Montgomery County, Maryland
Unique Building Address Processor Program
Creating an Address Points DB for Next Generation Geocoding
Program Category: Information Technology

1. Abstract

The Montgomery County (MC), Maryland Department of Technology Services - Geographic Information Systems (DTS-GIS) team, developed an ArcGIS based Unique Building Address Processor Program (UBAPP) to provide the Montgomery County Department of Fire and Rescue Computer Aided Dispatch staff with the most accurate geographic and attribute data information and to improve address matching for attaining information about building addresses and locations. The Unique Building Address Processor Program functionality includes geographical data display, and attribute information from DTS-GIS databases, including Montgomery County portion of the Maryland Motor Vehicle Administration (MVA) address records, centerlines, building footprints, and aerial photography. DTS-GIS staff uses this processor program to correct building addresses by referencing MVA records and in turn provides up-to-date geographic information and pin point accuracy for other county programs that use address matching/locations, such as and not limited to, MC 311, Board of Election Voter Registrants, MC Department of Finance MVA revenue, and MC Public School pupil registrants.

2. Need for the Program

The Montgomery County UBAPP was developed to improve unique building address accuracy that is utilized as reference data for ESRI address locators. Numerous MC staff use the ESRI address locators for point data location and mapping for the county addressing applications. This program enhances the ability of MC staff to rely and trust more comprehensively on the MC Building Address Repository (BAR) database that is a product of this processor. Prior to the development of the program, the ways in which to collect correct unique building addresses were variegated and not absolute in the exactness of the address. DTS-GIS staff created the program to reduce the complexity of correcting and gathering the unique building addresses and to provide a sophisticated, yet simple program, to allow DTS-GIS staff to quickly update and maintain current unique building addresses for Montgomery County. As a result, DTS-GIS staff can quickly find patterns in Montgomery County of incorrect unique building addresses based on the input of MVA address location points (derived from the MVA vehicle registrations) by a staff member.

3. Description of the Program

The UBAPP was designed and tested on the ESRI GIS software ArcGIS 10.1. After research and revisions, the UBAPP was available to supporting staff. The following sub-section describes the UBAPP and its innovative and effective design.

Unique Building Address Processor Program (UBAPP)

Step 1: Establish functional requirements

Upon many phone calls, emails and meetings to discuss DTS-GIS Staff's needs, functional requirements were established for the UBAPP in August of 2012. The application was to provide quick access to geographical data of the county and information for databases in Montgomery County's GIS including, MVA points, street centerlines, building footprints, aerial photography, and property polygon boundaries

(maintained by Maryland National Park and Planning, MNCPPC). GIS database attributes used include MVA address records, centerline address ranges and the property addresses repository (MAR) maintained by MNCPPC. The map layers needed for the project are listed in the ArcMap Table of Contents and can be turned on and off by a check mark, to display a variety of data to be referenced for accurate correction of unique building addresses.

The program is installed on one designated secure PC, in a Montgomery County DTS-GIS staff member office. The program can be invoked by opening a designated .mxd file in ArcGIS 10.1 and in doing so all related current data downloaded, on the hard drive is available for ease and speed of use. The vehicle registration address data provided by the Maryland MVA is to be downloaded yearly by a DTS-GIS staff member.

Step 2: Collect data, documents, and information

DTS-GIS is the clearing house for all the needed geographic and associated attribute data to operate the UBAPP. Geographic data is provided by DTS-GIS in, ArcGIS geodatabases, coverages and shapefiles. The data layers include, but are not limited to, centerlines, and building footprints. These data layers are updated and downloaded weekly and then go through quality control checks. The many data sources in the program are then updated. MVA address records utilized are a by-product of the Department of Finance revenue allocation project, consequently the data comes in on a yearly basis. These addresses were geocoded against the existing unique building addresses and a geographic point layer was created. When there was not a match to the buildings the addresses were then geocoded against the centerline address ranges and the resulting point layer was then used as an indicator to further investigate why MVA addresses matched on an address range and not on a unique building address. The UBAPP is then put to work in researching, discovering and correcting the unique building addresses, thereby increasing the level of accuracy in the unique building address geographic information.

Step 3: Unique Building Address Processor Program Reveals Errors

The processor in its inherent design, revealed the unique building address errors. Errors were highlighted in the Program as red points that were an indication of MVA addresses matched to centerline data (address ranges) and not to unique building addresses. Matching to unique building addresses were not attainable for the many reasons, building not built, cul-de-sac residence did not get MAR assigned correctly, residence assigned wrong MAR (needed Tax Assessment address assignment), residence on corner assigned wrong street name or premise address, new address assigned to building not applied to new or existing building, un-split buildings require split to obtain assigned address, erroneous MVA address (reversed numbers, misspellings), MVA address is non-existent building, original address for building was assigned by overlaying property polygons (if building intersected neighboring property polygon it may have been assigned an erroneous address). The errors in the unique building addresses were highlighted in this process so as to be researched, corrected and made into a more robust address base data layer.

Step 4: Unique Building Address Processor Program Review and Correction

UBAPP was employed to research an erroneous unique building address, by way of the many MC data layers available. Some of those layers included, MNCPPC Master Address Repository and property polygons, State Department of Assessment Taxation address, Department of Fire and Rescue .pdf images of the building layouts ("Preplans") and Department of Permitting Services and lastly MVA addresses. Tools, such as, ESRI's Spatial Adjustment was used to edit invalid addresses and bring them in line with the actual address. Splitting buildings to include a missing address, heads up digitizing new building footprints, based on ortho-photos (2012) or site plans were also applied. When the incorrect unique building address errors were highlighted in the Program as red points, corrected, they turned green as an

indication of complete. The UBAPP discovered, reviewed and corrected 21,399 buildings (out of a total of 330,000 buildings) as a part of composing a more powerful address data layer over a year's time and is a continuing effort presently to keep current with the changing landscape in Montgomery County. As of January, 2014, 751,862 (99.46%) of the November 2013 MVA addresses (755,908) can be successfully machine matched to the BAR database, whereas in January 2013, the match rate for the 2012 data was 99.44%.

Date	Building Address Points	Maryland MVA Vehicle Registration Addresses	Round 1 machine address matched	%
Nov. 2011	306,151	748,798	738,390	98.61%
Nov. 2012	322,795	754,641	750,447	99.44%
Nov. 2013	330,368	755,908	751,862	99.46%

Table 1. As the quality of the Building Address Points improves, the Round 1 Machine Address Match rates increase

Step 5: Install UBAPP
The UBAPP has been installed on one PC. The appropriate network drives have been connected to the PC so that live updates and downloads may take place directly from the DTS-GIS databases.

Step 6: Maintain application content
The associated geographic data from MC are downloaded by a DTS-GIS staff member on a monthly basis. The DTS-GIS MVA address data is reviewed and prepared for input into the UBAPP by a DTS-GIS staff member, every fiscal year. The application content including GIS shape files, DFRS preplans and MNCPPC data is maintained monthly by a DTS-GIS staff member. The system administration of the application is also provided by DTS-GIS.

4. Use of Technology

The application was initially created and tested on a Montgomery County Government DTS-GIS Precision T5500 with Microsoft Windows 7.0 running ESRI's ArcGIS 10.1.

5. The Cost of the Program

The total cost to develop the DTS-GIS UBAPP including staff time (programming and data maintenance) and software/hardware equipment is approximately $25,000. Approximately 30 hours of staff time were invested into the development of the application at a cost of $1,275. The *ArcGIS for Desktop* software cost approximately $9,000. Maintenance cost will vary according to staff salary.

In order for the application to be run, a Pentium 2 GHz or better Intel-based personal computer running Windows XP or Windows 7 with ESRI's ArcGIS 10.0. A standard county T1 connection (100MB or 1 GB) to the County network should satisfy the needs of staff.

6. The Results/Success of the Program

This processor grew out of a need to maintain unique building addresses for the Department of Fire and Rescue Computer Aided Dispatch, and to make the task of researching address data daily, simpler and

more controllable. Thus, the need for creation of the processor was evident. The UBAPP is used on a regular basis to research and correct unique building addresses and the consequences of having a more accurate building address data is evident in any MOCO address application in the accuracy of address locations.

The positive results of this application consist of a simple and uncomplicated way for DTS staff to correct unique building addresses. The processor will help reduce the demand on staff time in researching the data and producing accurate building addresses.

The complete and up-to-date building addresses will be even more critical with the new E911 CAD system that the County is in the procurement process. The new CAD's address verification will be based on the building addresses first. If this fails, address ranges of the centerline database will then be used.

7. Worthiness of an Award

The DTS-GIS staff with MVA addresses to enter data, make building addresses and address locators searching for geographic building information, process in seconds rather than hours. Consequently, it is anticipated that the implementation of this processor will replace the need to utilize hard copy sources to research data thereby, resulting in a significant savings in staff time and retrieving a larger amount of address data within the area of interest. The delivery of address data involving MVA/buildings empowers DTS-GIS staff to find the pertinent address data that fits their needs. As a result, DTS-GIS staff time, in this otherwise time consuming task, may be minimized.

Although, there are other agencies that maintain this kind of geographic information database, Montgomery County is one of the first few local governments to develop this kind of service using MOCO MVA addresses.

8. Supplemental Materials

The following three figures were included in the supplemental PDF document.

Figure 1: A location error based on a new building not recorded

Figure2: An error based on an incorrect street assignment to a building

Figure 3: The MVA addresses were geocoded against the existing unique building addresses and a geographic point layer was created.