

SURVEY REPORT
2003
GEODETIC CONTROL RESTORATION
of
JEFFERSON COUNTY, KENTUCKY
JUNE, 2003

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SURVEYOR'S REPORT FOR RESTORATION

Opening Statement:

This report provides an explanation of the methods used in the execution of this restoration 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 two 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. Due to normal daily activities and construction within the county, monuments have inevitably been disturbed or destroyed. Therefore, LOJIC has employed Fuller, Mossbarger, Scott & May (FMSM) to provide monument restoration in areas where monuments have been reported missing.

Scope:

Curt Bynum, LOJIC GIS Coordinator and Project Administrator, requested the Contractor, FMSM, to provide restoration of the current Geodetic Control Network. This project required Jacobi, Toombs, and Lanz Inc. (JTL), the Subcontractor, to define areas where restoration was needed and restore local control.

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 intervisible with the remaining station or azimuth mark. An exception to the intervisible pairs was the restoration of GPS 86-43 Reset, where a readily identifiable physical feature was used as an 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. Once the monument was constructed, it was incorporated into the existing GPS network using proper GPS field procedures and then reduced by Least Squares to compile coordinate values.

Project Areas:

Four areas of missing/damaged monuments were submitted to JTL:

- Area No. 1: LOJIC monument GPS 86-43 located in downtown Louisville at West Jefferson and Sixth Street was reported damaged.
- Area No. 2: LOJIC monument AN 40-01 located off Westport Road at the corner Murphy Lane and Tazwell Drive was reported missing.
- Area No. 3: LOJIC monument GPS 86-37 located off Bardstown Road and Bartley Road was reported damaged.
- Area No. 4: LOJIC monuments STA 024-2001 and AZI 024-2001 located at U.S. Highway 42 and the Gene Snyder Freeway were both reported to be missing.

Reconnaissance Report:

Upon field reconnaissance the following were observed:

- Area No. 1: Monument recovered but missing the aluminum cap. A new monument was set.
- Area No. 2: Monument was destroyed due to recent construction of a sidewalk. A new monument was set.
- Area No. 3: Monument was recovered but missing the aluminum cap. A new monument was set.
- Area No. 4: Both monuments were recovered in good condition but most of the reference points as shown on the recovery sheet had been removed due to recent construction of the Gene Snyder Freeway. New reference ties were measured for an update of control sheets.

GPS Equipment and Procedures:

Three Trimble 5700 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.

Loop Closures:

Once all of the GPS observations were completed and downloaded, the observation data was then processed to create baselines (vectors). Evaluations were made concerning the strength of each baseline considering reference variances and ratios (Trimble software flags all potential weak baselines), and only the baselines with low reference variance and high ratios were accepted. Once the baseline evaluation was complete, vectors were then connected together forming closed loops. Drawings showing the loop configurations and closures are shown in Appendix A.

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 and GPS 86-34 were constrained horizontally and Goshen Rm1 and BU 07-01 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.		0.02	✓	
Goshen RM 1	0.03			✓
GPS 86-34		0.04	✓	
STA 008-2001	0.01	0.07		
BU 07-01	0.03			✓

As a result of the constrained network, all of the non-constrained points were within 0.01 to 0.03 feet of their published coordinates horizontally and were within 0.02 to 0.07 feet of their published coordinates vertically.

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.

Conventional Survey Methods:

A suitable location for the azimuth mark (buddy point) for GPS 86-43 Reset could not be found due to the existing improvements in the downtown area. Therefore, a flagpole upon the clock tower of the old City Hall situated at the corner of Sixth Street and West Jefferson was used as an azimuth mark. Refer to the conventional survey computation section for angle observations and azimuth computations.