

A Fast Track Implementation of City Works in Allegheny County, Pennsylvania

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ABSTRACT

This paper presents a county-wide GIS-centric Computerized Asset Management System (CMMS) implementation case study. The Allegheny County Department of Public Works (DPW) has replaced their existing work order and asset management system due to the lack of developer support for their previous CMMS software. The new system utilizes Azteca System's Cityworks CMMS software package in conjunction with Environmental System Research Institute's (ESRI) latest ArcGIS platform to provide a GIS-centric and enterprise geodatabase-connected Management Information System. The overall goals of this project include establishing a replacement maintenance management system that addresses the following components: Service Request Module, Work Order Management Module, Asset Management Module, and a Pavement Management Module. The central focus of the new system is the maintenance of the following five assets: roads, roadside assets, bridges, parks, and buildings. The initial implementation was completed in record time frame--six months--with the efforts of Motorola and ATS Chester Engineers. The implementation is broken down into three phases and will aid in Allegheny County's pursuit of the American Public Works Association (APWA) accreditation. ATS-Chester Engineers located in Moon Township, Pennsylvania (15 miles from Pittsburgh) is the prime contractor for this project. Motorola and Collective Efforts are the sub-contractors.

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INTRODUCTION

As shown in Figure 1, Allegheny County is located in southwestern Pennsylvania. It's 2000 census population is 1.3 million and area is 745 square miles (water 2%). The county was founded on January 22, 1800. It's the home of three championship professional sports teams

including Pittsburgh Steelers, Pittsburgh Pirates, and Pittsburgh Penguins. Allegheny County is also the home to eight Fortune 500 firms: Heinz, USX, USAirways, PPG Industries, General Nutrition Centers, PNC Corporation, Mellon Bank, and Alcoa. The elevation in the county varies from 700 to 1,400 above mean sea level. There are three major rivers (Ohio, Allegheny, and Monongahela) and over 2000 bridges in the county.



Figure 1. Study Area Location Map

DPW comprises of the Administrative; Engineering and Construction; Facilities and Fleet; and Road, Bridge and Park Maintenance Divisions. The success of the department as a whole is a direct result of partnerships among the Divisions, the unselfish desire to contribute, and the diverse talent and qualifications of respective staff.

DPW's mission statement: We are committed to providing the residents and visitors of Allegheny County with world-class infrastructure, maintenance and engineering services delivered in a timely and cost effective manner. We are dedicated to our vision and core values.

DPW initiated a detailed program to improve public works operations and management. A Department-wide self-evaluation of over 400 policies and practices is being performed in an effort to gain better insight into how services are provided, create a comprehensive program for positive change, orient and train supervisors and become a better managed public agency. When completed, the Department will be eligible to apply to APWA for agency accreditation. Only 20 Public Works agencies in North America have met the stringent APWA requirements and received accreditation.

It has been well established today that a GIS-based CMMS is more efficient (Shamsi, 2002; Shamsi 2005). To accomplish the above mentioned goals and for efficient management of their assets and tracking the service requests, DPW decided to implement a GIS-centric CMMS program using the Cityworks software. Cityworks is a GIS-centric CMMS software from Azteca Systems located in Sandy, Utah (Azteca Systems, 2004). Azteca won ESRI Foundation Partner of the Year award in 2005. Cityworks is the first GIS-centric application certified by National Association of GIS-Centric Software (NAGCS). Cityworks is one of the few CMMS products that are GIS-centric (seamlessly integrated). Cityworks allows users to leverage their spatial data investment because in Cityworks, the GIS database is essentially the asset inventory. For more Cityworks information visit the Web site www.azteca.com.

PROJECT OBJECTIVES

- To design and implement a GIS-based CMMS
- To obtain APWA accreditation
- To migrate from Stantec to Cityworks

PROJECT SCOPE

This project included GIS representation and CMMS implementation for the following assets managed by DPW.

- County roads
 - 800 lane miles
 - 310 named routes
 - 17,540 segments (105 ft each)
- Roadside assets
 - Guiderails (2,709)
 - Traffic signs (11,765)
 - Walls (1,192)
 - Manholes (2,095)
 - Storm drains / inlets (4,755)
 - MS4 outfalls (3,000)
- Bridges (237)
- Culverts (386)
- Parks (9) (11 feature classes)
- Buildings (150)
- Warehouses (3,000 materials and 500 suppliers)

PROJECT SCHEDULE

- Phase 1 was completed in less than six months from February 22, 2005 to August 8, 2005. The project schedule is shown in Figures 4 (tabular) and 5 (Gantt chart).
 - GIS mapping (import Roadware asset survey data)
 - Database configuration, installation, and implementation
 - Migration of legacy data from, Stantec system, DPW's previous non-GIS CMMS
 - Training and mentoring
 - Go-live support
 - Three modules
 1. Service request (customer call-in)
 2. Work order
 3. Asset management
- Phase 2 (in progress)
 - Two modules
 1. Pavement management (MicroPaver)
 2. Storeroom
 - Three applications:
 1. Highway Occupancy Permit (HOP) interface
 2. Roadware inspections interface
 3. Configuration for trades (electrical, carpentry, etc.)
- Phase 3 (scheduled for 2007):
 - JD Edwards Interface

Task No.	Title	Start Date	Target Date
1	Contract Award	2/7/2005	2/7/2005
2	Project Kickoff Meeting	2/22/2005	2/22/2005
3	Implementation Planning Services	4/4/2005	4/7/2005
4	Project Design Review	3/7/2005	4/1/2005
5	Ship Software to ATSCE	4/1/2005	4/1/2005
6	Implementation Services Meeting	4/4/2005	4/7/2005
7	On-site Cityworks Orientation	4/4/2005	4/4/2005
8	Installation	4/4/2005	4/7/2005
9	Gather required information (on-site)	4/4/2005	4/7/2005
10	Processes	4/4/2005	4/7/2005
11	Conduct Process Workshop	4/4/2005	4/7/2005
12	Configuration	4/18/2005	6/3/2005
13	Installation & On-site Review	6/6/2005	6/10/2005
14	Training	7/11/2005	7/15/2005
15	Pilot Operational Roll-out	8/1/2005	8/8/2005
16	Pilot Go-Live	8/1/2005	8/4/2005
17	On-Site Go-Live Support	8/1/2005	8/8/2005
18	Ad-Hoc Remote Support	8/9/2005	8/16/2005
19	GIS and Mapping	4/5/2005	12/31/2005
20	Mentoring and Support	8/17/2005	12/31/2005

Figure 4. Phase 1 Project Schedule Table

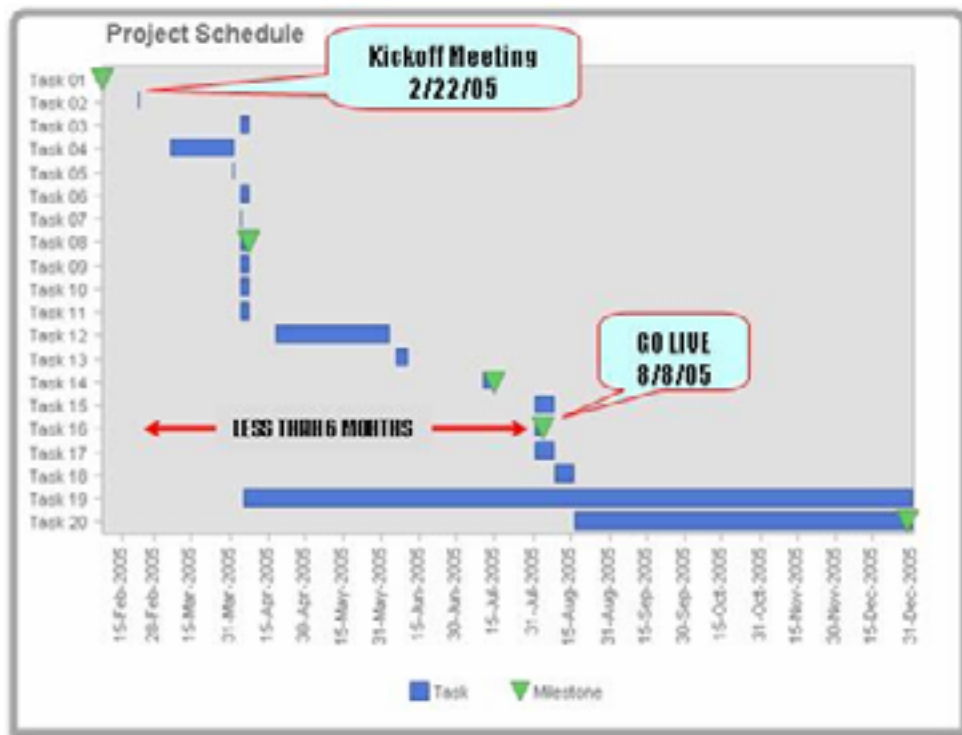


Figure 5. Phase 1 Project Schedule Gantt Chart

SYSTEM SPECIFICATIONS

- 60 concurrent users
- Software
 - Cityworks 4.3
 - 20 concurrent Cityworks desktop licenses (to support 60 concurrent Cityworks users)
 - ArcGIS 9.1
 - ArcEditor for editing
 - ArcView for production
 - ArcSDE
- Hardware
 - Windows Server 2003 R2
 - SQL Server 2000 for CW 4.3 database and ArcSDE geodatabase
 - Citrix Presentation Server 4
 - Approx 18 DELL thin clients
 - 10 connected via VPN through DSL
 - 3 connected via VPN through Dialup
 - 5 sitting on network
 - The thin clients have the application published to the desktop.

PROJECT RESULTS

Phase 1 project results are summarized below.

- Cityworks was successfully implemented in 6 months using a 100% GIS-centric solution (Cityworks + ArcGIS Geodatabase).
- Project was completed within the proposed time and budget. There were no change orders. The project team accomplished a go-live within 6 months from February 2005 to August 2005.
- Formal hands-on training was provided for all the 60 DPW users. The training was done for five consecutive days. Both the GIS training and Cityworks training was provided. Cityworks Desktop training was provided for all the users. Cityworks Designer training was provided for the administrative group.

Project details are described below.

Cityworks Configuration

- 279 work order types (in WOTemplate Table)
- 105 service request types (in Problem Leaf Table)
- 1,391 Material types (in Material Leaf Table)
- 3,264 equipment types (in Equipment Leaf Table)
- 520 employees (in Employee Table)
- Store room
 - 3000 unique material types
 - 500 unique suppliers

GIS Work For Parks

DPW did not have an existing GIS layer for Park assets. This was done by conducting heads-up digitization of park features in Phase 2 of the project from the year 2005 one ft resolution color orthophotos in a geodatabase. The following 11 park features were captured. Figure 6 shows an ArcGIS screenshot of digitization results (captured park features).

1. Swimming pools
2. Lakes
3. Ponds
4. Play grounds
5. Ball fields
6. Tennis courts
7. Rest rooms
8. Shelters
9. Office buildings
10. Storage buildings/sheds
11. Parking lots

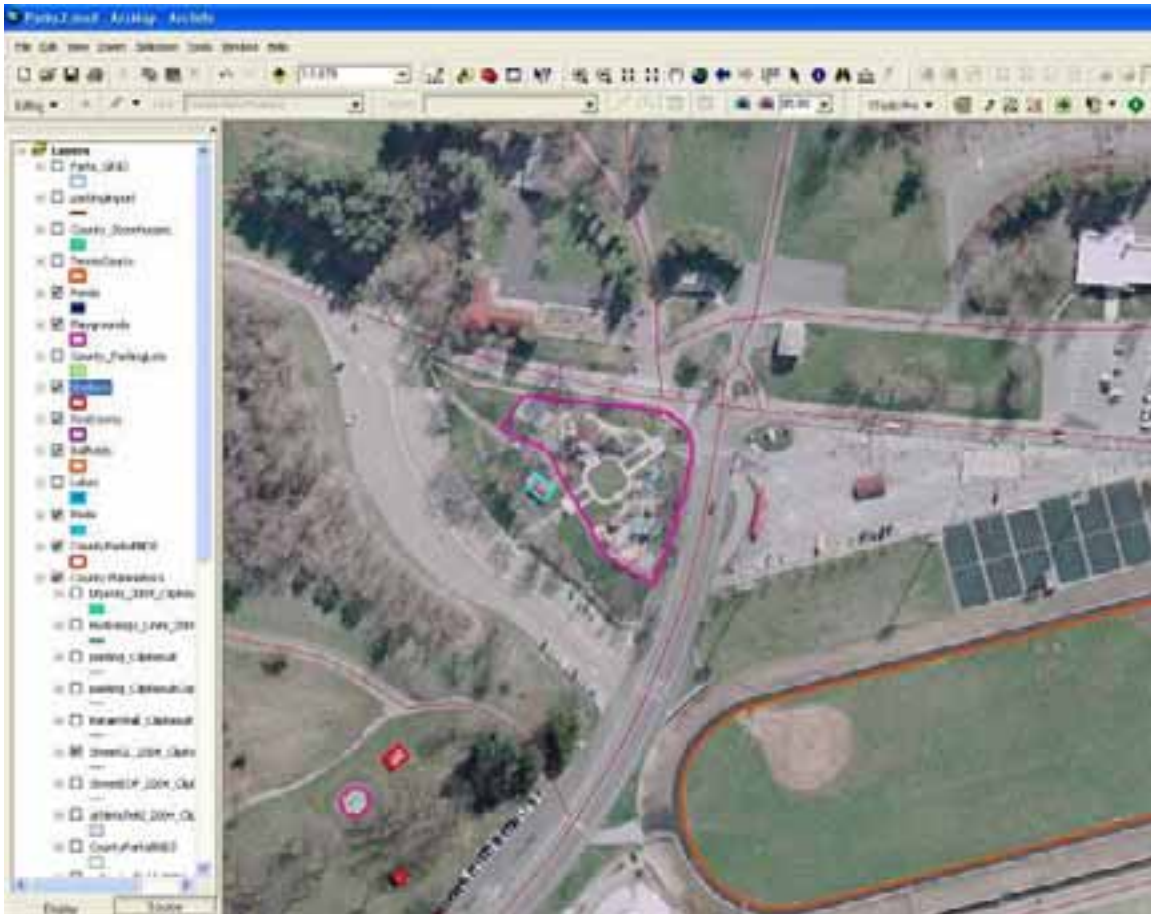


Figure 6. Parks Digitization Screenshot in ArcGIS

Roadware Data Interface

Several years ago, DPW collected asset information using the Roadware technology (www.roadware.com). Roadware Group Inc. is known for its innovative and customer driven Automatic Road Analyzer (ARAN) technology. First developed in the mid 1980s, the modular ARAN is a multifunctional vehicle used for road surface data collection. Currently employed by dozens of transportation and infrastructure agencies around the world, ARAN and its subsystems and software form the core of an integrated pavement management solution.

Roadware designs, manufactures and distributes a variety of state-of-the-art products to facilitate the collection of quality infrastructure data. They use special vehicles equipped with lasers, digital video cameras, and GPS. Panoramic imagery is collected at regular intervals. Any assets that appear in the images can be inventoried. GPS stores a record of the vehicle position. All images are geo-referenced to the location at which they were captured. Roadware can measure up to 15 different data items in a single pass at traffic speeds. Outputs are formatted for import into a GIS or other CMMS software environment

In Phase 2, a Roadware data interface was developed to display Roadware photos and videos in ArcGIS. The benefits of this interface are:

- Each DPW user does not have to learn the Roadware software
- DPW does not need the Roadware software licenses for each user
- Roadware data is integrated with the Geodatabase

Figure 7 shows an ArcGIS screenshot of the Roadware data interface displaying an assets video segment. Figure 8 shows an example display of Roadware pavement condition and photos in ArcGIS.

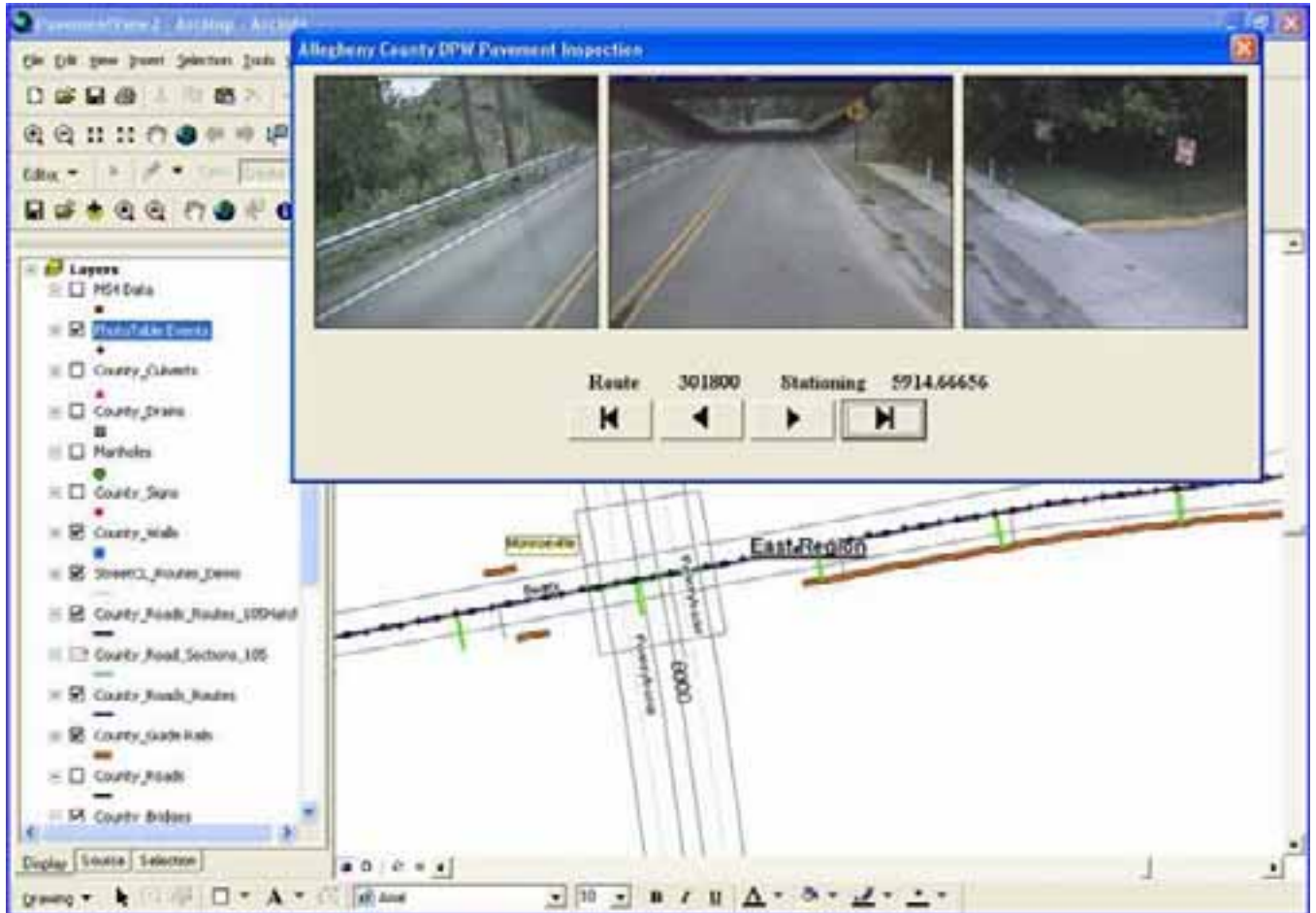


Figure7. Displaying Roadware Assets Video in ArcGIS

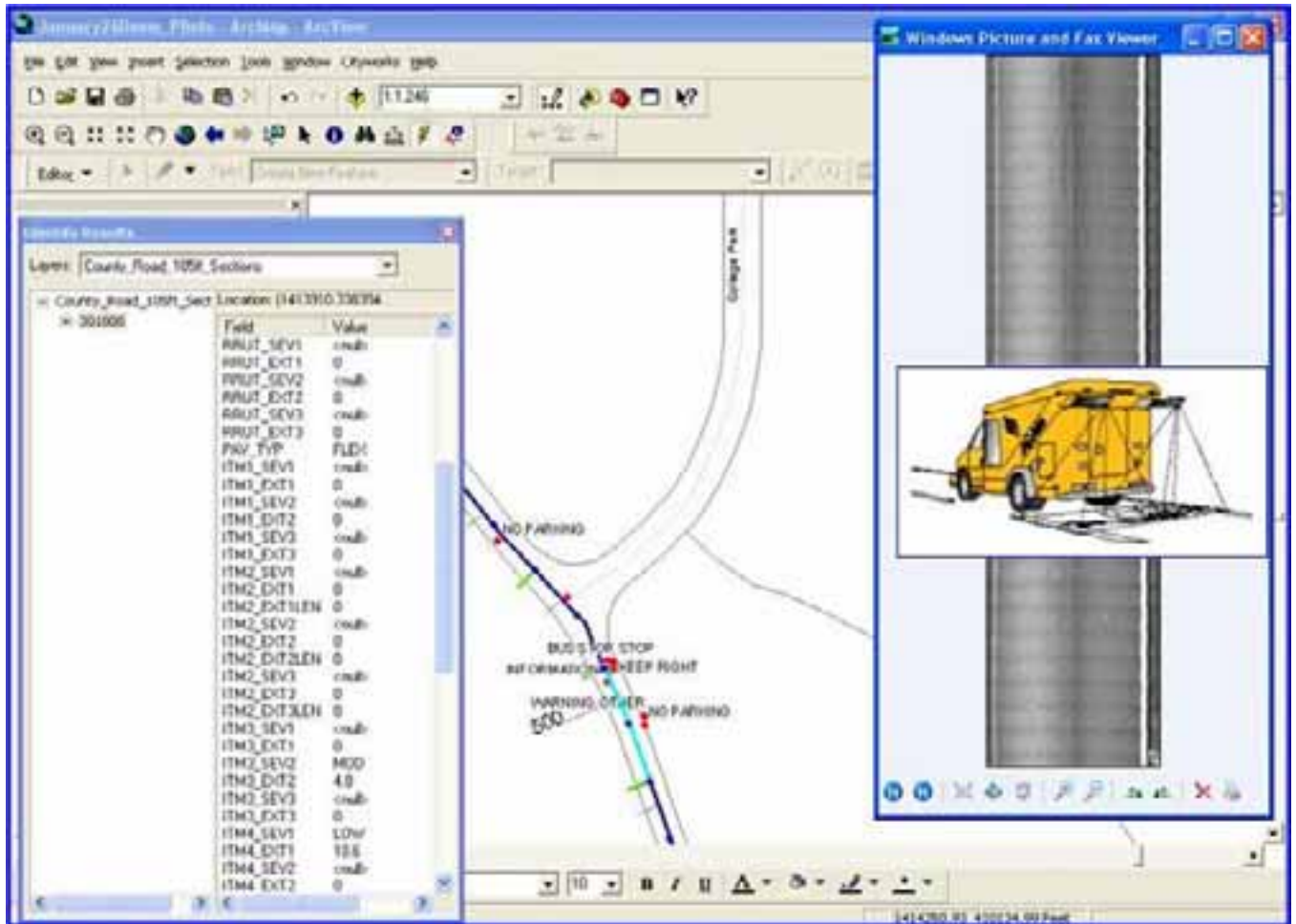


Figure 8. Displaying Roadware Pavement Video in ArcGIS

Cityworks Examples

Figure 9 shows a screenshot of Cityworks Service Request window (form). This example shows recording a problem (in the lower left side of the interface) for a leaking pipe that is causing the road to buckle. The caller information is recorded in the upper right side of the service request window. The caller address is geocoded by GIS and a point is added on the map. The service request window allows converting this service request to a work order by clicking on the “Create” button in the work order area on the left side. When this button is clicked, the caller information and the problem is transferred to the Work Order window shown in Figure 10.

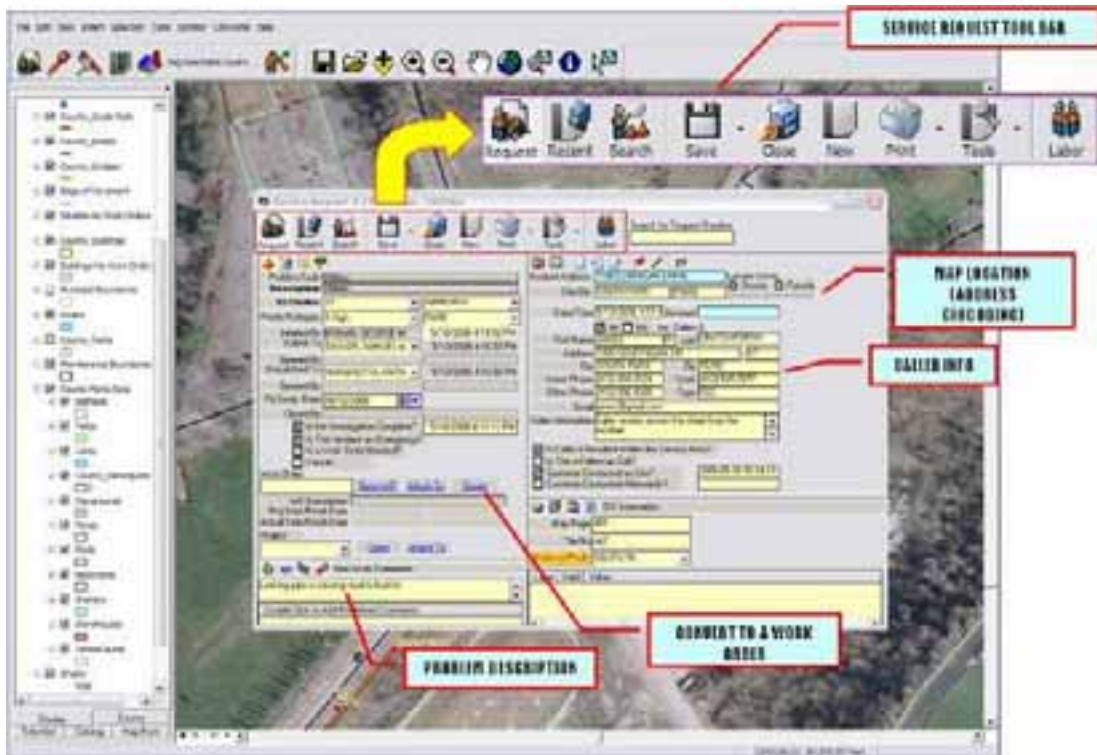


Figure 9. Cityworks Service Request Screenshot

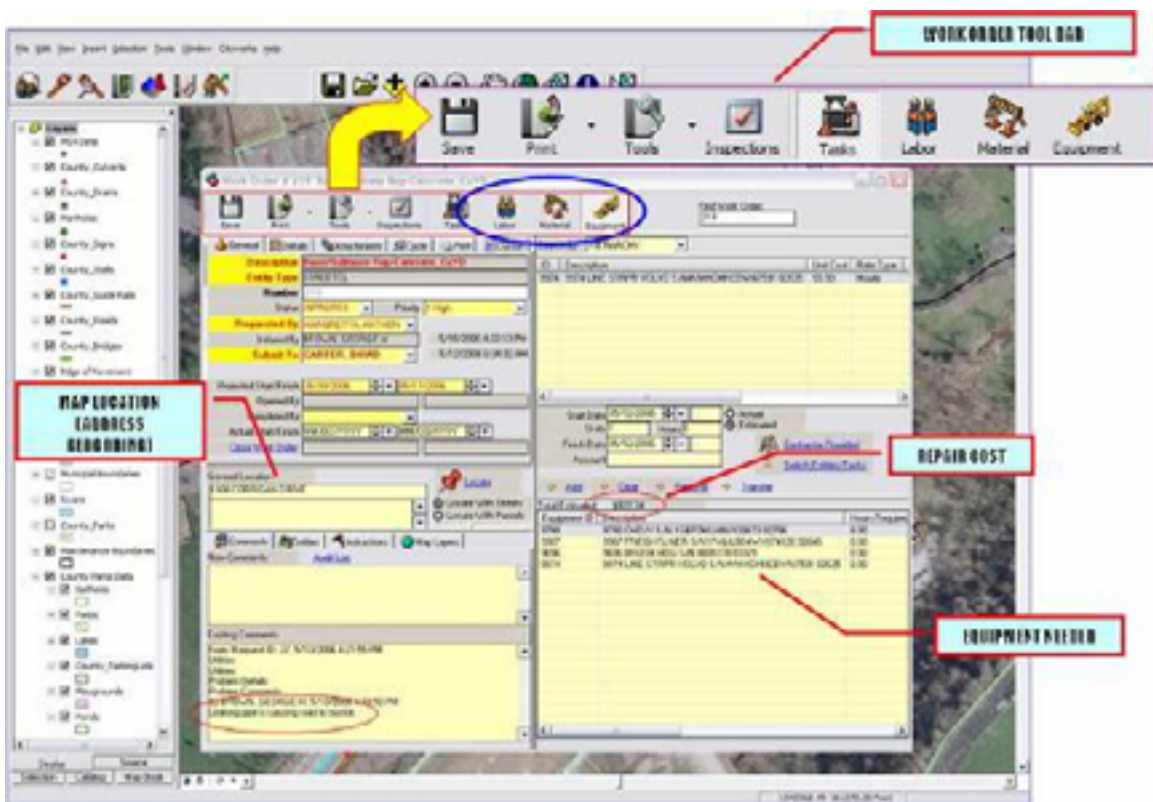


Figure 10. Cityworks Work Order Screenshot

PROJECT PORTAL

The success of this project depended on team work and efficient communication. One of the project management tools project team used in this project was a Web-based project portal. This password-protected portal allowed the project team members to link directly to project-related files and data such as GIS and Cityworks files, meeting minutes, meeting action items, project schedules and work breakdown structures (tasks, milestones, events, etc.). This portal was created by using pre-compiled modules which linked project data and files through a series of database connections and XML files. As portal users updated information through the web interface, other users gained instant access to updated data as those updates occurred. Figure 11 shows a screenshot of the project portal displaying the project schedule in Gantt chart format.

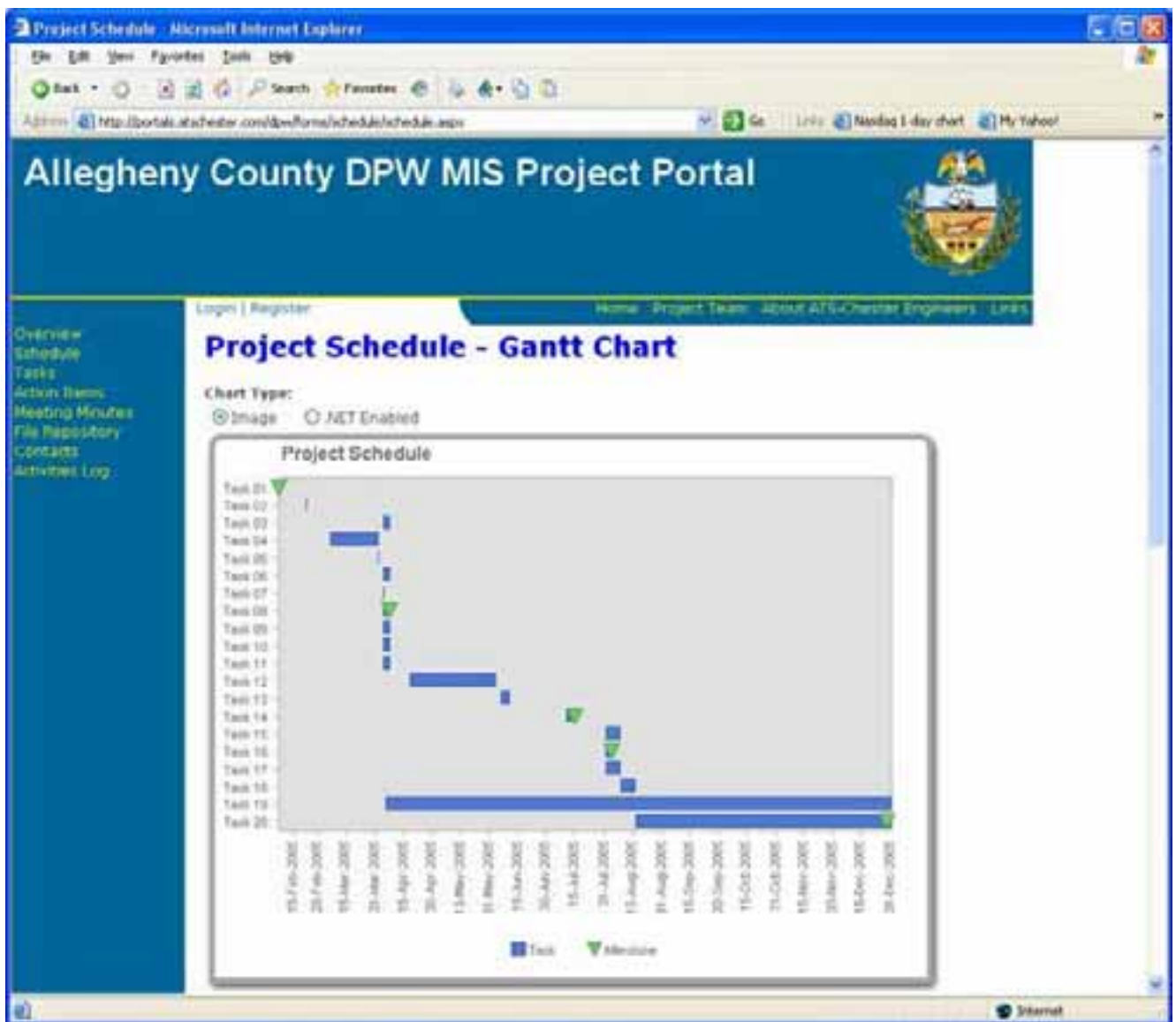


Figure 11. Project Portal Screenshot

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