

# Montgomery County, Maryland Streetlight Maintenance Reporting Map Service

Program Category #14: Information Technology

## 1.0 Abstract

The Montgomery County, Maryland Department of Information Systems and Telecommunications - Geographic Information Systems (DIST-GIS) team, in partnership with the Department of Public Works and Transportation (DPWT), created an internet map service to enable the public (customers) to accurately locate and report malfunctioning streetlights maintained by Montgomery County Government. Customers can use the web map service to locate malfunctioning County-maintained streetlights by address, by street intersection, or by geographic area. Once a malfunctioning light is located, the customer can then select a streetlight, represented as a point on the web map, and submit a brief streetlight outage report to the DPWT Streetlight Outage Customer Service database, so that the streetlight can be processed using a web-based Administration Tool. Consequently, the map service improves customer service efficiency by providing customers with an accurate and a convenient means to report streetlight outages any time of day using web browsers, such as Microsoft's Internet Explorer 5+, Netscape's Navigator 4.7, or Opera 5.12. The map service can be accessed by visiting DPWT's Traffic Control, Lighting and Engineering (TCLE) web site <http://tcle.dpwt.com/StreetLighting.html> or the Montgomery County Government Geographic Information Systems (GIS) Map Server (<http://gis.co.mo.md.us/ims/lights>).

## 2.0 Need for the Program

The Streetlight Maintenance Reporting map service was developed to enable citizens to report streetlight outages accurately and to improve DPWT-TCLE customer service efficiency. Prior to July 2000, all streetlight malfunctions were reported via telephone and customers frequently did not provide exact streetlight pole locations. This required extensive staff time to research and to locate the poles on paper maps, which typically yielded inaccurate results. In July 2000, the [www.dpwt.com/tcle](http://www.dpwt.com/tcle) web site became operational and enabled customers to report streetlight outages via email, which required less time and improved positional accuracy. However, this process still required staff to research and to verify streetlight locations on paper maps - a very time consuming process when multiplied over an average of ten to fifteen reported streetlight malfunctions per day.

As a result, DIST-GIS developed a web-based streetlight reporting map service application to improve customer service efficiency by significantly streamlining the outage reporting process and by improving the positional accuracy of the outage submittal in order to reduce staff time and costs spent on map research. Consequently, a web-based application was developed to enable customers to locate a streetlight by address, by street intersection, or by geographic extents, to select a streetlight (represented as a point on a map), and to submit contact and descriptive information regarding the malfunctioning streetlight to a database. In addition, DPWT-TCLE required DIST-GIS staff to develop a secure customer service Intranet application to enable certain staff members to process customer service requests.

### **3.0 Description of the Program**

The Streetlight Maintenance Reporting map service application was developed on the DIST-GIS test web server connected to the Montgomery County Government Intranet. The Intranet, or internal web network, provided a good proving ground for DIST-GIS programmers and enabled DPWT-TCLE staff to review the content and the design of the application using a web browser. Revisions and comments for the application were provided to DIST-GIS during status meetings and via email attachments. After the map service application was approved by DPWT-TCLE, it was published to the County Internet Map Server for public access. The following procedures were used to create and maintain the map service application.

#### **Streetlight Maintenance Reporting Application**

##### **A. Determine the functional requirements of the map service**

In late June 2001, DPWT-TCLE provided DIST-GIS with functional requirements for the development of a web-based map service application that would enable customers to accurately locate and report malfunctioning streetlights maintained by Montgomery County Government. The application was to be completed by early September 2001. DPWT-TCLE staff members were to provide the streetlight GIS databases and web content for input into the map service application, while DIST-GIS staff were to process and quality assure the streetlight data in addition to collecting additional ancillary GIS data for use in the application. Once processed and quality assured, the data were to be input into an ArcIMS 3.0 Intranet map service, so that the web-based application could be developed and tested.

Once approved by DPWT-TCLE, the map service and web-based application were to be published on the County ArcIMS Internet high-performance web and map servers, maintained by DIST-GIS. The web and map server configuration was required to support simultaneous "hits" from web browsers such as Netscape 4.7, Microsoft Internet Explorer 5+, and Opera 5.12, and enable customers access the application in less than 15 seconds using a standard 56k modem 361 days (99%) a year. The streetlight GIS data, maintained by DPWT-TCLE, and the ancillary GIS data were to be updated and input to the map server on a quarterly basis.

A link to the map service application was to be established on the DPWT-TCLE web site (<http://tcle.dpwt.com/StreetLighting.html>) and the eMontgomery Portal (<http://www.emontgomery.org>). Future revisions to the map service and application would be coordinated on an as-needed basis.

##### **B. Collect and Process Data**

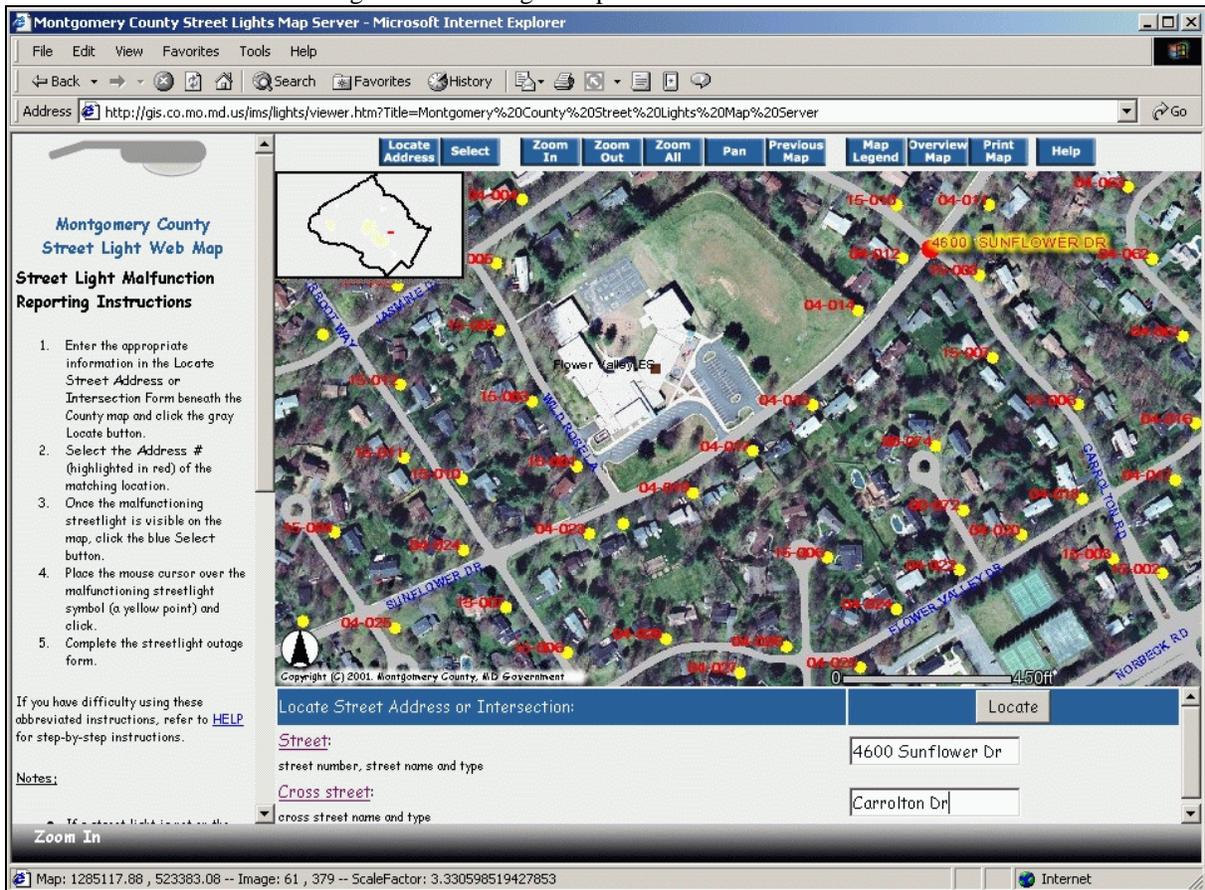
Several streetlight GIS databases, containing over 25,000 streetlights, were provided by DPWT-TCLE for the map server. These databases were quality assured, updated, and merged into one GIS streetlight file by DIST-GIS staff to enable dynamic web mapping access and to improve future streetlight data management and maintenance processes. In addition to the streetlight data, high-resolution one-foot digital color ortho-photos, street centerline, and roadway surface data were collected from the County GIS database. These data sets were used in the application to assist customers to locate and to select malfunctioning streetlights.

### C. Create the Map Service and Develop the Prototype Application

An ArcIMS 3.0 map service was created by DIST-GIS to serve the streetlight and ancillary GIS data on the ArcIMS Intranet GIS map server (AIMS), a Dell Poweredge 2400 with Microsoft Windows NT 4.0 Server, 20 gigabytes (gb) of storage space, and 512 megabytes (mb) of RAM. The prototype Streetlight Maintenance Reporting application and Administration Tools were developed by DIST-GIS using Hyper-text Markup Language (HTML), Javascript, and Microsoft's Active Server Page (ASP) technology. The ArcIMS Designer tool was used to generate an ArcIMS HTML Viewer web site, which automatically created HTML and Javascript necessary to generate the web maps. The HTML code and Javascript programs were then modified using Microsoft Frontpage 2000 to satisfy the functional mapping requirements of the application. The ASP programs were created and linked to the modified ArcIMS HTML Viewer to enable customers to submit streetlight outage and contact information dynamically to a Microsoft Access Customer Service database using Microsoft OLE DB 4.0 Data Connector object. Once submitted, the Streetlight Administration Tool, also developed with ASP, is used to display and download the data stored in the Customer Service database to a DPWT central database.

Using the Streetlight Maintenance Reporting application, a customer can enter the closest street address or intersection into a form, select the best address match (there may be more than one address) and locate a malfunctioning streetlight on the map (Figure 1)

Figure 1 – Streetlight Map Server Address Selection



In order to report a malfunctioning streetlight, the customer need only select the correct streetlight (yellow dot) from the map image to open the Streetlight Outage Form (Figure 2).

Figure 2 – Streetlight Outage Form

**Street Light Outage Form**

You have selected **Montgomery County Pole# 04-014** located on **SUNFLOWER DRIVE**. If this information is correct, then please take a few minutes to complete the form below. You need only to enter zip code, light malfunction, and comment. When you have completed the required fields, indicated by an asterisk (\*), then click the **Submit Form** button. If you would like to clear the form then select the **Clear Form** button.

**Please note:** Information recorded in this form may be subject to disclosure. You are not under any obligation to fill in your name, phone, or e-mail address.

**Contact Information**

First Name:

Last Name:

\*Zip Code:

Phone Number:  -  -  Ext:

E-mail Address:

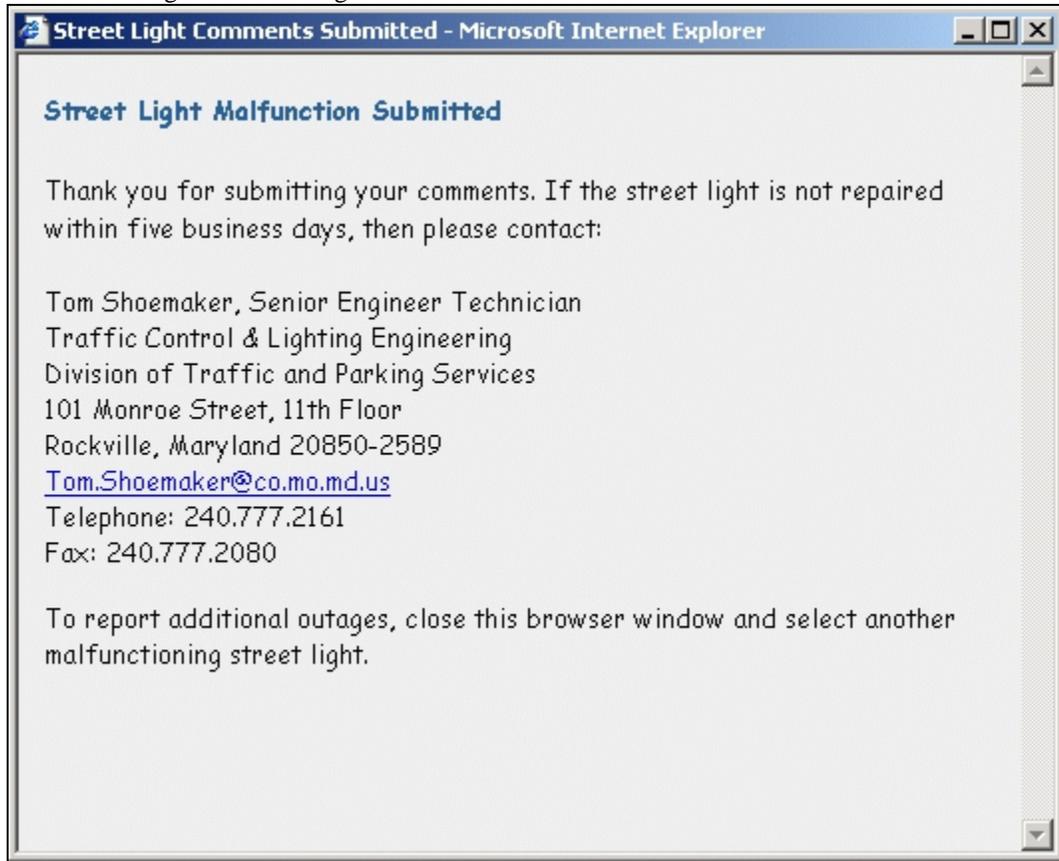
**Street Light Information**

\*Malfunction: (Pick One)

\*Comments: (Provide a brief description of the malfunction and additional location information)

Once submitted, the requests for service are stored in the DPWT-TCLE Streetlight Outage database on the County GIS web server and the customer is informed that their request will be processed within five business days (Figure 3). If the customer is reporting a light that has been reported within the last five days, the application will inform the customer that the light has been recently submitted. Contact information is also provided should the customer have any questions. And, if a customer is unable to locate a streetlight using the map application, he or she can use another web form to submit the malfunctioning streetlight to the DPWT-TCLE database.

Figure 3 – Streetlight Malfunction Submittal Results and Contact Window



After the streetlight outage request for service has been successfully submitted, designated DPWT-TCLE staff members then use the password protected Administration Tool to generate a service request report by date and download Service requests to their central database (Figure 4). The development of the Administration Tool prolonged the release of the Intranet application approximately one month.

Figure 4 – Administration Tool Report Results

**Report Results**  
You have selected 5 records

Call Number	Control ID	Street Name	Pole Number	Complaint	Contact Name	Contact Phone	Comments
020204001	4467	GREGERSCROFT ROAD	11-015	Outage	Jakubiak,Susan	3013408917	light has been out for a day or more. adjacent light on autumnwood is also not functioning.
020204002	4481	AUTUMNWOOD WAY	09-002	Outage	Jakubiak,Susan	3013408917	light has been out for a day or more; the light is at the end of the driveway at 9905 Autumnwood Way.
020204003		Dinwiddie Drive & Old Gate Place	11-004	Outage	Unknown,Unknown	5555555555	No light
020204004		Meadow Farm Rd.	Unknown	Outage	Kale,Joseph	3019470079	There are 3 lights on our street that are not operating properly as follows: - The very last light on the street does not work at all and the globe has separated from the pole, creating a safety hazard - The next two lights in succession cycle on/off
020204005	11577	SUNFLOWER DRIVE	04-014	Dim	Daniel,Chris	5555555555	THIS IS A TEST DO NOT PROCESS THANK YOU

[Parse and Download Caller Information](#)  
[Parse and Download Conditions](#)

**D. Review, revise, and approve the Application for Public Access**

In mid-September, the map service application was reviewed by DPWT-TCLE staff and revised by DIST-GIS. Once the revisions were made, the application was approved for public access and published to the County GIS Web Server and Map Server.

**E. Application Maintenance**

DPWT-TCLE staff are responsible for maintaining the streetlight GIS database and delivering updates to DIST-GIS in an ArcView shape file format on a quarterly basis. In addition, DIST-GIS staff provides quarterly updates for all other GIS data used in the map service. Also, DIST-GIS provides the application programming support and the system administration of the web server and map server.

**4.0 Use of Technology**

ESRI's ArcIMS 3.0 Internet map server technology is used to administer and generate web maps used in the Streetlight Maintenance Reporting map service application. Microsoft FrontPage 2000 was used as the web development software to program HTML, Javascript, and ASP programs. HTML and Javascript code were used to modify the ArcIMS HTML Viewer, while ASP scripts, were used to create the Streetlight Outage Submittal forms and result pages as well as the Administration Tool. Microsoft OLE DB technology was used to dynamically connect web browser ASP scripts with the Microsoft Access database. Digital ortho-photos were incorporated into the map server using MrSID image compression

technology. Rollover images were developed by using Adobe Illustrator 9 and Adobe Photoshop 6.0 software.

The web site was initially published to the Montgomery County Government GIS Intranet Web Server and Map Server, a Microsoft Windows NT 4.0 Server with a 20 gb hard drive and 512 mb of RAM running Microsoft's Internet Information Server 4.0. Once approved for public access, the map service and applications were published on the web server, a Dell 2400 Windows NT 4.0 Server with a 20 gb hard drive and 512 Mb's of RAM, while the data were stored on the map server, a Dell Windows NT 4.0 Server with 4 CPU's, four 18 gb hard drives, and 4 GB's of RAM. The ArcIMS application server, located on the web server, administers 4 ArcIMS spatial servers on the map server in order to satisfy the application's performance requirements.

## **5.0 The Cost of the Program**

The total cost to develop the Streetlight Reporting Maintenance application and Administration Tool is estimated at \$11,000. An estimated 400 hours of staff time were invested into the development of the applications. It is anticipated that additional equipment costs and staff time for web administration, software upgrades, and application maintenance will change over time with advances in web mapping technology. Web updates and server maintenance costs, not factored into the total cost of web site development, are estimated to be \$2,000 annually. Also, the hardware and software used to generate the web site already existed and were not factored into the cost estimate.

In order for a customer to access the map service application, a Pentium 400 MHz or better Intel-based personal computer running Windows 95, Windows 98, Windows 2000, or Windows NT 4 with a Netscape 4.7, Internet Explorer 5+, or Opera 5.12 web browser is recommended. A standard 56K modem connection or better to the Internet should satisfy most customer needs. Although a computer may cost the customer approximately \$800.00, the web browser software is free. The customer can also purchase a printer that costs approximately \$150.00 to print information and generate maps from the application.

## **6.0 The Results/Success of the Program**

The performance of the web site is quantified by monitoring customer feedback as well as analyzing web server reporting and map server statistics. So far, the application has received over 1,000 visits in its first three full months of service, an average of 333 visitors per month. Of those visitors, 316 have reported a streetlight outage in Montgomery County, Maryland, an average of about 105 per month. Furthermore, over the last three months, the ArcIMS map server has generated approximately 40,000 maps, an average speed of about 2.4 seconds per map. At this rate, if the public continues to use the map service application and the DPWT-TCLE staff uses the Administration Tool effectively, it is conservatively estimated that DPWT will save over \$11,500.00 per year in staff time alone by minimizing research, processing, and data entry. Web server reports are tabulated, analyzed, and presented during regularly scheduled meetings, so that future development will accommodate anticipated customer requests.

## **7.0 Worthiness of an Award**

The Streetlight map service application and Administration Tool enables DPWT-TCLE staff to improve customer support efficiency, to practice better data management and maintenance procedures, and to reduce staff costs. Eventually, it is anticipated that Montgomery County municipalities, such as the City of Rockville, who also maintain streetlights will coordinate and share resources and data in the development of future applications, so that County residents or customers can use the Internet to report outages in their county, city, or town.