

SURVEY REPORT

2004

**GEODETIC CONTROL DENSIFICATION
AND RESTORATION**

of

JEFFERSON COUNTY, KENTUCKY

JUNE 2004

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SURVEYOR'S REPORT

Opening Statement:

This report provides an explanation of the methods used in the execution of this restoration and densification survey of the existing GPS network established by the Louisville/Jefferson County Information Consortium. Several other documents and exhibits are provided within this report which further elaborate the survey computations and procedures.

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Introduction:

Within the last few years the Louisville/Jefferson County Information Consortium (LOJIC) has put together an accurate GPS network throughout Jefferson County, Kentucky and portions of the surrounding counties. LOJIC has employed Fuller, Mossbarger, Scott & May (FMSM) to provide monument restoration in areas where monuments have been reported missing, and densification of the current GPS network.

Scope:

Curt Bynum, LOJIC GIS Coordinator and Project Administrator, requested the Contractor, FMSM, to provide densification of the current Geodetic Control Network. This project required Jacobi, Toombs, and Lanz Inc. (JTL), the Subcontractor, to coordinate with LOJIC and define areas where restoration and densification were needed and set monuments where GPS observations could be taken.

Reference Datums:

All restored monuments were to be on the following datums:

Horizontal datum: North American Datum of 83 (NAD 83) tied to the NGS's High Accuracy Reference Network (HARN)

Vertical Datum: North American Vertical Datum of 1988 (NAVD88)

New Monument Installation:

All monuments were constructed with a 3½ standard survey disk set in a poured-in-place 10" diameter concrete cylinder to a depth of 40". These monuments were installed intervisable with the remaining station or azimuth mark.

Subcontractor's Responsibility:

The Subcontractor's responsibility was to compile reports of missing or disturbed monuments and then field verify whether these reports were accurate. In cases where the monument was no longer useable, a new monument was placed in the vicinity of the original monument and referenced with new control monument description sheets and digital photographs.

The Subcontractor's responsibility also included compiling information and determining areas where monument densification was needed. Factors in determining these areas were:

1. Evaluating where the existing monument spread was greatest (reducing the two-mile grid to a one-mile grid).
2. Population growth and development.
3. MSD capital improvement projects.

JTL was instructed to utilize any suitable existing MSD control monuments when available and to install new monuments. Digital photographs as well as new reference ties were completed for future recovery and update of the control sheets. All of the monuments were incorporated into the existing GPS network using proper GPS field procedures and reducing by Least Squares to compile coordinate values.

Project Areas:

Areas of Restoration

- Area No. 1: LOJIC monument GPS 86-29 located at the corner of Brownsboro Road and Schuler Road was reported damaged.
- Area No. 2: LOJIC monument AZI 050-2003 located at Dixie Highway and Shipley Lane was reported damaged.

Areas of Densification

- Area No. 1: This area is located on Third Street Road between Outer Loop Road and Manslick Road.
- Area No. 2: This area is located on Cooper Chapel Road between Pagoda Drive and Smyrna Road.
- Area No. 3: This area is located on Blankenbaker Parkway just south of Interstate 64.
- Area No. 4: This areas is located on Thurman Road just north of Echo Trail.
- Area No. 5: This area is located on Shelbyville Road just east of the Gene Snyder Freeway.
- Area No. 6: This area is located along Gene Snyder Freeway between Billtown Road and Old Heady Road overpass.

Reconnaissance Report:

Restoration

Upon field reconnaissance, the following was observed:

- Area No. 1: The monument was recovered but was missing the aluminum cap. A new monument was set.
- Area No. 2: The monument was destroyed due to recent construction of a sanitary sewer line. A new monument was set.

Densification

Once field reconnaissance was complete, new monuments were set at all six areas for the densification.

GPS Equipment and Procedures:

Three Trimble 5700 GPS receivers and one Trimble 4800 GPS receivers were used throughout the static network. Each session was a minimum of 20 minutes. At the end of each day the receivers were checked in and data entry logs were collected. Mission planning was utilized so GPS observations were taken at times when the Position Dilution of Precision (PDOP) was four or below. Once all of the sessions were complete, loop closures were calculated and evaluated.

Network design:

Once the new monuments were in place, existing LOJIC monuments were selected as project control. The control was selected in a configuration to optimize the stability of the GPS network both horizontally and vertically. Sufficient redundancy was incorporated in this network for quality control.

Evaluation/Comparison of Coordinate Values:

In any survey adjustment, a decision must be made on which monuments should be held or constrained. For this particular adjustment, Louisville South Base, Goshen Rm1, GPS 86-15 and Bowman Reset were constrained horizontally. Louisville South Base, Goshen Rm1, STA 028-2001, and STA 011-2001 were constrained vertically. Table 1 shows the differences between the published coordinates and the measurements produced by this network.

**TABLE 1
COMPARISON OF COORDINATE VALUES**

NAME	△ HORIZONTAL (FEET)	△ VERTICAL (FEET)	CONSTRAINED	
			HORIZONTAL	VERTICAL
Louisville S.B.			✓	✓
Goshen RM 1			✓	✓
STA 028-2001			✓	✓
GPS 86-15		0.155	✓	
Bowman Reset		0.158	✓	
STA 011-2001	0.006			✓
STA 037-2001	0.050	0.025		
STA 050-2003	0.029	0.011		
CA 20-01	0.023	0.143		
AZI 8629-2001	0.057	0.037		
AZI 031-2001	0.044	0.036		

As a result of the constrained network, all of the non-constrained points were within 0.01 to 0.06 feet of their published coordinates horizontally and were within 0.01 to 0.16 feet of their published coordinates vertically.

[In comparison to past observations and results, the vertical value produced from this network differs from the value published for Bowman Reset. The first restoration and densification project conducted by this company found the elevation for Bowman Reset to check with the published values. The previous values were the result of Louisville South Base and Goshen RM1 being constrained for elevation. When two additional monuments were added to the network for vertical control (STA 028-2001 and STA 011-2001), Bowman Reset was 0.16 feet different from published values. Additional evaluations were conducted and found no reasons why the results were not consistent with past observations. Additional GPS observations were taken and added to the network for further verification. The additional data produced the same results for Bowman Reset, being 0.16 feet different than the published values.]

The Network Adjustment Report can be found in Appendix B which includes adjustment style settings, statistical summaries, Geoid model statistics, weighting strategies, and adjusted coordinates with corresponding statistical data.