IMAGIS — The Indianapolis Consortium: Adding Work Management to AM/FM

Patrick L. Stevens
Director
Indianapolis Department of Public Works

The Indianapolis IMAGIS project (Indianapolis Mapping and Geographic Infrastructure System) is a consortium with eight participants from the private and public sectors. The consortium was initially bound by a Memorandum of Understanding and ultimately by the IMAGIS Service Agreement between Indiana University and the eight participants. From its inception, the IMAGIS consortium was intended only to produce a county-wide, comprehensive, land-related digital database that would serve as the AM element of AM/FM (Automated Mapping/Facilities Management) projects for existing or future participants.

Six of the eight participants have started FM applications. This paper describes the experiences of the Department of Public Works in incorporating third party work management software into its AM/FM system and discusses application costs and budgets for all city utilities.

INTRODUCTION

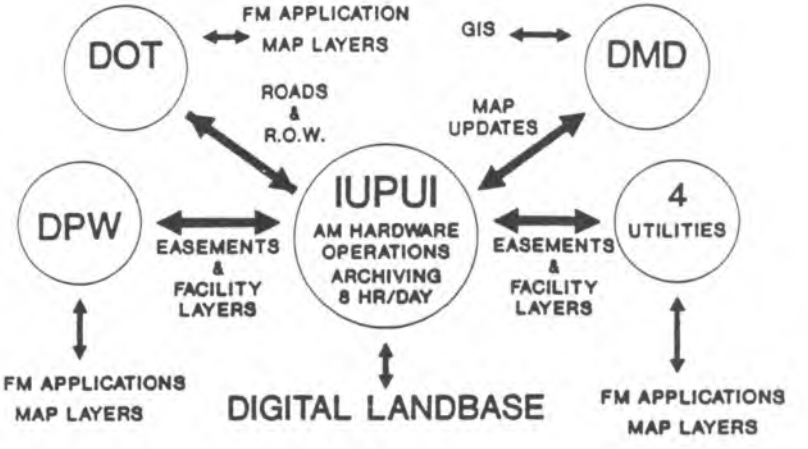
During 1986 and early 1987, the IMAGIS Executive and Technical Committees worked with a consultant to develop specifications for database creation and hardware and software purchases. They also prepared the agreements that would bind the participants. Key features of the project included:

- Costs for creating and maintaining the land data base were split 80/20 between public/private sectors.
- The entire service area of 496 square miles was constructed from new aerial photography. Positional accuracy was plus or minus two feet.
- The IMAGIS database was completed over a four year period (1986-1989) at an estimated total cost of $7 million, or approximately $21 per land parcel.
- The hardware for storing and maintaining the digital landbase is housed at the local campus of Indiana University/Purdue University (IUPUI). The IUPUI Computer Center also provided operating services such as data backup and software loading.

Figure 1 schematically shows the organization and the relationships of the participants. It is important to note that the Department of Metropolitan Development (DMD) has been designated as the "keeper of the map," and bears the responsibility for updating most map elements. The DMD will add parcel, zoning, building footprint information and land use information as it is captured through the zoning and construction permitting processes. Actual building

otprints, elevation contours, impervious surfaces, etc. will be captured through riodic photographic updates.

Figure 1: IMAGIS Organization



ADDING WORK MANAGEMENT (AM/FM/WM) IN THE DEPARTMENT OF PUBLIC WORKS

The vast majority of activity in an organization that manages any type of community-wide facility occurs in areas other than planning and engineering. Most activity consists of monitoring the level of service provided, acting on customer requests, physically maintaining the facility, issuing and recording work orders, maintaining inventories and rolling stock, managing a labor force and cost accounting. In general these activities are called Work Management (WM).

The Department of Public Works manages several county-wide programs including sanitary sewers, drainage and flood control facilities, solid waste collection and disposal and air pollution control. The Department's strategy is to implement an automated Work Management (AM/FM/WM) system for each of its major programs over a several year period as budgets allow. Sewer programs were scheduled first. There are a few sewer maintenance Work Management packages on the market, but none were found that produced maps or communicated with mapping packages. An RFP was issued to firms that offered a sewer maintenance Work Management package that:

- Ran on, or had the ability to be imported to, the VAX VMS environment;
- Demonstrated the ability to transfer files to and from the Synercom system and produced maps while in the sewer maintenance package; and
- Managed all phases of a sewer maintenance program including physical inventory, cleaning, construction, inspection, complaints, fleet management, labor, and materials.

The RFP also required that the firm provide a turn-key package including all data conversion. Four firms responded to the RFP and Hansen Software was

selected as the vendor best able to fulfill our requirements. Figure 2 is a schematic of the basic features of the Hansen package.

In defining the interface between the Work Management (WM) package and the AM/FM package, it was recognized that both packages had database management abilities. Two broad questions that had to be answered were, "How do we keep from duplicating data in the two data bases?" and "Which data base manager should be relied upon for day-to-day activities?" It was concluded that while most sewer maintenance activities have geographic significance, they are not geographic in nature and do not require the powers of a mapping system data manager. Any activity can be located on the map merely by knowing the address of the activity or sewer segment number. Both of these exist as attributes in separate data layers in the AM/FM database. Figure 3 shows that the interface between the two databases occurs through either address or sewer segment number.

Producing a map of sewer maintenance activities can be accomplished by transferring the address or sewer segment files that have been produced by standard query of the WM database. The Hansen package produces ten standard mapping routines from the various modules in the WM package. For example, the construction work order routine will produce a file of segments that have had a certain type of repair or perhaps have barricades in place. The complaint routine will produce files by either address or segment number that can be mapped to help diagnose problems.

FM/WM BUDGET FOR SEWER MAINTENANCE

The IMAGIS strategy calls for the consortium to own only the AM hardware and software while each participant must obtain separate hardware to perform its FM/WM applications. The Department of Public Works spent the following to implement the entire sewer FM/WM program, including hardware and mapping software capable of supporting other Department programs:

Hardware Purchase	$200,000
Software Purchase (Synercom and Hansen)	300,000
Data Collection and manual mapping	1,500,000
Convert manual maps to digital layer	75,000
Convert sewer records to digital database	300,000
Total	$2,275,000

This program costs approximately $11 per connected customer and approximately $0.18 per linear foot of sanitary sewer. Figure 4 compares the relative cost of implementing and maintaining the FM/WM system to other activities that commonly occur in a sewer program such as smoking and rehabilitation. In terms of relative cost, the $0.18 per foot management system investment is nearly one tenth the cost of manually inspecting one foot of sewer.

The hardware component of the FM/WM system cost $2.90 per connected customer and includes a CPU and communications network capable of supporting most of the Department's future needs. The Department's philosophy is that everyone who either uses or builds the database should have easy access to it. Therefore, the network reaches the Engineering, Customer Service, Sewer Maintenance and Leak Busters Divisions. The network installed is shown in Figure 5.

Figure 2 : Hansen Features

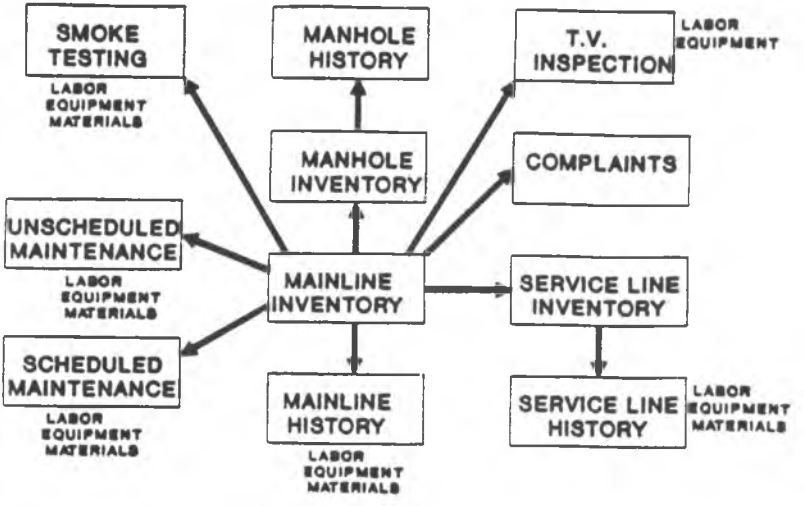


Figure 3: AM/FM/WM Data Structure
Sewer Application

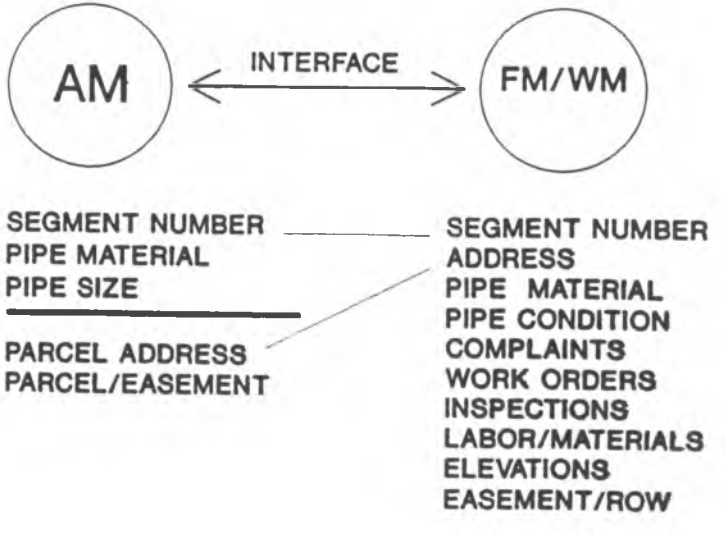


Figure 4: Sewer Costs

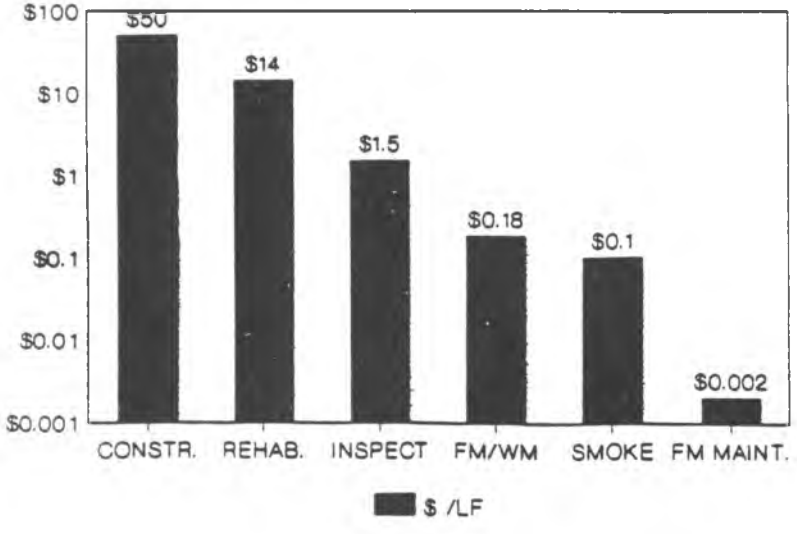
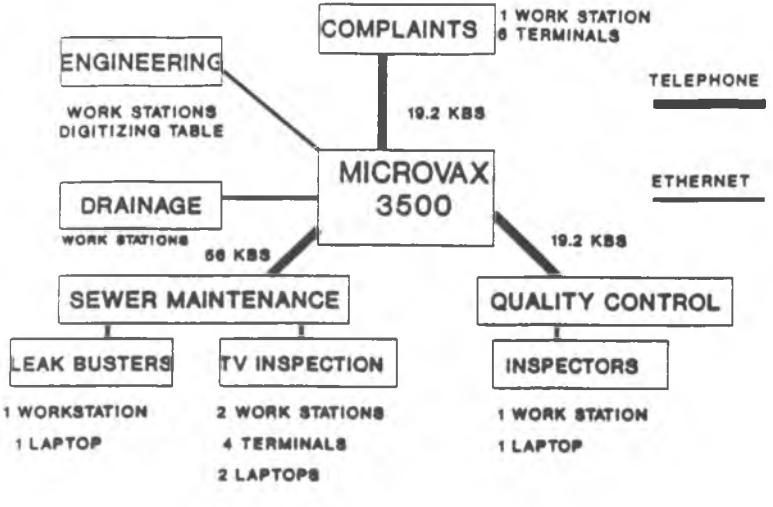


Figure 5: Network Configuration



The network connects four remote sites, which will eventually expand to six sites. One of the features of the Work Management package is its ability to download to, and upload data from, laptop computers used by field people. There was initial reluctance to use laptops for data entry in the field. However, after one or two day's use, the laptops became very popular. At the start of a day's work a supervisor downloads the database for the sewer segments that each crew will be working on. Inspection data is then entered directly into the laptop. Downloading occurs at the end of the day, which avoids the transfer of paper records for each segment. So far, only TV inspection personnel are using the laptops, but future software updates will allow other types of field data to be entered through the laptops.

USING IMAGIS FOR SOLID WASTE COLLECTION

Solid waste in Marion County had historically been collected by the Department's crews in the inner city area and by twenty-five companies in disorganized fashion throughout the remainder of the county. In the suburban areas, individual homeowners contracted for collection services and, as a result, a subdivision could be receiving solid waste pickup five days per week by five or more haulers. In 1990, the Department expanded its control of collection of 220,000 homes throughout the county. Each hauling company was awarded a geographic area with approximately the same number of homes it served prior to the expansion. A software package was needed to:

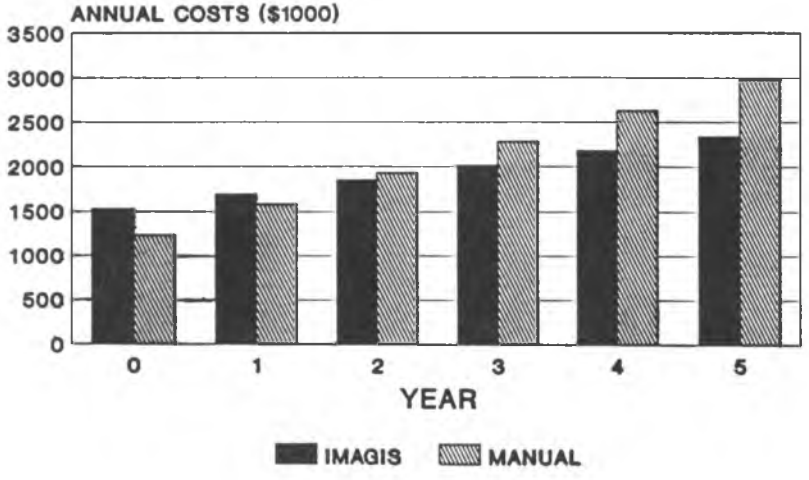
1. Create the areas to assign to hauling companies;
2. Count the homes in each area;
3. Send bills to each address in each area;
4. Track billing and payment history for each address;
5. Track service requests or complaints for each address; and
6. Pay each hauler for the number of homes in its area.

Because the IMAGIS database was being completed and debugged during the time the expansion was being prepared, the engineers were often forced to perform the task by both manual and computerized methods. Figure 6 is a table of the costs experienced doing this work both ways. Setup costs were higher for the computer-based system of establishing hauler areas, however annual costs were lower. Figure 7 shows that the payback for this investment occurs after the third year of operation.

Figure 6: Solid Waste Application
Project Costs ($1000)

	IMAGIS		MANUAL	
	FIRST COST	ANNUAL	FIRST COST	ANNUAL
DEFINE AREAS	3	1	30	5
VERIFY ADDRESS	230	1	230	20
BILLING SOFTWARE	973		973	
HARDWARE & SOFTWARE	323	10		
SERVICE REPS.		150		325
TOTAL	1,529	162	1,233	350

Figure 7: Cost Comparison
Solid Waste Program



COSTS FOR CITY WIDE INFRASTRUCTURE MANAGEMENT

An informal survey of AM/FM users shows that the cost of creating an FM application that incorporates data for each customer falls in the range of $5 to $15 per parcel. Data conversion is the greatest cost for these applications, and the existence of an automated data base can keep the application cost at the low end of the range. The IMAGIS participants were asked for the costs they had spent or budgeted for the creation of their FM or WM applications. These costs were converted to a per customer or per parcel basis and are shown in Figure 8.

Figure 8: IMAGIS Cost for Infrastructure
$ / Customer

AM	$30
Sewer FM/WM	12
Water FM/WM	12
Gas FM/WM	16
Streets FM/WM	8
Solid Waste	7
Telephone	4
Electric	6
Total	$95

This table shows that the cost of implementing these applications and creating a base map can easily be in the range of $100 per parcel. This cost is much higher than most people anticipated. However, when compared to a revenue stream of $3000 to $4000 that a parcel generates each year in taxes and utility fees, a $100 investment that can provide better service over several years seems wise.