

Harris County's Benchmark Network Evolves Into
Web-Based GIS Mapping Solution

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Idea Integration

Abstract

Harris County established a benchmark control network containing over 1,500 monuments for the updated Flood Insurance Study. This system was spatially designed in ArcGIS 8.x, and various layers of information were developed in association with this network to be used as support in the future. This information was delivered to the community via a user friendly, web-site with GIS mapping capabilities that allowed the user to search for a monument by street address, proximity, monument ID, coordinate location, map grid number, or even select by region. This innovation was built on an ArcIMS platform with custom JavaScript

ArcXML and ASP.Net code for the navigation and search utilities. Several other data layers including monument photos and sketches are also available for download. This site was designed to be easily maintained with a database that can be updated resulting in the auto-generation of revised HTML pages.

Introduction

As a part of the Tropical Storm Allison Recovery Project, DR-1379, Harris County, Texas, field surveys were taken in the Fall of 2001. These surveys were taken by FEMA Indefinite Delivery Indefinite Quantity (IDIQ) contractors at bridge locations and other structures. In an attempt to control this of this extensive surveying effort, only existing monuments were used. These control monuments were existing markers that had been leveled to the 2001 adjustment. As a part of the Federal Emergency Management Agency's (FEMA) requirements for Reference Marks (RM) some temporary benchmarks had to be established however their stability did not meet the needs of the National Flood Insurance Program. To assist the residents of Harris County, the HCFCD established a county-wide network of over 1,500 permanent floodplain reference marks to North American Vertical Datum, 2001 Adjustment. This new monumentation has the same datum as the new digital flood insurance rate maps and will assist the 35 communities in Harris County with the administration of floodplain ordinances. Over 900 new monuments were constructed for this network and careful consideration was taken when placing the marks to ensure long term stability.

Because subsidence varies continuously and differentially across the county, a control network can be used for periodic updates & stream cross-section geometries. All cross-section data must be relevelled over time and slab elevations need to be checked with a high degree of certainty in highly populated areas.

Data Standards

Most of the work effort was performed with dual frequency, full-wavelength Globe Positioning System (GPS) receivers. The vertical standard was the National Geodetic Survey (NGS) 2-centimeter standards as published in NOAA Technical Memorandum NOS NGS-58, November 1997. The horizontal standard was NGS Second Order Class I standard as published in the Federal Geodetic Control Committee (FGCC) entitled “Geometric Geodetic Accuracy Standards and Specifications for Using GPS Relative Positioning Techniques” dated August 1, 1989. Precise differential leveling was used to tie obstructed sites to the rest of the network and was performed to meet the maximum loop misclosure specifications for the NGS Second Order Class II monuments. Vertical standard for leveling is published in the FGCC document entitled “Standards and Specifications for Geodetic Control Networks” dated September 1984. Three continuously operating reference stations Reference Stations (CORS) were monitored by NGS and located at extensometer sites were used as the primary control for the project. These points include Addicks 1795 CORS ARP (ADKS),

PID AJ6426, Northeast 2250 CORS ARP (NETP), PID AJ6430 and Lake Houston CORS ARP (LKHU), PID AF9521. The secondary network for control was the stations surveyed in October 2000 by NGS and adjusted in 2001.

Data Hurdles

Distributing detailed information about all 1,518 of these Floodplain Reference Marks was a challenge but crucial to the effectiveness of the network. Therefore, a basic plan was formed at the conception of this project. All data submitted each week and over the following 18 months would be converted into a single seamless uniform product. Some of these products included the digital pictures taken by the field surveying teams of each monument and scanned in field sketches that provide monument location either on the structure or in the ground (see Fig 1). These two pieces of information, although very descriptive, had less value when compared to the data storage each item represented on the ArcIMS server. Therefore, it was determined that all digital information scanned or otherwise should be combined and converted to an Adobe® PDF format. Other items deemed important for conversion included the floodplain reference mark sheet that describes the type of monument, coordinate location, stamping, survey method, and floodplain RM number. These PDF's although small in size, conveyed the information in an easily downloadable and printable format that field survey crews all over Harris County use everyday.



HARRIS COUNTY FLOODPLAIN REFERENCE MARKS

Project Name:	Tropical Storm Allison Recovery Project	Floodplain RM No.:	200240
		Stream Number:	U105-00-00
Station Sketch:			
Photo 1-Station Detail:		Photo 2-Station Area Picture:	

Fig 1.- Monument Location Sheet

Data Servicing

Upon completion of the county-wide survey, mass amounts of data was stored digitally and needed to be accessed by both public and private entities throughout Harris County. Most of the data distribution ideas were centered around using the world wide web as a tool for data distribution, therefore, ArcIMS was considered the most viable option. Today, the solution takes advantage of ArcIMS custom ArcXML, and the ArcIMS HTML Viewer to facilitate information exchange

without the constant need for editing. Other solution features included an intuitive and appealing HTML interface with custom java script for advanced data retrieval and navigation. Many clients particularly liked the ability to select the monuments interactively on the screen or through a pre-defined search criterion. These search query options included selection by cross street, monument ID, FIRM Panel, and proximity analysis. Searching by street address (Fig 2) is another option, which was accomplished using the H-GAC's previously geocoded street centerline coverage. This dynamic compilation of querying is accomplished by accessing the Microsoft Access database thru ASP.NET and ADO.NET technology. These custom .NET applications then respond to the client needs with a dynamic HTML (DHTML) web page that is customized by query parameters set forth in the initial server request. Although this application of ArcIMS was significantly improved with other custom solutions, it gave more control to the user and was designed to be modular for future updates and applications.

References

Guidelines and Specifications for Flood Hazard Mapping Partners; Appendix L,\

NOAA Technical Memorandum NOS NGS-58, Nov, 97

Standards and Specifications for Geodetic Control Networks, Sept. 1984

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