LEVERAGING GIS DATA TO ENHANCE PUBLIC SAFETY

1.0 Abstract of the Program

The Montgomery County, Maryland Department of Technology Services - Geographic Information Systems (DTS-GIS) team, in cooperation with the Montgomery County Fire and Rescue Service (MCFRS), developed an ArcMap GIS based "Driveways" data set that assists in routing Police, and Fire and Rescue personnel and vehicles to public safety incidents in a timely manner. Data from the past was only useful in routing vehicles to the nearest street, but the nearest street was not always the fronting street, and thereby didn't always provide direct access to buildings. In response to this defect, driveways were created to assist navigating public safety vehicles to an incident's location, directly, saving time and possibly life.

2.0 The Problem or Need for The Program

The Montgomery County "Driveways" data set was developed to improve MCFRS staff efficiency and to provide more useful geographic information to the participants of a Public Safety incident using a Routing Network Application (RNA) on an Automatic Vehicle Location (AVL) terminal for dispatching and finding incidents. The GIS program is devised to represent geographic lines with attributes that enhance centerline data in an RNA. The purpose is to direct public safety vehicles to accurate incident locations. The creation of these lines, called "Driveways," help first responders find the quickest and most accessible route for a dispatched vehicle. The outcomes of this dataset will be uploaded into the public safety Computer Aided Dispatch (CAD) software to cut down on the time needed to make it to incidents quickly. MCFRS asked DTS-GIS to create the data to reduce the number of incorrect RNA occurrences.

3.0 Description of The Program

Extensive analysis was done to capture data points needed in order to produce a data set that includes all addresses whose nearest street was not the fronting street. ESRI's ArcGIS mapping software was used to create the points of interest and to display them for examination. Overlaying the points on aerial photography was used to display real time paved and unpaved access to these points of interest so that lines indicating driveways could be formed. Once these driveways were created, they were "snapped" to the building and centerline data sets to indicate the direction a public safety vehicle could take to access the incident. The driveway data set included attributes such as the building address and the centerline address ranges and street names. The driveway data set was then incorporated with public safety centerlines, used in the CAD proprietary RNA, to indicate the quickest directions to an incident.

In creating the Driveways data set, a discovery of the addresses that were routing to the nearest streets but not the fronting streets had to be determined. In order to come up with a data set of these addresses, lines needed to be produced from a building point to the nearest street centerline. These line attributes had to be populated with the values of nearest street name and

building street name. A comparison of these values was then executed and “near street not equal to building street” were the addresses that would need a driveway.

Production and Development Process

Step 1: Highlight buildings that are nearest to centerlines not of the building address

The public safety RNA directs vehicles using the nearest street name from the dataset centerlines, but the nearest street name may not be the building’s accessible street, or, the given street name in a building address. The nearest street name is determined by calculating the distance from the centroid of the building structure to the street. Some buildings are on a corner lot, so the RNA may choose the side street, but a hedge or fence may be blocking the accessibility of the structure (See Figure 1 of attached supplemental materials).

The need to highlight the difference between the nearest/side street, in this case, to the building’s street name is crucial in gaining access to the building. If the buildings proximity to a highway is not accessible to it and is closer than the street in front of the building (See Figure 2 of attached supplemental materials), this creates an error in the RNA, resulting in choosing the incorrect accessible street.

If the buildings are sandwiched between two streets (See Figure 3 of attached supplemental materials), the RNA may choose the wrong street, a block off, to access the building associated with the incident.

In all these cases, a comparison function was used to highlight building street names with the nearest street names and were then incorporated into a data set to be reviewed. See the following illustrations in the supplemental materials to demonstrate a building that has an address street name not equal to the nearest centerline.

Step 2: Determine necessity of a driveway to assist RNA

When a comparison table of highlighted buildings whose street address does not match the nearest centerline was created, the need for an assist line to force the RNA to the accessible street could then be reviewed and determined if a driveway is a necessity to access the building. In some cases, the nearest street being chosen by the RNA is an accessible street option to reach the building. A second data set was created using the selection set of the differing near and fronting street names. That data set consisted of 35,580 records. Each one of these records were looked at manually to decide if the associated building required a driveway in assisting the CAD proprietary RNA. Using aerial photography, visualizing paved and unpaved physical driveways, and paths and sidewalks of buildings, were the most common method of constructing a needed driveway line. Some buildings that are surrounded by centerlines on all four sides of the building do not need an assist because it can be accessed by any of the 4 nearest streets. Some buildings have dual entrances, such as commercial centers have multiple entrances into the parking lot, so the nearest centerline may not be the building address street name, but the nearest

centerline can be used as an accessible route to the building (See Figure 4 of attached supplemental materials).

Corner lots can also be ruled out for an assisting driveway if the driveway is circular and covers both fronting streets (See Figure 5 of attached supplemental materials).

Buildings that have existing driveways off the nearest centerline that are more than 300 feet needed to be added to the routing centerlines to direct safety vehicles to the entrance of the building, including such places as campsites with cabins in the woods (See Figure 6 of attached supplemental materials).

These factors are all determinations of the need to include driveways to assist centerlines in directing safety vehicles to the entrances of structures. Driveways were then drawn in from the centerline that represents the building address street name, following the aerial photography physical location of the driveway or a path (dirt or concrete) to the building structure garage entrance or front door.

Step 3: Priority list to organize the 35,580 records into 4 tiers of action
A list of building polygons whose nearest street names were exit ramps and State and County highways were the first tier of data to be analyzed. Second tier were building polygons that were located farther than 300 feet from the accessible centerline (roadway). Third tier were building polygons that had 2 sided entrances from the roadway, i.e.: buildings on a corner lot that have circular driveways were discounted from the list of potential driveway candidates. Fourth tier building polygons were flag lots, a real estate term that describes a land parcel that lies at the end of a long driveway (See Figure 7 of attached supplemental materials).

A driveway may be drawn if the nearest street is in the side yard of the building and is blocked by a fence or tree line, in which case the driveway is drawn from the sidewalk up to the front of the house. Sometimes the nearest streets may not be the building address but are the most accurate way to reach the entrance of the building, so a driveway is not created.

Step 4: Develop data for use in RNA
The existing centerline data was merged with driveways determined for assisting the RNA. Many considerations were looked at to develop the data for use in the RNA. Necessary driveways were included in the centerline data to be used for RNA; the data was then quality checked. Physical connections were needed between centerlines and new driveways. Driveway data included attributes that were required by the RNA that exist in the centerline data to validate the accuracy of the RNA. Once these items were completed, the driveway data set was ready to be uploaded for use by the RNA.

5.0 The Cost of the Program

Using ArcGIS software to highlight, determine and create was a process that took 6 months by one DTS-GIS staff member continually working 5 business days and 8 hours every day. Quality

Control of the data sets, Driveways and the centerlines that incorporate them took another 6 months to make sure when the final data was run using the RNA, it ran smoothly and without error. Implementing the data set in the RNA took a week by the coordinators of RNA, who are heavily MCFRS staff. The total estimated investment of DTS-GIS and MCFRS staff time on this project was $50,000 - $75,000 in “soft costs” associated with staff time only. No additional hardware or software was purchased for this project.

6.0 The Results/Success of the Program

This data set grew out of a need to update and maintain the centerline data layer in order to provide the Public Safety RNA a driveways data layer that assists vehicles in routing to the correct street name in accordance with the building street name. Thus, the need for auditing the data set was evident. The performance of the driveways data set will be evaluated by using an ArcMap to add and edit driveways in the quarterly geo loads. The positive results of this data set consist of a simple and uncomplicated way for DTS-GIS staff to maintain, update and edit the important geographic information surrounding a building that is in need of public safety vehicle routing to an emergency incident. The data set will help reduce the demand on staff time in responding to the inquiries of MCFRS staff when the RNA does not respond to a route that is inaccessible to a building.

7.0 Worthiness of Award

DTS-GIS provides MCFRS staff with an additional data set to incorporate into the RNA resulting in information produced by the RNA more accurately. Consequently, it is anticipated that the implementation of this data set will replace the need to manually look up the erroneous results of the RNA, resulting in a significant savings in staff time. As well, the RNA will process a route more quickly by retrieving a greater amount of geographically accurate routes for public safety vehicles. The delivery of geographic data surrounding an emergency incident empowers MCFRS staff to find the pertinent geographic data that fits their needs. As a result, MCFRS staff time, in this otherwise time-consuming task, may be minimized.

Although, there are other jurisdictions that maintain this kind of a geographic information database, Montgomery County is one of the first few local governments to develop this kind of data set implementation for its public safety agencies. The driveways data set serves as a model for other jurisdictions who provide geographic data and information to their public safety planners.

8.0 Supplemental Materials (Attached)