 2016-007 EMS Site APN 5286A TOPO & BOUNDARY 2016-09-21"]

Traverse Survey Report

Project Job Number: 2016-007 **Name:** EMS Site APN 5286A TOPO & BOUNDARY

This document serves as a brief summary of the horizontal and vertical control established for topographic mapping and boundary surveys. For information on CCSF control network see Record of Survey #8300 in Book 21 at Page 147-157 SFOL "CCSF 2013 High Precision Network Survey Report" and the "CCSF 2013 Second Order Leveling Network Survey Report".

OVERVIEW

Date: 09/7/16, Revised 09/21/16 (no change in positions)

General Location: Bordered by Upton, McKinnon, Barnwell & Jerrold Avenues, U DPW Maintenance Yard

Survey Purpose: Established new control points based on CCSF-CS13 and CCSF-VD13 utilizing conventional traversing referenced to HPND Points and CCSF-VD13 Benchmarks for control for a Topographic & Boundary Survey.

PROJECT DATUMS & REFERENCE SYSTEM

Horizontal & 3D Datum: NAD83 (2011) 2010.00 Epoch

Reference Network: CCSF HPN (CCSF High Precision Network) & HPND (HPN Densification Network)

Projection: CCSF-CS13 (CCSF Coordinate System of 2013) (See RWK000 for projection parameters)

Convergence and Combined Scale Factor: See Starnet Listing File ".LIS"

Vertical Datum: CCSF-VD13 (CCSF 2013 NAVD88 Vertical Datum)

Reference: CCSF-VD13 Benchmarks

INSTRUMENTS, DATA COLLECTION & PROCESSING

Date of Field Survey: 2016/09/09-14

Field Crew: A. Krivokapic, T. Maldonado-Lee

Office Processing: M. McGee, J. MacCallum

Terrestrial Instrument: Leica MS50

Instrument Job Name: 16-007_09092016

Processing Software: Leica GO v8.1 and Starnet v6

TRAVERSE ADJUSTMENTS & ANALYSIS

Network: Traverse from HPND Point 243-242 northeasterly along Bayshore Hwy to 222 & 230, then SE, SW & NW to close on 243 (see diagram below)

HPND Control Stations: 242, 243, 222, 230 (230 not used in adj.)

VD13 Benchmarks: 10540, 10541, 242, 243

Destroyed Points: none

Points Established: See "COORDINATE LIST" below

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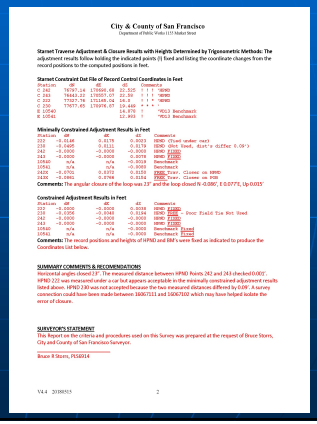
Survey Adjustments and Reporting

Survey Reports

Long Form continued



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Starnet Traverse Adjustment & Closure Results with Heights Determined by Trigonometric Methods: The adjustment results follow building the indicated points (!) fixed and listing the coordinate changes from the record positions to the computed positions in feet.

Starnet Constraint Out File of Record Control Coordinates in Feet

```
Station    Northing     Easting      Height   Comments
C 242     76536.14   171866.48   22.320  ! ! ! *NGVD
C 243     76442.22   171857.07   22.32   ! ! ! *NGVD
C 222     75457.94   171148.07   22.32   ! ! ! *NGVD
C 230     75675.80   171878.07   18.440  * * * *NGVD
B 10540                          16.070  !     *VD13 Benchmark
B 10541                          12.893  !     *VD13 Benchmark
```

Minimally Constrained Adjustment Results in Feet

```
Station   dN        dE        dZ        Comments
230     -0.0146    0.0175    -0.0021   HPND (Tied weaker rmk)
222     -0.0405    0.0111    -0.0179   HPND (Not fixed, diff' > diffcr 0.08')
242     -0.0008    -0.0008   -0.0002   HPND FIXED
243     -0.0008    -0.0008   -0.0002   HPND FIXED
10540     n/a       n/a      -0.0018   Benchmark
10541     n/a       n/a      -0.0083   Benchmark
2420    -0.0701    0.0371    0.0159    PNDL Over: Closed on HPND
2430    -0.0361    0.0760    0.0154    PNDL Over: Closed on HPD
```

Comments: The angular closure of the loop was 23" and the loop closed N 0.008', E 0.0771', Up 0.015'

Constrained Adjustment Results in Feet

```
Station   dN        dE        dZ        Comments
222     -0.0000    -0.0000   0.0018    HPND FIXED
2420    -0.0000    -0.0000   -0.0000   PNDL Over: Prev Field Tie Not Used
242     -0.0000    -0.0000   -0.0000   HPND FIXED
243     -0.0000    -0.0000   -0.0000   HPND FIXED
10540     n/a       n/a      -0.0000   Benchmark Fixed
10541     n/a       n/a      -0.0000   Benchmark Fixed
```

Comments: The record positions and heights of HPND and BM's were fixed as indicated to produce the Coordinates List below.

SUMMARY COMMENTS & RECOMMENDATIONS

Horizontal angles closed 23". The measured distance between HPND Points 242 and 243 checked 0.003'. HPND 222 was measured under a car but appears acceptable in the minimally constrained adjustment results listed above. HPND 230 was not accepted because the two measured distances differed by 0.09'. A survey connection could have been made between 16007111 and 16007102 which may have helped isolate the error of closure.

SURVEYOR'S STATEMENT

This Report on the criteria and procedures used on this Survey was prepared at the request of Bruce Storrs, City and County of San Francisco Surveyor.

Bruce R Storrs, PLS8014

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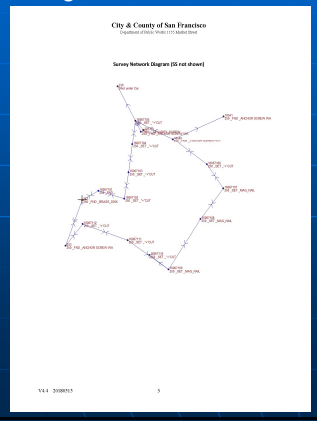
Survey Adjustments and Reporting

Survey Reports

Long Form continued



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Survey Network Diagram [SS not shown]

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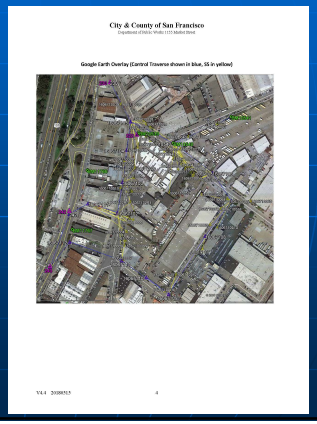
Survey Adjustments and Reporting

Survey Reports

Long Form continued



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Google Earth Overlay [Control Traverse shown in blue, SS in yellow]

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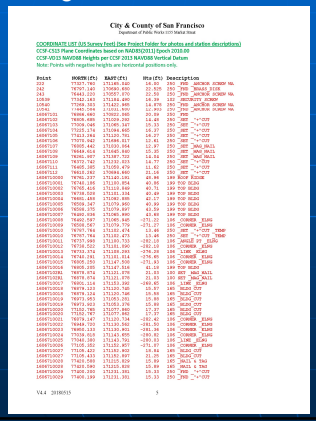
Survey Adjustments and Reporting

Survey Reports

Long Form continued



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COORDINATE LIST (US Survey Feet) [See Project Folder for photos and station descriptions]

CCSF-CS13 Plane Coordinates based on NAD83(2011) Epoch 2010.00

CCSF-VD13 NAVD88 Heights per CCSF 2013 NAVD88 Vertical Datum

Note: Points with negative heights are horizontal positions only.

```
Point     NORTH (FT)  EAST (FT)   Hts (FT)  Description
202       77357.783   171185.820   16.30   250  PVD  ANCHOR SCREW NA
203       77357.783   171185.820   16.30   250  PVD  ANCHOR SCREW NA
242       76442.220   170857.070   22.32   250  PVD  ANCHOR SCREW NA
10538     77312.140   171184.490   16.39   180  MEMORY SCREW
10539     77357.783   171185.820   16.30   250  PVD  ANCHOR SCREW NA
10541     77442.220   170857.070   12.893  250  PVD  ANCHOR SCREW NA
16007101  76906.480   170222.260   20.59   250  PVD
16007102  76906.480   171009.260   16.48   250  SET  "+"/OUT
16007103  77008.040   171085.147   15.13   250  SET  "+"/OUT
16007104  77109.600   171160.034   13.78   250  SET  "+"/OUT
16007105  77213.243   171233.761   14.27   250  SET  "+"/OUT
16007106  77076.042   171484.017   12.41   250  SET  "+"/OUT
16007107  76938.841   171734.273   10.55   250  SET  "+"/OUT
16007108  76848.816   171620.840   10.20   250  SET  WAS NAIL
16007109  76906.487   171387.722   14.54   250  SET  WAS NAIL
16007110  76973.742   171232.815   14.77   250  SET  "+"/TOP
16007111  76985.185   171050.479   11.62   250  SET  "+"/OUT
16007112  76985.185   170867.142   11.62   250  SET  "+"/OUT
16007200  76761.237   171140.241   49.48   149  ROOF EDGE
16007201  76741.180   171130.854   49.86   199  TOP BLDG
16007202  76721.123   171121.467   49.86   199  TOP BLDG
16007203  76718.026   171121.224   49.86   199  TOP BLDG
16007204  76801.489   171042.886   42.17   199  TOP BLDG
16007205  76926.247   171079.860   40.39   199  TOP BLDG
16007206  76926.370   171079.897   40.39   199  TOP BLDG
16007207  76926.493   171079.934   40.39   199  TOP BLDG
16007208  76482.047   171085.645   -171.22 195  CORNER  ELEV1
16007209  76508.567   171079.779   -171.27 195  CORNER  ELEV1
16007210  76534.086   171073.913   -171.32 195  CORNER  ELEV1  TEMP
16007310  76797.784   171132.473   15.48   250  SET  "+"/OUT  TEMP
16007311  76737.989   171130.733   -282.10 195  ANGLE PT  ELEV
16007312  76738.512   171131.990   -282.10 195  CORNER  ELEV
16007313  76732.372   171138.241   -276.29 195  LINE  ELEV
16007314  76726.232   171144.491   -270.48 195  CORNER  ELEV
16007315  76726.154   171147.506   -271.93 195  CORNER  ELEV
16007316  76726.193   171147.516   41.19   199  TOP BLDG
16007317  76726.232   171147.526   41.19   199  TOP BLDG
16007318  76779.074   171151.878   31.93   195  SET  WAS NAIL
16007319  76791.114   171151.592   -260.85 195  LINE  ELEV
16007320  76791.123   171150.546   15.57   145  BLDG OUT
16007321  76791.114   171129.546   15.89   145  BLDG OUT
16007322  76791.123   171108.546   15.89   145  BLDG OUT
16007323  76791.114   171063.276   15.89   145  BLDG OUT
16007324  77192.783   171057.840   17.27   145  BLDG OUT
16007325  77192.783   171057.840   15.89   145  BLDG OUT
16007326  77192.783   171130.734   -282.42 195  CORNER  ELEV1
16007327  76946.720   171132.592   -281.50 195  CORNER  ELEV1
16007328  76946.116   171131.801   -281.34 195  CORNER  ELEV1
16007329  77338.910   171141.450   -280.93 195  CORNER  ELEV1
16007330  77338.910   171141.450   15.89   145  BLDG OUT
16007331  77128.222   171132.807   -271.37 195  CORNER  ELEV1
16007332  77128.222   171132.810   18.84   145  BLDG OUT
16007333  77128.222   171132.810   15.89   145  BLDG OUT
16007334  77128.088   171132.829   15.89   145  BALL & TAG
16007335  77128.088   171132.829   15.89   145  BALL & TAG
16007336  77128.193   171131.391   15.33   250  PKD  "+"/OUT
16007337  77128.193   171131.391   15.33   250  PKD  "+"/OUT
```

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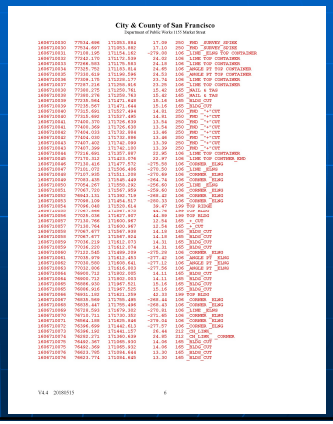
Survey Adjustments and Reporting

Survey Reports

Long Form continued



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```
16007338  77534.496   171051.884   17.39   250  PKD  SURVEY NOTHE
16007339  77534.496   171051.884   15.33   250  PKD  "+"/OUT
16007340  77128.145   171126.145   -278.30 195  LINE  ELEV1 TOP CONTAINER
16007341  77128.145   171172.539   24.02   195  LINE TOP CONTAINER
16007342  77128.003   171170.343   24.18   195  LINE TOP CONTAINER
16007343  77128.752   171163.814   24.85   195  ANGLE PT TOP CONTAINER
16007344  77128.752   171163.814   24.85   195  ANGLE PT TOP CONTAINER
16007345  77128.175   171216.177   23.74   195  LINE TOP CONTAINER
16007346  77128.175   171250.616   23.35   195  LINE TOP CONTAINER
16007347  77128.175   171285.055   23.35   195  LINE
16007348  77128.175   171285.276   15.82   145  BALL & TAG
16007349  77128.564   171471.464   18.16   145  BLDG OUT
16007350  77128.567   171471.464   15.16   145  BLDG OUT
16007351  77128.564   171537.464   14.81   250  PKD  "+"/OUT
16007352  77128.564   171603.464   14.81   250  PKD  "+"/OUT
16007353  77128.564   171626.439   13.54   250  PKD  "+"/OUT
16007354  77128.564   171705.639   13.54   250  PKD  "+"/OUT
16007355  77128.564   171771.639   13.54   250  PKD  "+"/OUT
16007356  77128.564   171837.639   13.48   250  PKD  "+"/OUT
16007357  77128.564   171903.639   13.39   250  PKD  "+"/OUT
16007358  77128.564   171929.160   13.39   250  PKD  "+"/OUT
16007359  77128.564   171957.697   12.95   106  LINE TOP CONTAINER
16007360  77128.564   171957.697   12.95   106  LINE TOP CONTAINER  END
16007361  77128.416   171477.572   -275.50 106  CORNER  ELEV1
16007362  77128.072   171536.496   -270.30 106  LINE  ELEV1
16007363  77128.072   171536.496   -270.30 106  CORNER  ELEV1
16007364  77128.072   171585.429   -266.74 106  CORNER  ELEV1
16007365  77128.067   171550.292   -264.60 106  LINE  ELEV1
16007366  77128.067   171567.720   -259.80 106  CORNER  ELEV1
16007367  77128.067   171392.719   -248.22 106  CORNER  ELEV1
16007368  77128.067   171392.719   -248.22 106  LINE  ELEV1
16007369  77128.067   171535.416   28.47   180  TOP ELEV1
16007370  77128.067   171671.406   44.79   180  TOP ELEV1
16007371  77128.067   171671.406   44.79   180  TOP ELEV1
16007372  77128.067   171535.067   12.54   145  _ CUT
16007373  77128.067   171535.067   12.54   145  _ CUT
16007374  77128.067   171467.938   14.16   145  BLDG OUT
16007375  77128.067   171467.938   14.16   145  BLDG OUT
16007376  77128.067   171467.938   14.16   145  BLDG OUT
16007377  77128.067   171412.574   14.31   145  BLDG OUT
16007378  77128.067   171459.239   -275.29 106  CORNER  ELEV1
16007379  77128.067   171459.239   -275.29 106  CORNER  ELEV1
16007380  77128.067   171535.641   -277.12 106  ANGLE PT  ELEV1
16007381  77128.067   171512.006   -277.56 106  ANGLE PT  ELEV1
16007382  77128.067   171512.006   -277.56 106  ANGLE PT  ELEV1
16007383  77128.067   171512.006   14.11   145  BLDG OUT
16007384  77128.067   171512.006   14.11   145  BLDG OUT
16007385  77128.067   171512.006   14.11   145  BLDG OUT
16007386  77128.067   171467.525   15.16   145  BLDG OUT
16007387  77128.067   171467.525   15.16   145  BLDG OUT
16007388  77128.067   171402.259   42.33   199  TOP BLDG
16007389  77128.067   171402.259   42.33   199  TOP BLDG
16007390  77128.067   171402.259   42.33   199  TOP BLDG
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16007392  77128.067   171402.259   42.33   199  TOP BLDG
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16007399  77128.067   171402.259   42.33   199  TOP BLDG
16007400  77128.067   171402.259   42.33   199  TOP BLDG
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16007402  77128.067   171402.259   42.33   199  TOP BLDG
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16007409  77128.067   171402.259   42.33   199  TOP BLDG
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16007529  77128.067   171402.259   42.33   199  TOP BLDG
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