Route Mapper / Places of Interest Guide
Montgomery County, Maryland
Program Category #14: Information Technology

1.0 Abstract

The Montgomery County, Maryland Department of Technology Services-Geographic Information Systems (DTS-GIS) team developed the Montgomery County Route Mapper (RMAP) and the Places of Interest (PLOI) Guide to enable web visitors or customers to locate a street address, to find a Place of Interest within Montgomery County, MD, and to generate maps with travel directions, time estimates, and distances. The RMAP and PLOI Guide also enable visitors to find the nearest PLOI by address or to search for a PLOI by title, by place name, or by category. The search results returned to the customer provide contact information, including the name, address, city, zip code, phone, and web site, for over 1,820 places of interest located within Montgomery County, MD. In addition, the PLOI search results provide links to RMAP applications so that customers can display a location map or generate a map with travel directions, time estimates, and distances. Customers need only a web browser (Internet Explorer 6+ or Netscape 6+) to access the RMAP or the PLOI Guide that is hosted on the County's Geographic Information Server (http://gis.montgomerycountymd.gov/content/gis/ploi.asp).

2.0 Need for the Program

The RMAP and PLOI Guide were developed in response to a request from eMontgomery, now called the Department of Technology Services Application Development Team, to provide customers (County residents and staff) with an easy to use web application to locate Montgomery County places of interest and to generate travel maps, directions, distances, and time estimates. It was anticipated that the web applications would improve customer service by providing around the clock access to accurate geo-spatial data, information, and interactive mapping service technology, while reducing the demand on staff time and resources spent on processing related information, routing, or mapping requests. Customers would no longer need to contact DTS-GIS staff to provide PLOI-related data or to perform general routing or mapping tasks. Instead, they need only use their web browser to quickly search or browse the PLOI Guide for location address and contact information or to open RMAP to generate maps and travel directions, distances, and time estimates.

3.0 Description of the Program

Application Requirements

eMontgomery provided DTS-GIS with application requirements during the Summer of 2000 to develop a web application(s) to enable their customers to locate Montgomery County Places of Interest and to generate travel maps, directions, distances, and time estimates within an average of 5 seconds using either Netscape or Internet Explorer web browser and a standard 56 kilobyte per second (kbps) modem connection 361 days (99%) a year. The application(s) were to enable customers to search for a place of interest by title or name, by place name or city, by category, and by the nearest street address. The search results returned were to include the name, address, city, zip code, phone (if available), and web site (if available) for each place of interest. In addition, the results were to provide hyperlinks to RMAP so that customers could display, zoom, and pan an interactive location map or print a map with travel directions, time estimates, and distances. The application designs were also to be in concert with the current County web site theme.

System Requirements

The RMAP and PLOI Guide were to be deployed on the County GIS web/map servers. Initially, the applications were to be tested and published on a Dell PowerEdge 1300 server running Windows 2000 Application Server and Internet Information Server 5 with RouteMap Internet Map Server (IMS) 1.2. A dedicated Dell PowerEdge 2400 server running Microsoft's 2000 Web Server and Internet Information Server 5.0 as well as Environmental Systems Research Institute's (ESRI) RouteMap IMS 2.5 and ArcIMS 4.0.1 software was to be used for future testing purposes. Eventually, the applications were to be moved to a Dell PowerEdge 6450 server with four 700 megahertz Xeon central processing units (CPU's), 4 gigabytes of random

access memory (RAM), and 72 gigabytes (gb) of hard disk space running Microsoft's 2000 Web Server and Internet Information Server 5.0 as well as RouteMap IMS 2.5 and ArcIMS 4.0.1. In addition, the data were to be developed on Dell personal computers, such as a Dell OptiPlex GX400 with a 1.8 gigahertz processor, half a gb of RAM, and 30 gb hard-drive running the Windows 2000 or XP Professional operating system with ESRI's ArcView 3.3 and ArcGIS 8.3 software. The GIS Enterprise database server, a Sun Enterprise Server running ArcSDE 8.3 and Oracle 9, was to provide base map data layers for validating the places of interest.

Data Requirements

The County PLOI database and RouteMap IMS proprietary datasets were to be used to satisfy the application's data requirements. A Microsoft Access 2000 database was to be used to store the PLOI data table containing address and contact information in addition to latitude and longitude coordinates stored as decimal degrees. DTS-GIS staff members were to be responsible for updating the database attributes in addition to maintaining the geo-spatial accuracy at 1 inch equal to 200 feet or 1:2400 scale of each place of interest on an annual basis. All data used in the application were to be projected in a Cylindrical Projection (decimal degree units) to eliminate the curvature of the longitudinal lines, so that the map, when zoomed in, will appear like a flat two-dimensional map.

Data Development and Maintenance

In order to develop and maintain the PLOI database and satisfy the RMAP and PLOI Guide data requirements, DTS-GIS staff have used the most recent high resolution (one square foot per pixel) digital aerial ortho-photos together with the County's 1:2400 scale property and building footprint data (stored in ArcSDE 8.3/Oracle 9) to validate place of interest locations and attributes using ESRI's ArcView 3.3 and ArcGIS 8.3 software. In addition, other ancillary data sources such as the Maryland-National Capital Park and Planning Commission's Points of Interest file and the Internet have been used to locate a particular place of interest in some cases. A team of two staff members reviews each other's work to ensure data quality thereby avoiding record duplication and data-entry errors. As a result, the PLOI database is complete and accurate.

The current PLOI database contains over 1,820 records and is classified into 29 categories (See Figure 1). Each record in the database contains place of interest's name, category, address, city, zip code, phone number (if available), and web site (if available) address as well as its latitude and longitude coordinates stored as decimal degrees. DTS-GIS staff members have been maintaining the database attributes and the geo-spatial accuracy (1:2400) of each place of interest on an annual basis since 2000.

Figure 1 - Montgomery County Places of Interest (29 Categories)

In order to satisfy ESRI's RouteMap IMS data requirements, each place of interest category was exported into one of the 29 dBase V files and loaded into RouteMap IMS by geographic (latitude/longitude) coordinates. In addition, ESRI and Geographic Data Technology (GDT) Version 4.1 proprietary data sets including streets, major roads, railroads, city limits, lakes/major rivers, and counties were also loaded to provide geo-coding or

address-matching services and base map references. Since these data are updated annually through a third party (ESRI and GDT), some street addresses, especially new addresses, may not be mapped. Currently, RouteMap IMS does not support customized non-proprietary street center-line address data. All data used in the application are projected in a Cylindrical Projection (decimal degree units) to satisfy the data requirements.

Application Design, Development, and Deployment

In August/September of 2000, RMAP and PLOI Guide were designed and developed in concert with the County's eMontgomery Web Portal on a dedicated eMontgomery web/map server. However, in the winter of 2003, the applications were re-designed in accordance with the most recent Montgomery County Portal web design standards to provide continuity and design flexibility, to avoid duplication of effort, to improve content management, to address accessibility issues, and to improve overall performance. The applications were published on the new County GIS web/map server in April 2003. By implementing the County web design standards, RMAP and PLOI Guide customers experience a consistent look and feel throughout their visit. In addition, since a few style sheets, include files, scripts, and dynamic templates are used to control, present, and print content, design changes (i.e. graphic updates, link updates, font changes, etc.) can be implemented quickly. Moreover, pre-defined content templates facilitate web content maintenance and integrate well with County Portal master templates. Pre-defined templates, style sheets, include files, and scripts greatly reduce time spent on individual web design and programming efforts.

The design enables customers to easily navigate to other County Portal web content or applications by clicking a link in the header or the left navigation bar or by using the global buttons (Residents, Government, Business, Culture & Leisure) available on every page above the GIS web content and applications. In addition, the footer of each web page provides links to the County Portal privacy policy, user rights, accessibility, and disclaimer. Moreover, since each web page is dynamically generated, a Text Version link is provided in the upper left corner of every web page to satisfy American Disability Act Section 508 requirements. A customer can toggle from the Template Version to the Text Version to view content. However, the Text Version toggle is not yet implemented for the RMAP applications.

The RMAP and PLOI Guide are very simple to use. The customer is provided with several search options to find a place of interest by address, by title, by place name, or by category and to generate maps, travel directions, or time estimates using RMAP. Descriptive blurbs or information are provided on each web page within the application to help guide customers through the interface. In addition, a help button is provided in the RMAP application to describe the graphic user interface. The appearance of the data rendered in either Netscape 6+ or Internet Explorer 6+ browsers are very clean and satisfies the County Portal web design requirements.

<u>Find a Place of Interest By Address and Get Directions</u>

For example, a customer can search for all the elementary schools within 3 miles of a specific Montgomery County address (Figure 2). The search results depict a list of elementary schools with contact information (their associated web site) within 3 miles of the specified address (Figure 3).

Figure 2: Find Nearest Place of Interest by Address

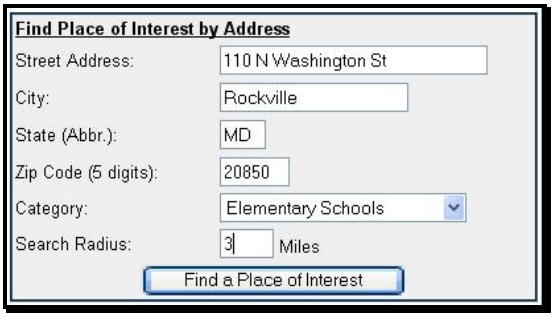
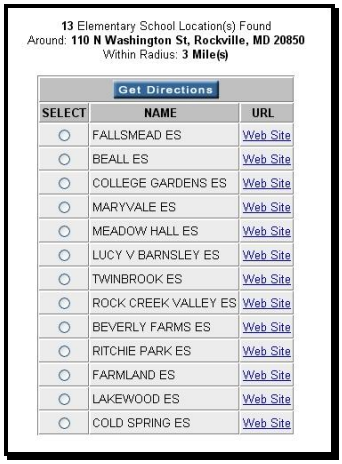


Figure 3: Find Nearest Place of Interest by Address Results



To generate travel directions and maps the customer can select the radio button adjacent to the place of interest and click the Directions button. Travel directions and time estimates will then be listed to enable customers to find a place of interest from the specified address. An overview map or a turn by turn map with directions can also be generated (Figure 4). A customer can simply use their browser to print the directions and maps.

Figure 4: PLOI Guide: Overview Map with Travel Directions and Time Estimates

Depart 110 N Washington St, Rockville, MD 20850

#	Driving Directions
1	**Go South on N Washington St** Drive 0.3 mile(s) ~ < 1 minute
2	**Turn right on State Hwy 189 (Maryland Ave)** Drive 1.0 mile(s) ~ 1 minute(s)
3	**Turn right on Fallsmead Way** Drive 0.1 mile(s) ~ < 1 minute
4	**Turn right on Watts Branch Pky** Drive 0.6 mile(s) ~ 1 minute(s)
5	**Make sharp left on No name** Drive 0.2 mile(s) ~ < 1 minute
6	**Turn right on Currier Ct** Drive < 0.1 mile(s) ~ < 1 minute
7	**Turn left on Gerard St** Drive 0.1 mile(s) ~ < 1 minute

Arrive FALLSMEAD ES
Driving distance: 2.4 mile(s) Driving time: 4 minute(s)

Find a Place of Interest by Name, by Category, or by Place Name

If a customer does not have an address, then he or she could use the Guide to search for a place of interest by name, by category, or by place name individually or in combination. After locating the place of interest, the customer could then generate travel directions and/or location maps. For instance, a customer can use this tool to locate all the Apartments in the Rockville area that contain the letters "Roc" in its title or name (Figure 5).

Figure 5: Search Place of Interest by name, by category, or by place name

The results, which satisfy the search criteria, are returned along with the category and place name. Each record returned in the results includes the place of interest's full name, street address, city, zip code, and phone number. In addition, hyperlinks to place of interest web sites are provided (if available) in addition to links for generating interactive location maps and travel maps (See Figure 6).

Figure 6: Places of Interest Guide Search by Name, Category, and Place Results

APARTMENT: ROCKVILLE

4 records have been found. Go back and search again.

Name	Address	City	Zip	Phone	URL	Map	Directions
ROCK CREEK TERRACE (GARDEN)	12510 VEIRS MILL RD	ROCKVILLE	20853	301-946-0393	Web Site	Get Map	Get Directions
ROCK CREEK TERRACE (HIGHRISE)	12630 VEIRS MILL RD	ROCKVILLE	20853	301-946-0393	Web Site	Get Map	Get Directions
ROCK CREEK WOODS APTS.	13205 TWINBROOK PARKWAY	ROCKVILLE	20851	301-881-1565	Web Site	Get Map	Get Directions
ROCKLIN PARK APARTMENTS	702 LENMORE AVE	ROCKVILLE	20850	301-294-9448	Web Site	Get Map	Get Directions

If the customer would like more information about a particular place of interest, then the web site link can be selected to "drill down" access more information about a selected place of interest. If a map of the area surrounding the place of interest is required, then the customer can click the Get Map link to create an interactive RMAP location map (See Figure 7). The RMAP interactive map application enables customers to pan, zoom in, zoom out, create a printable map, open the map legend, and get travel directions. In addition, on-line help is provided to assist customers with using the RMAP application.

Figure 7: Places of Interest Guide/Route Mapper Interactive Location Map

If the customer would like to generate a travel map with directions to the selected place of interest, then he or she could select the Get Directions link in the places of interest search results depicted in Figure 6 or select the Directions button in the RMAP interactive location map application. The RMAP-Get Travel Directions web page then enables customers to enter their starting address anywhere in the continental United States. Once the starting address (only address and zip code are required) has been entered, the customer can select their highway preference (more or less highway driving) and click the Get Travel Direction button since the destination address fields are automatically populated with the place of interest address (See Figure 8). As a result, a table with a list of travel directions, distances and time estimates will be generated (See Figure 9). The customer can print the text directions or opt to display the travel directions with an overview map or a turn by turn segment map by clicking the appropriate radio button next the option and selecting the Get Map button.

Figure 8: Get Travel Directions Form

Figure 9: Get Travel Directions Results (Text Version)

4.0 Use of Technology

RMAP and PLOI Guide data and applications were created using GIS, web design, and database software on both Windows and Unix operating systems installed on Dell personal computers or Sun Servers (Table 1). The applications were designed using Microsoft Frontpage 2000, RouteMap IMS, and programmed using Active Server Page (ASP) technology (both VBscript and Javascript), cascading style sheets, server-side include files, and Hypertext Markup Language (HTML). The databases were maintained or managed using ArcView 3.3, ArcGIS 8.3 and managed using Microsoft Access 2000 and RouteMap IMS 2.5 software. In addition, Structured Query Language (SQL) technology was used to access geo-spatial databases (Access and Oracle) through Open Database Connectivity (ODBC) over the County T3 network.

Table 1: Software/Hardware used to develop Route Mapper – Places of Interest

Software	Function	Operating System	Hardware
Adobe Illustrator 10	Prepare map legend for PLOI Guide categories	Windows 2000 Professional	Dell Precision 330
Adobe Photoshop 6	Prepare map legend for PLOI Guide categories	Windows 2000 Professional	Dell Precision 330
ArcGIS 8.3	Maintain PLOI datasets	Windows XP Professional	Dell OptiPlex GX 400
ArcSDE 8.3 / Oracle 9	Serve PLOI – validation base map data layers	Unix	Sun Enterprise Server
ArcView GIS 3.3	Maintain PLOI datasets	Windows 2000 Professional	Dell OptiPlex GX 400
Microsoft Access 2000	Store PLOI database for web access	Windows 2000 Server	Dell PowerEdge 6450 Server
Microsoft Frontpage 2002	Create RMAP and PLOI applications in ASP	Windows 2000 Professional	Dell PowerEdge 2400 Server
RouteMap IMS Versions 1.2 - 2.5	Create/manage map service and web application	Windows 2000 Server	Dell PowerEdge 6450 Server

For a customer to use RMAP or PLOI Guide, a 500 MHz or better personal computer running Windows 98, Windows 2000, Windows XP, or Windows NT 4 with a Netscape Navigator 6+ or Internet Explorer 5+ web browser is recommended. A 56 kbps and/or cable modem with a connection to the Internet through an Internet Service Provider (ISP), either through a phone line of cable line, should satisfy most customer needs.

5.0 The Cost of the Program

The total cost to develop RMAP and PLOI applications including staff time (data maintenance, web programming and server maintenance) and software/hardware equipment was approximately $75,000. Approximately 1,400 hours of staff time were invested into the preparation of the data, the development of the application, and the system administration at a cost of $50,000. The personal computers used to create and maintain the data and the web servers used to test and publish the application cost a total of $7,500, while the

graphic, the web publishing, and the GIS software cost approximately $15,000. The total cost for the digital aerial ortho-photos, approximately $110,000, was not applied to the total project cost due to the fact that they were purchased to support all County-wide base mapping projects. Future costs for application revisions, data maintenance, and server upgrades will be dependent upon advances in technology.

6.0 The Results/Success of the Program

RMAP and PLOI Guide application performance is measured using a web server reporting software package, called WebTrends, to monitor and calculate the number of customer web visits by day, month, and year. A RMAP or PLOI Guide customer is counted each time they visit the applications, however they are only counted once per visit no matter how many pages they view. If the customer's browser remains idle for more than 15 minutes, then the visit is terminated. If the same customer visits the applications again, a new visit is calculated. Since going on-line in August/September of 2000, it is estimated that RMAP and PLOI Guide have received an estimated 103,200 visits, an average of 2,580 visits per month. During the last reporting month (December 2003), the applications received over 3,200 visits.

In addition to calculating the number of visits, Web Trends enables DTS-GIS staff to resolve the customer's domain or Internet Protocol (IP) address and to identify the date and the time that the client/server transaction occurred. Thus, the frequency and duration of web server transactions can be monitored over time. Likewise, the RouteMap IMS server manager component is also used to measure the responsiveness of the map server to customer requests. Currently, the map server takes less than 5 seconds to process and respond to a customer request for travel maps and directions. Consequently, the web server (IIS) and map server (RouteMap IMS) can be updated or tuned to accommodate RMAP and PLOI requests if necessary. To date, current RMAP and PLOI Guide request loads have not overburdened the web server or the map server software.

Major RMAP and PLOI application customers include the general public and Montgomery County residents in addition to Montgomery County Public Schools, Department of Recreation, Department of Housing and Community Affairs, Department of Liquor Control, Community Use of Public Facilities, Department of Economic Development, and the County Council. As a result, the RMAP and PLOI Guide applications have reduced the demand on DTS-GIS staff time and computing resources and have empowered the customer to find a Montgomery County place of interest or generate travel maps, directions, and time estimates around the clock year round. So far, there have been no customer complaints. In fact, DTS-GIS management estimates that the RMAP and PLOI Guide applications save the County approximately $100,000 in staff time annually. This amount equals roughly the annual operating budget of the DTS-GIS team. In an era of continuing local government cost cutting, this savings represents a significant step toward service improvement and cost reduction.

7.0 Worthiness of an Award

RMAP and PLOI applications provides customers with a means to find a street address or a place of interest within Montgomery County and to generate maps with travel directions, time estimates, and distances in seconds any time of day throughout the year using a web browser. By implementing the County Portal web design standards, customers enjoy consistent, stable, reliable, and fast access to web content, applications, and data, while web application development staff avoid web design duplications, improve content management, and address accessibility issues. Thus, the RMAP and PLOI applications save the customer time and energy, while minimizing DTS-GIS web application development and location-based service work loads.

The RMAP and PLOI Guide applications serve as models for other jurisdictions who are interested in providing location and routing services for their customers or residents.