

Spatially Enabled Accounting Systems for Governmental Transparency and Accountability

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Abstract

In recent times, urban governance in the US has placed emphasis on transparency and accountability. Though the Governmental Accounting Standards Board (GASB) has moved toward establishing accounting requirements to reflect these needs, accountability information is difficult to understand when governmental assets are stored in ArcGIS GeoDatabases with no link to financial data about these assets. This paper first gives an overview of the GASB 34 requirements and the ArcGIS system and then reviews ArcGIS spatially enabled GeoDatabase with Great Plains and SQL Server based enterprise GIS-Accounting system. This system not only tracks assets, liabilities, payroll, customers, vendors and purchasing management but it also creates a system adhering to various governing body's accountability requirements. Overall, the system was easy to navigate and sensitive to the effects of minute changes made to geographical entities reflecting them in GIS Mapping, charts, graphics and reports required by the various governing bodies.

Introduction

Urban governance is defined by the UN-Habitat as “the sum of the many ways individuals and institutions, public and private, plan and manage the common affairs of the city.” (Etten & Dool, 2001). The responsibility of managing a city’s affairs is thus not only limited to the local government but involves a larger arena of stake holders including national and regional governments, the private sector, non-profit organizations, community based organizations, professional associations and members of the civil society. The success criterion for urban governance set by UN-Habitat is characterized by several interdependent and mutually reinforcing norms grounded in the realities of local planning and management; of these “transparency and accountability” is increasingly being emphasized in the United States.

In this paper, I will first give an overview of how the requirement for transparency and accountability have altered the Governmental Accounting Boards reporting criterion and then go on to explain ESRI’s Geographical Information System and finally review a spatial accounting software that is particularly geared toward meeting the needs of governmental clients for meeting transparency and accountability requirements.

The Urban System

A simple way to think of the entire urban system would be to think of it as an integration of various subsystems. We will look at urban institutions from a functional standpoint and divide the urban systems into categories depending on whether the functions are private, public, public or service functions (Charnes, 1972).

1. *Private Functions*: Urban institutions that are both owned and managed privately per internationally accepted North American Industry Classification System (NAICS, 2002) codes:

- 11 Agriculture, Forestry, Fishing, and Hunting
- 21 Mining
- 22 Utilities
- 23 Construction
- 31-33 Manufacturing
- 42 Wholesale Trade
- 44-45 Retail Trade
- 48-49 Transportation and Warehousing , Etc

2. *Public Functions*: Non-private, non-governmental institutions

- a) Religious and social clubs
- b) Non-profits

3. *Service Functions*: Governmental institutions for providing services to citizens

- a) Public safety system: Police, fire, EMS, homeland security
- b) Justice system: Courts and Correctional
- c) Healthcare system: Public and Private Health
- d) Education system: Elementary, middle, high, colleges and universities
- e) Welfare system
- f) Transportation systems: Bus, rail, and subway
- g) Utility system: Water, wastewater, gas, electric, and telecommunication
- h) Cultural systems: Theaters, convention centers, and performance halls.
- h) Public works system: Construction and maintenance the areas accessible to the public.

Each of the above subsystem has a spatial and a fiscal component. For instance the public works departments which build and maintain public infrastructure assets like roads, storm water drainage, highways, bridges and lighting systems have spatial information about all these assets and be stored in a Geographical Information System. The fiscal information for each of these subsystems however is stored in separate, non-linked databases.

There are several software packages available in the market that can keep track of the financial data of public assets. The objectives of these packages range from simple maintenance of components to capital planning of whole systems. Though certain organizations are extending asset management systems into GIS for their clients, there is no commercially available package in the market that can do that for all the above subsystems and produce reports per US regulatory bodies at the same time. Before reviewing one such package, it is important to understand governmental financing to justify the cost of a package of this kind.

Governmental Finance

All the above-mentioned subsystems operate on interrelated or independent funds. For construction projects, governments either fund and operate the entire project or use quasi-private (special districts) to finance and operate the projects at an arms length. Local agencies normally finance the services related to their jurisdiction (with public bonds or federal revenue sharing with state and local governments) whereas the federal government finances public works of national importance. Increasingly, the growing federal budget deficit and political decision making, has reduced federal spending forcing states and local governments to commit their resources with more flexibility and prioritizing the available funds for the “right” projects (Hudson, 1997).

Governmental managers look for cost effective, well-managed capital improvement plans that improve bond and financial ratings to boost public, private, taxpayer, and legislative confidence. The need for flexibility on their part makes it more difficult for people who are trying to understand funding mechanisms to figure out what exactly is taking place. Overseeing bodies, investors and creditors have thus been pressuring the government to increase their accounting accuracy and transparency of operations to provide better financial and operational data. They have also demanded for awareness of true funding levels for various categories (Wilson, 2001). These have brought about much needed changes in record keeping methods. All functions now performed by governments share common accounting standards and reporting requirements. Whatever the sources of financing, or whatever the purpose, local governments, whatever their size, must meet GASB (Governmental Accounting Standards Board), GAAP (Generally Accepted Accounting Principles), AICPA (American Institute of Certified Public Accountants), and other accepted and or required accounting principles and standards.

GASB Accountability Requirements

The 1999 adoption of the Government Accounting Standards Board Statement 34 (GASB 34), laying out the framework for financial reporting by states and local governments in the United States, is considered one of the most significant steps in the Board’s history. Geared toward serving greater accountability to the public, GASB 34 brought governmental reporting closer to meeting accounting principles and to private sector models (Granof, 2003). It required governments to show long-term stewardship of public resources both at a fiscal and at the operational level. It introduced two new statements for the ease of matching resources and responsibility and incorporated a full accrual basis for accounting for all resources including

infrastructure. GASB 34 also required a complete assessment of the condition of the assets every three years to make sure that they are preserved at established levels. The current fiscal year (2005) is the first in which all local and state governments should have adopted this new system for prospective asset reporting. More time however has been allowed for retroactive infrastructure reporting (Cagle, 2002).

Unlike the private sector, governmental accounting is based on fundsⁱ. These can be divided into 3 broad categories: governmental, proprietary and fiduciary (Freeman, 2002). Most operational activities of municipalities, states, counties and districts are accounted for by *governmental* funds. Commonly financed through taxes and intergovernmental revenues, these funds include police, fire department, public works, education, health and human services. There is no expectation that these funds will be reimbursed for services rendered to constituents or other departments. In contrast *proprietary* funds are nonexpendable, in that, the government may make an initial contribution but thereafter is expected to pay its own way (at least in part) through user charges. Examples of these funds are water and sewer services. A class apart, *fiduciary* fund activities and resources benefit parties other than the government (Granof, 2003).

Historically, each category of funds tried to provide its readers with its own kind of information; in other words, each fund has its own *measurement focus*. Governmental funds for example allow readers to assess "whether sufficient resources existed to finance current period activities." The measurement focus is thus the *current financial resource flows or expenditure* accounting. Expenditures are outflow of resources (like cash) for *operating* (e.g. paying salaries), *capital outlay* (e.g. purchase of fire truck) or *debt services* (represent benefits for prior, current and future periods). In assessing proprietary funds readers would like to know whether there was sufficient revenue to cover the cost of providing the respective services; accordingly, proprietary funds use *economic resource flow* measurement that is the basis of *expense* accounting. Expenses, classified as *operating* (e.g. insurance and bonding) or *non-operating* (e.g. subsidies), are the cost of goods and services in a particular period. GASB 34 removed this differentiation as it was a source of confusion and moved towards the requirement of a consolidated financial statement using the same measurement focus – that used by proprietary funds - for all funds (Patton, 2001).

Accountability can be either fiscalⁱⁱ or operational. *Fiscal accountability* is achieved by focusing on the current financial resource flow measurement (the method used for governmental funds). Historically the public has emphasized this measurement focus ever since they first demanded accountability. Over time however, GASB has realized the need for *operational accountability*, that looks into long-term management decisions, in addition to fiscal accountability. Statement 34 defines operational accountability as "government's responsibility to report the extent to which they have met their operating objectives efficiently and effectively, using all resources available for the purpose and whether they can continue to meet their objectives for the foreseeable future." Thus government funds reported in current financial flows measurement focus also have to be reported using economic resource flows measurement focus. Current financial resource flows measurement focus required accounting only for current assets and liabilities; the economic resource flows measurement focus required that all assets and liabilities be reported (Patton, 2001).

Financial Statements

Transparency is the key to built trust in government. It is defined as the attribute that makes a government stable, reliable and predictable (Woodbridge, 2001). Government financial

reports, the window through which citizens, government managers and auditors/financial intermediaries see and evaluate how the government is functioning, need to clearly report overall information, indicate the sources of revenue, narrate analytically the government's financial activities and position (Management Discussion and Analysis), be explicit about major individual funds, show capital assets and long-term debts, and specify all trust arrangements that have been made by the government (Kravchuk, 2001).

Transparency allows the public to see the services provided by the government and permit potential participants to suggest alternatives to the practiced methods. For this, statement 34 requires two separate but related set of financial statements. The first set-- the *fund statements*--view the government as a collection of separate funds and uses the current financial resource flows measurement focus. The 3 categories of funds (governmental, proprietary and fiduciary) necessitate 3 sets of statements, each containing a slightly different focus. The second set, presented in full accrual basis called the *government-wide statements*, for the same transactions, consolidates all of government's own operation and includes within its measurement focus all of the government's economic resources including capital assets. There are two government-wide statements: a *statement of net assets* (or balance sheet) and a *statement of activities* (operating or income statement). As mentioned earlier, operational accountability is required on all activities in the government-wide financial statements. This means that *all* assets are reported. This leads to capital assets, like infrastructure assets to also be reported in the financial statements. To be really accurate then one needs to report expenses like depreciation for the cost of using the capital assets.

Capital asset reporting requirements and depreciation

Statement of Net Assets:

In this statement, all capital assets that are purchased or constructed are reported at *historical costs*ⁱⁱⁱ—the amount paid at the time the asset was acquired. Similarly, donated assets such as the streets, utilities, parks, educational and cultural infrastructure in new developments are reported at *fair value* when donated. Most capital assets depreciate and are reported as net of *accumulated depreciation* over time. Inexhaustible capital assets such as land and land improvements however do not depreciate.

GASB 34 allows for latitude in how the depreciation in the funds is reported for fixed or capital assets in two ways the *straight-line depreciation* method or the *modified approach*. In the straight-line depreciation method the initial cost of the project is distributed over a certain predetermined useful life of the asset and the portion "used up" in each period is recorded. Any preservation effort must be added to the value of the asset (or capitalized). In the modified approach, a level of maintenance is predetermined, within limits and the cost associated are calculated. As maintenance is performed the actual costs are acquired that keep the infrastructure up to acceptable levels of performance or 'new' performance standards. Thus assets reported using the modified method is not depreciated^{iv}.

Capital assets are separated into *governmental* or *business-type* activities (formally known as enterprise funds). Governmental activities report assets associated with, or those that arise from, activities reported in the governmental funds. Since governmental fund financial statements are prepared using the current financial resource flows measurement focus, any amount that is paid for general capital asset is not reported as capital asset in the governmental funds balance sheet. Instead, it is noted as expenditure in the governmental funds operating statement to take into account the outflow of financial resources for the purchase.

Statement of Activities:

Besides the Statement of Net Assets, GASB 34 requires depreciation expense to be noted in the government wide statement. If historical costs are not available, group method of depreciation, in which a class of assets thought to be acquired at the same time, are depreciated at the same rate depending on the estimated age and estimated useful life left. Another method approved by GASB 34 is the modified approach whenever the user in this case is more interested in learning about the changes in the condition of the asset and the cost of maintaining them rather than its hypothetical depreciated value. Thus by the modified method, if a government is using an asset management system or able to show that it is maintaining its assets at or above a predetermined level, then it does not have to report a depreciation expense. It does however have to report as expense all amount spent on infrastructure assets (other than those for additions and improvements-which are included as addition to capital assets) in the period they were incurred.

Capital Improvement Plan

Capital Improvements are major physical asset acquisition or construction that is of significant dollar value. Managing capital improvement costs is one of the most daunting tasks that municipal manager faces for the savings that can be realized over time from capital improvements are not always apparent. The hardest aspect to find out is the impact on future tax rates that have to be determined from the government financial reports. Cities need financial models that can predict project costs and allow evaluation of alternative funding scenarios. Also needed are the financial impacts of alternative assumptions based on measurements such as annual reserve levels, capital project funding and annual debt service coverage. Besides, alternative rate structures are also needed to determine the effect on utility or tax bills.

Urban Information Systems

Before the adoption of the GASB 34 in 1999, most governmental assets, being varied, were stored in incompatible formats in different databases. Tracking costs on development, maintenance and operation of past, current and future plans as required by GASB 34 calls for a compatibility of the various data and software that could not only keep track of assets, funds, purchasing and vendors, but also generate required reports. Of the several accounting software available in the market, Great Plains Financials Enterprise is an enterprise accounting system that has a large and growing market share. In addition to the regular General Ledger, Human Resources and Payroll modules, Great Plains offers numerous applications. Government centric add-ons like Fund Based Accounting, Encumbrance Accounting and Grant Management are also available. These modules integrate with Analytical Accounting Module and track funds against specific programs and keep a close eye on expenditure.

For geographically referenced urban data, the largest market share is ESRI's ArcGIS system. This system has the following components:

ArcGIS

ArcGIS is ESRI's integrated GIS software package consisting of ArcMap, ArcCatalog and ArcToolbox and available in 4 versions in increasing levels of functionality. The 4 versions, ArcReader, ArcView, ArcEditor and ArcInfo are collectively known as ArcGIS Desktop and range from simple data reading to complex analytic engines. They are capable of data creation, visualization, integration and analysis with increasing levels of capability.

ArcSDE (Spatial Database Engine)

ArcSDE (Fig 1) is ESRI's middleware software package that is considered to be a communication gateway between one or more large relational databases (like SQL Server™) that is used by a set of multi-user or distributed ArcGIS clients. It is an application server that uses a single database model that besides managing spatial data is also capable of storing it. It allows for long transactions and versioned workflows.

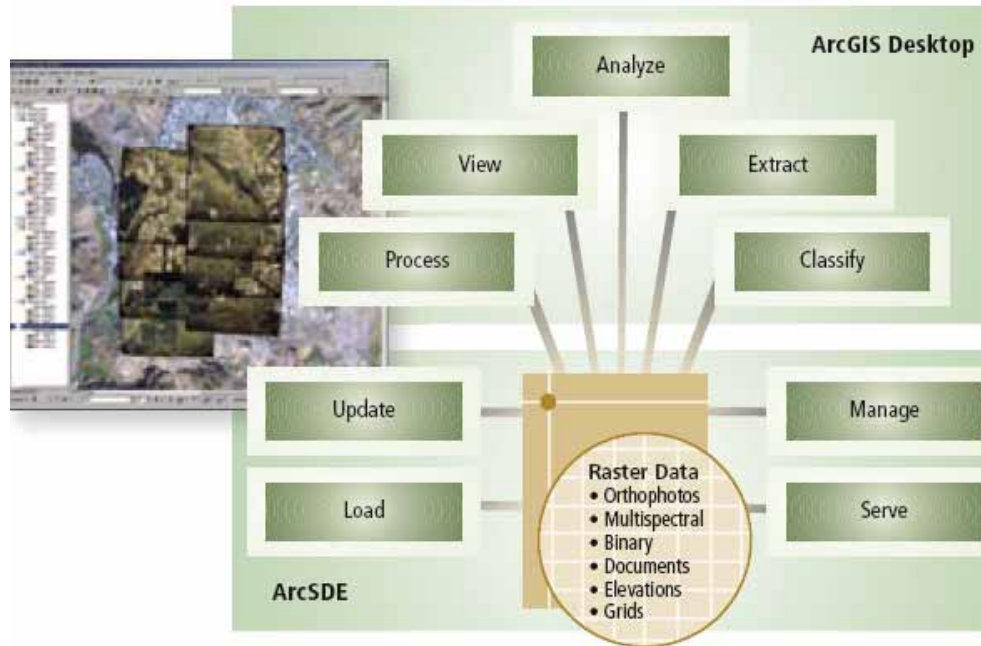


Fig 1: ArcSDE functions

Source: <http://www.esri.com/library/brochures/pdfs/arcsde-server.pdf>

Geodatabase

A GeoDatabase (Fig 2) is a Relational Database Management System (RDBMS), specifically designed to process all data used by GIS. This spatially enabled relational database management system allows sophisticated rules and relationships to be set up and processed based on SQL and GeoSQL calls from the database. ArcSDE is used to bridge GIS and databases providing the process for spatially enabling the database. Once in the GeoDatabase, any data (such as an address, building, street, fire hydrant, etc), tied to a point, line or polygon geo-reference can be mapped.

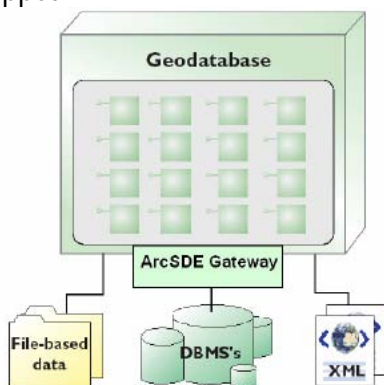


Fig 2: The Geodatabase

Source: Brown (2004)

ArcObjects

ESRI software is broken down into functional components known as ArcObjects. This kind of modular architecture facilitates platform independence and scalability of the ESRI product line. The library of ArcObjects use Component Object Modeling (COM) technology.

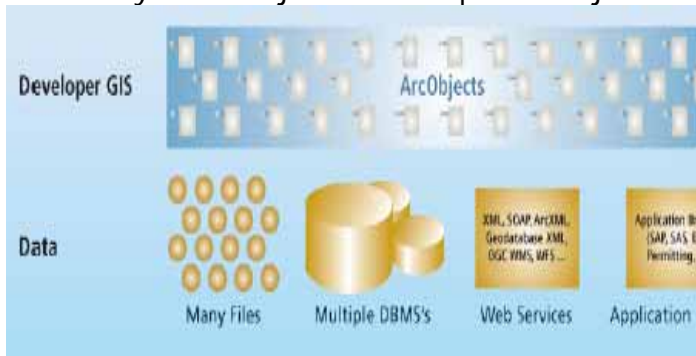


Fig 3: Arcobjects

Source: Brown (2004)

ArcEngine

For building custom applications using multiple application programming interfaces (API) ArcEngine provides a library of embeddable GIS components.

ArcGIS Server

Centrally managed enterprise GIS applications used by multiple clients are stored in an ArcGIS Server. It is used for building server-side applications for both enterprise and web computing frameworks.

The Total System

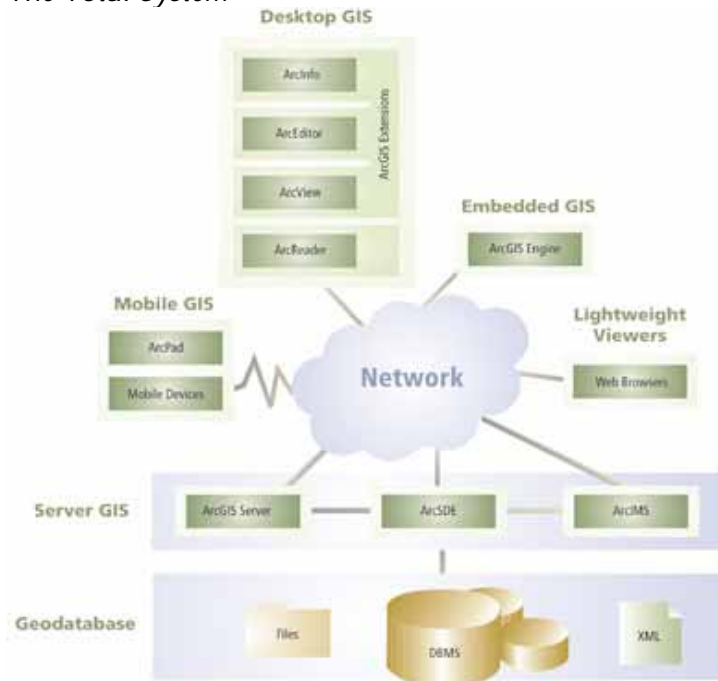


Fig 4: The total ESRI GIS System

Source: <http://www.esri.com/software/arcgis/geodatabase/>

Review

Metroware, in the business of creating urban planning and analysis software solutions, has spatially enabled Great Plains by creating a single platform marrying physical, spatial and fiscal data and has made GIS the basis for implementing GASB 34 and other governing body requirements.

The primary advantage of using ArcGIS enabled Great Plains is the ease of use. The Metroware drop-down menu acts as a gateway to Great Plains accounting, ArcGIS, Metroware's design of a fiscal ArcSDE Geodatabase and the SQL Server Databases. It allows new data to be added and custom drop-down menus to be created by the user. The three programs, Great Plains, ArcGIS and Metroware's own planning analysis software retain their respective graphic user interface and making it easy to understand which software one is in. Separate drop-down menus, available for all three programs, significantly reduce the learning curve at the initial stages. Data can be accessed through any of the three programs. Fig 5 below shows simultaneously opened windows in Metroware's own software, Great Plains and ArcMap.

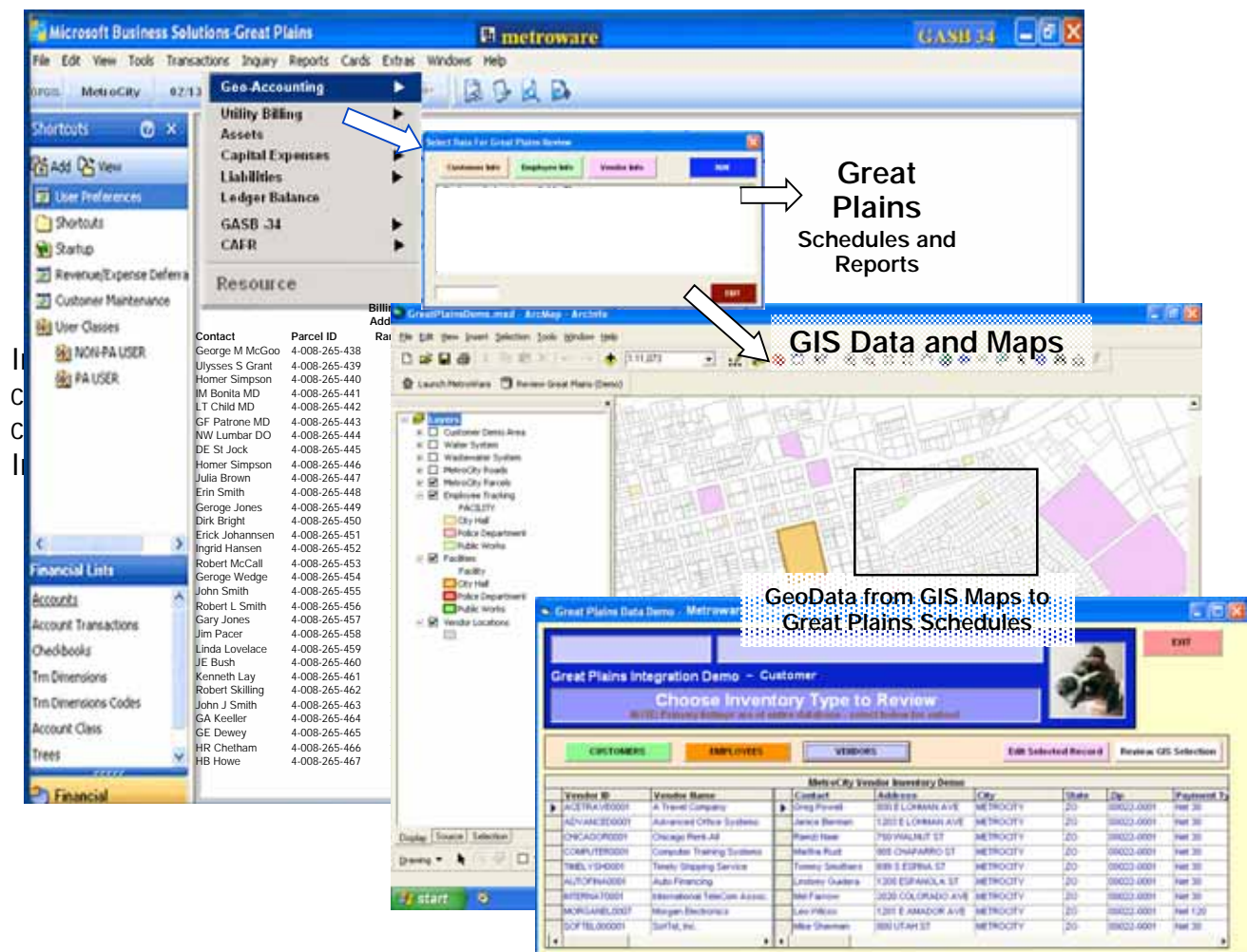


Fig 5: Metroware, Great Plains and ArcMap

Detailed inventories of all physical components of the urban system are stored in the Geodatabase. Examples of these are sanitary sewer system, signage and lighting. The level of detail goes down to the smallest component of each of the systems. For instance the water and wastewater infrastructure includes clean and wastewater lines, meters, laterals, valves, manholes, identification of number of pipe segment, type of pipe, pipe diameter, pipe segment length, pipe segment installation date, installation cost per linear foot, street address and other details. Being geographically enabled, it is possible to generate specialized reports for particular areas or special types of pipes for a particular area and also see a scaled, visual representation of the water and wastewater infrastructure. It is also possible to evaluate the condition of the pipes in terms of its age, maintenance work performed, and other details. This software makes accountability of the components of any urban subsystem, like the water system discussed here, possible at the most detailed levels. Accountability at a larger scale to auditors and other outsiders via reports are shown below. Fig 6 shows a GASB-compliant Statement of Net Assets highlighting water and sewer components and the corresponding ArcMap window indicating the layout of the pipes and location of the components. For creating this statement either the straight-line depreciation method or the modified approach could be used. Water and sewer being business type activities, can be shown broken down by individual clients (Fig 7).

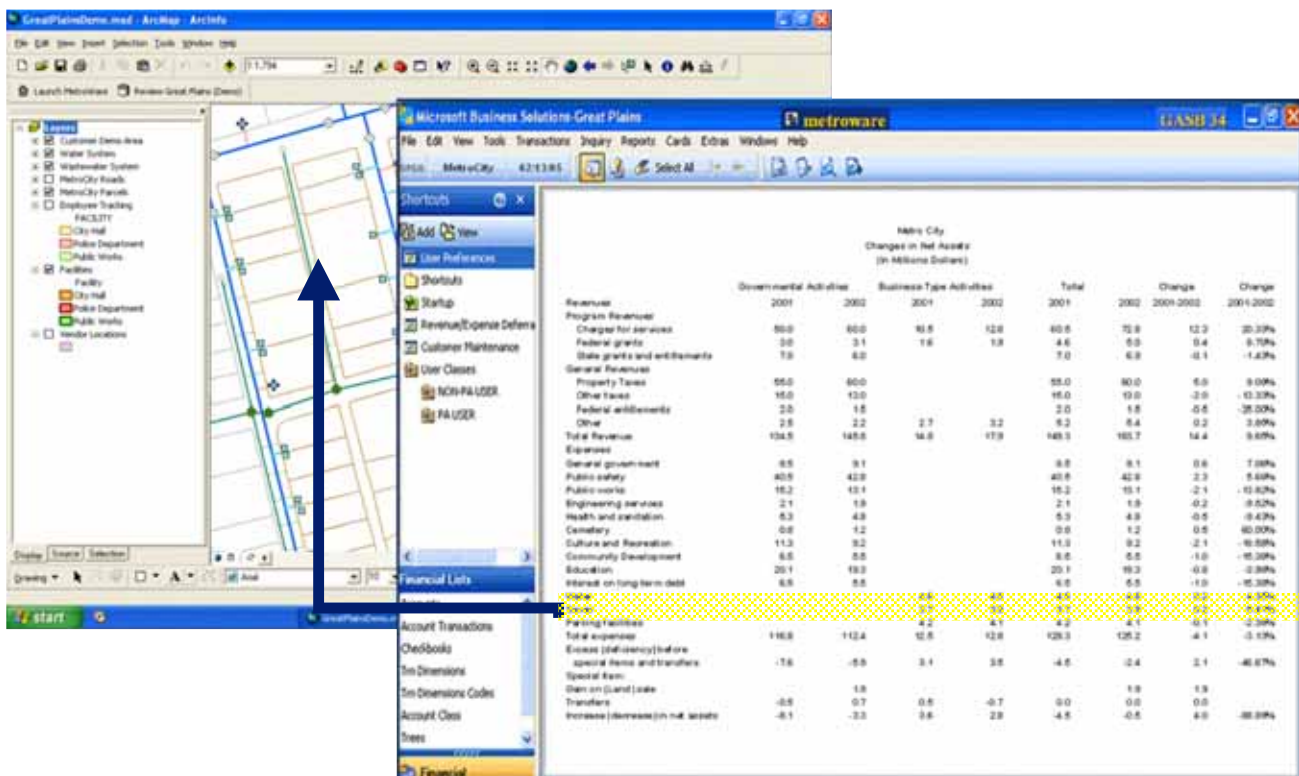


Fig 6: Statement of net assets indicating water and sewer assets with the corresponding location of pipes

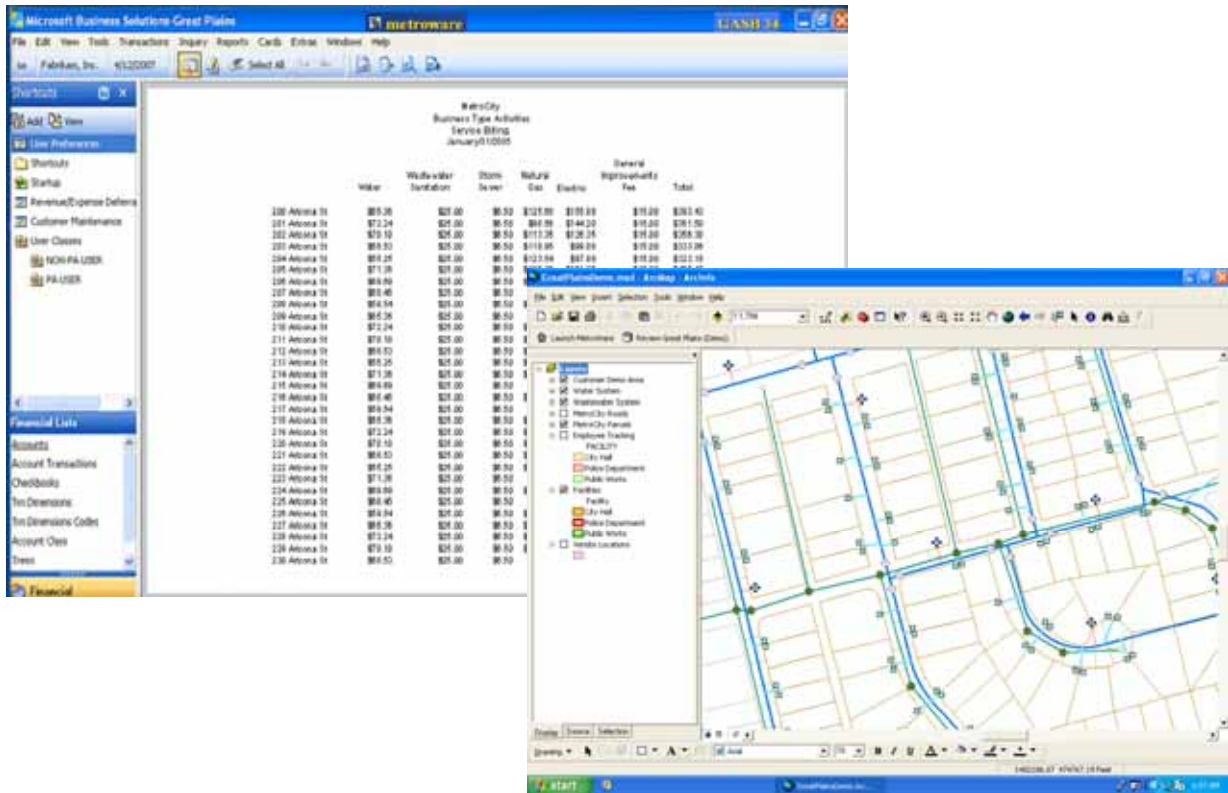


Fig 7: Water, sewer and other utilities by address

Additional advantages of this software package includes viewing field notes made on any part of the system, viewing assets by departments, predict project cost and calculating financial impacts for alternative assumptions in the financial models of capital improvement plans. The most important of all, the data handling capability in real time accommodates parallel decision-making activities possible. Decision making on alternative scenarios of the future is also a powerful possibility with this package.

This system is well suited for government of any size. The transparency and accountability needs for efficient and accurate reporting per GASB and CAFR requirements are more than adequately satisfied by this package. The cost of initial implementation though high would be well worth it if the software could be utilized for the private, public and the service functions of the entire urban system- something that it is capable of. The question would then arise if the various governmental departments would be willing to break traditional boundaries for a truly integrated system that a package like this promises. The primary drawback of this software would be the cost incurred, not in the initial implementation, but rather in the regular maintenance of the databases and the personnel. The logical next step for Metroware's GIS enabled Great Plains, at this point would be to meet the International Financial Reporting standards.

ⁱ A fund is "a fiscal and accounting entity with a self-balancing set of accounts recording cash and other financial resources, together with all related liabilities, and residual equities or balances, and changed therein, which are segregated for the purpose of carrying on specific activities, and changes therein, which are segregated for the purpose of carrying on specific activities or attaining certain objectives in accordance with special regulations,

restrictions, or limitations” From GASB, Codification of Governmental Accounting and Financial Reporting Standards (Stamford, Conn.: GASB, 1994), sec 1100.102 and 1300.

ⁱⁱ Fiscal accounting has been defined in Statement number 34 as “the responsibility of governments to justify that their actions in the current period have complied with public decisions concerning the raising and spending of public moneys in the short-term (usually one budgetary cycle or one year).

ⁱⁱⁱ In the absence of availability of historical cost *deflated current replacement cost* can be used.

^{iv} The modified approach has a potential problem. This method that is most likely be used by only the largest of the agencies and those with the most human and capital information resources. Though the depreciation method seems straight forward, most agencies divide assets like highways into segments depending on the kind of work being done on them. Either depreciation or preservation or both may be done on each of the segments. These would then be summed up at the Comprehensive Annual Final Report (CAFR). If however at a later time different parts of a certain segment need different kinds of attendance there is a possibility of very complex record keeping arises.

Reference

- Charnes, A., Kozmetsky, G., Ruefli, T. (1972). Information Requirements for Urban Systems: A View Into the Possible Future? *Management Science*, v. 19 (4)
- Cagle, R. F. (2002). Early Experiences: GASB 34 Infrastructure Reporting. *AACE International Transactions*. IT .07.
- Etten, J. V., Dool, L. V. D. (2001). Building Capacity to Build Urban Governance. *Social Development and Poverty Education*, v. 7 (1). Available at:
http://www.unhabitat.org/hd/hdv7n1/Building_Capacity_to_Improve_Urban_Governance.htm
- Freeman, R. J., Shoulders, C. D. (2002) *Governmental and Non-Profit Accounting: Theory and Practice*. 7th Ed. Upper Saddle River, N.J.: Prentice Hall.
- Granof, M. H., Wardlow, P. S. (2003). *Core Concepts of Government and Not-For-Profit Accounting*. John Wiley & Sons.
- Hudson, W. R., Haas, R., Uddin, W. (1997). *Infrastructure Management*, McGraw Hill.
- Kravchuk, R., S., Voorhees, W. R. (2001). The New Governmental Financial Reporting Model under GASB Statement 34: An Emphasis on Accountability. *Public Budgeting and Finance*. Fall 2001.
- NAICS (2002), 2002 NAICS Codes and Titles. Available at:
<http://www.census.gov/epcd/naics02/naicod02.htm>
- Morais, M. (2000). Introducing the ArcGIS Platform: One Look Many Applications. Available at: <http://gislounge.com/features/aa062800.shtml>
- Patton, T., K., Bean, D., R. (2001). The Why and How of the New Capital Asset Reporting Requirements. *Public Budgeting and Finance*, Fall 2001.
- Woodbridge, S. C., Garvin, M. J., Miller, J. B. (2001) Effects of Accounting and Budgeting on Capital allocation for Infrastructure Projects. *Journal of Management in Engineering*. April.
- Wilson, E. R., Kattelus, S. C. (2001). Implications of GASB’s New Reporting Model for Municipal Bond Analysts and Managers. *Public Budgeting and Finance*, Fall 2001.

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