

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

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# **SURVEYOR'S REPORT FOR DENSIFICATION**

## **Opening Statement:**

This report provides an explanation of the methods used in the execution of this 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 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. LOJIC has employed Fuller, Mossbarger, Scott & May (FMSM) to provide monument 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 define areas where densification was needed to utilize existing monuments or set new monuments where needed.

## **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.

## **Subcontractor's Responsibility:**

The Subcontractor's responsibility was to compile information and determine 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 densification monuments were incorporated into the existing GPS network using proper GPS field procedures and reducing by Least Squares to compile coordinate values.

## **Project Areas:**

Nine areas of monument densification were chosen by JTL:

- Area No. 1: This area is in Prospect located off Highway 42 on Hunters Lane and Westover Lane.
- Area No. 2: This area is located on Shelbyville Road and Blankenbeker Parkway.
- Area No. 3: This area is located off Taylorsville Lake Road on Routt Road south of Old Heady Road.
- Area No. 4: This area is located along Dixie Highway three miles south of the Gene Snyder Freeway.
- Area No. 5: This area is located off Dixie Highway just north of the Gene Snyder Freeway on Bethany Lane.
- Area No. 6: This area is located off Terry Road at Sylvania Park.
- Area No. 7: This area is located off Terry Road and LaVel Lane.
- Area No. 8: This area is located on Brook Lane and First Street.
- Area No. 9: This area is located off Brownsboro Road by Bear Creek.

## **Reconnaissance Report:**

Upon field reconnaissance the following were observed:

- Area No. 1: Two new monuments were set at this location.
- Area No. 2: Two new monuments were set at this location.
- Area No. 3: Two new monuments were set at this location.
- Area No. 4: Two new monuments were set at this location.
- Area No. 5: Two new monuments were set at this location.
- Area No. 6: Two existing MSD monuments were used in this location.
- Area No. 7: Two existing MSD monuments were used in this location.
- Area No. 8: Two new monuments were set at this location.
- Area No. 9: One existing MSD monument was used and one new monument was set in this area.

## **GPS Equipment and Procedures:**

Three Trimble 5700 GPS receivers and two Trimble 4700 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, Edward 2, GPS 86-15 and GPS 86-24 were constrained horizontally. Louisville South Base and Goshen Rm1 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	Δ HORIZONTAL (FEET)	Δ VERTICAL (FEET)	CONSTRAINED	
			HORIZONTAL	VERTICAL
Louisville S.B.			✓	✓
Goshen RM 1			✓	✓
Edward 2		0.001	✓	
GPS 86-24		0.042	✓	
GPS 86-15		0.15	✓	
Bowman Reset	0.021	0.00		
GPS 86-43 Reset	0.001	0.026		
STA 011-2001	0.031	0.055		
AZI 005-2001	0.017	0.104		
AZI 031-2001	0.047	0.001		

As a result of the constrained network, all of the non-constrained points were within 0.01 to 0.05 feet of their published coordinates horizontally and were within 0.01 to 0.15 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.