GIS and Fiscal Analysis: Toward an "Enterprise GIS"

Nearly everything a city spends money on is spatially distributed: road maintenance, police calls, planning and zoning, parks and recreation. Nearly all revenue a city collects is based on spatially distributed factors: population, property values, charges for services, or grant programs.

If a city had the ideal "transaction processing" system with which it could record the origin of every dollar that comes in, and the destination of every dollar of expenditure that goes out, using a GIS map and database, the fiscal impact of every land parcel could be specifically measured. This kind of system does not exist, and would be nearly impossible to create. However, with the use of GIS, measurable surrogate factors that are indicators of the revenues and expenditures can be used to simulate that ideal system. Furthermore, another ideal system is the "Enterprise" GIS in which all departments would collect and share vital information that can be used across the organization: parcel addresses, population, housing units by type, police calls, road frontage, zoning, etc.

This article describes a method to develop a GIS database that is designed to model both the "transaction" and "enterprise" ideals.

This approach is not new. It was first introduced in 1989, and won a grant from the National Science Foundation (NSF), and the Horwood Critique Prize from the Urban and Regional Information Systems Association (URISA). However, cities did not have the detailed parcel level databases back then. It has take over 20 years for cities to be in a position to be able to adopt such an approach. Reviving the work of 1989, the City of Anoka, MN conducted a new study for the year 2009, with surprising and enlightening results.

The GIS method differs with the traditional methods of trying to measure Fiscal Impact, which attempt to measure residential impacts or commercial/industrial impacts, but not both. Most residential methods rely solely on population, but population is not the only factor. Furthermore, the other methods do not address the impact of tax-exempt property. The GIS method studies <u>all</u> land uses in the entire city, and the <u>entire</u> annual revenues and expenditures; nothing is left out or double-counted. It separates out capital from operating items, and it takes into account special laws, revenue distribution formulas, and Tax Increment Financing (TIF) districts.

Revenue and Expenditure Factors

It all starts with the tax parcel map and database, typically developed and administered by the county. Key attributes include the PIN number, owner name, parcel address, land use type structure type, year built, homestead status, market value, tax capacity, TIF district, among others. To this "right-of-way parcels" were added, containing the attributes of road name and type, and jurisdiction.
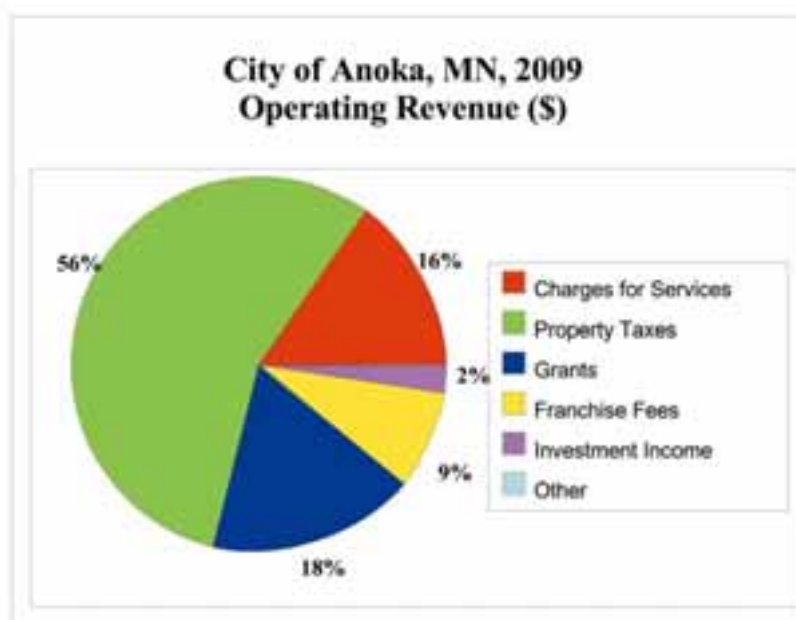
Attributes to be used as surrogates that were added to the parcel file included population, housing units by type, employment, police calls, fire calls, road frontage, sidewalk frontage, and electrical billing. The list of attributes added by the city was derived by looking at all of the items of revenue and expenditure and determining which measurable factors, in addition to the tax parcel items, could be identified down to the parcel level, to be used as surrogates to simulate the flows of revenues and expenditures.

Anoka's GIS Database	
County Tax Parcel Base	Attributes Added by City
PIN	Population (estimated)
Owner Name	Housing Units by type
Taxable Use	Employment by Employer address
Structure Type	Police Calls
Market Value	Fire Calls
Building Value	Road frontage by jurisdiction
Tax Capacity	Sidewalk frontage
Special Assessments	Electrical & water billing
Parcel Address	Land Use
Homestead status	Others
Year Built	
TIF District	

City Finances

Working with the city's finance director, operating items (items that recur every year on a regular basis) were separated from capital items, which may vary significantly from one year to the next. Operating items represented two-thirds of the budget and capital represented one-third. Bringing in members of the police department, public works, parks and recreation, planning, community development, and the city manager, weights were assigned to each of the factors, depending on their best judgment as to how they contribute to each budget item.

The following charts summarize the operating and capital revenues and expenditures for the City of Anoka in 2009.

City of Anoka, MN, 2009
Operating Revenue ($)

Property taxes are the largest source of operating revenue, at 56%. Using the tax parcel data file, this revenue source is directly tied to land parcels. More discussion on property taxes is provided below. Charges for services account for 16% of operating revenue. We do not have the benefit of actual transaction data, so it had to be allocated using a variety of factors such as police call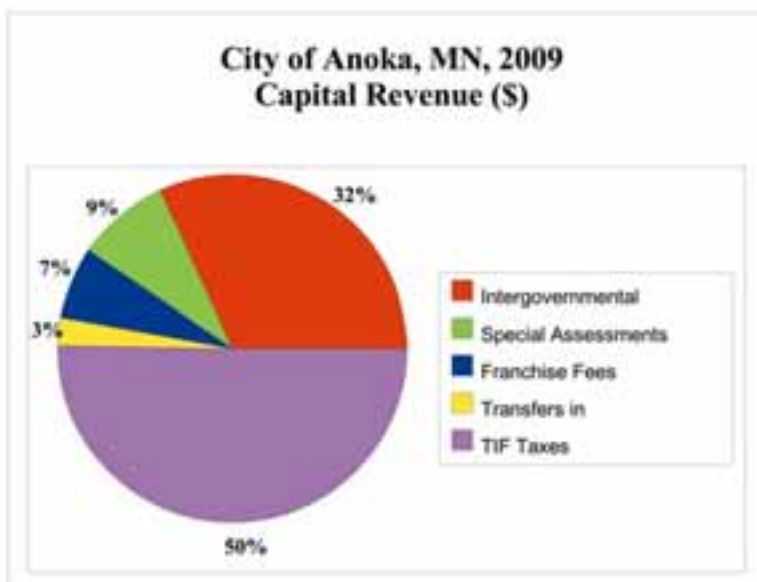s for fines and fees, commercial restaurants for liquor license fees, etc. The police department also contracts out for services

so the revenue for these services was allocated directly to the parcels involved. In another case, parking revenue was allocated directly to the parking lot parcel. In more ambiguous cases, such as general government charges for services, population (40%), employment (10%) and market value (50%) were surrogate factors.
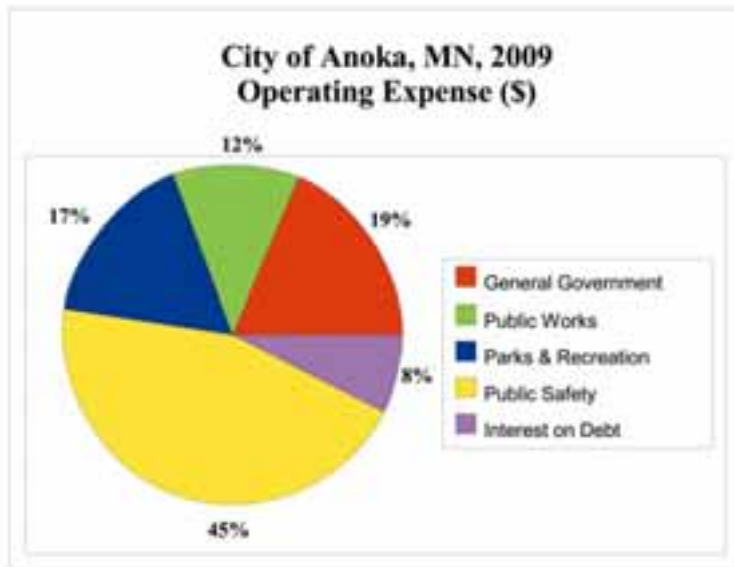
Grants were distributed using the same formula used by the granting agency used, and franchise fees were distributed based on electrical billing.

As mentioned above, property taxes are directly tied to land parcels, but there are adjustments that have to be made before determining the amount of property tax revenue that is derived from each parcel. One factor that affects revenue in the Twin Cities region of Minnesota is the **Fiscal Disparities** revenue distribution law, in which collects 40% of the growth in commercial and industrial development since 1971 into a regional pool. The value, and resulting tax revenue, is distributed back to cities based on the inverse of market value per capita. The result is that cities that have a lower market value than the regional average receive more, and those with a higher value receive less. This method deducts the contribution from the affected commercial / industrial parcels, and allocates the distribution back to the residential parcels based on the inverse of market value per capita.

Another factor that affects property tax collections is **Tax Increment Financing (TIF)** districts. Under TIF, all of the increase in value and taxes derived from an improvement to a district are removed from the operating budget, and dedicated to paying for capital improvements in the district. In addition, the taxes that would have been paid to the county and school district are captured and used in the same way. The city has 5 tax increment financing (TIF) districts, which bring in $2.5 million in capital revenue. About $1.1 million is captured local revenue, and $1.4 million is captured from the schools and county.

City of Anoka, MN, 2009
Capital Revenue ($)

Legend: Intergovernmental, Special Assessments, Franchise Fees, Transfers in, TIF Taxes
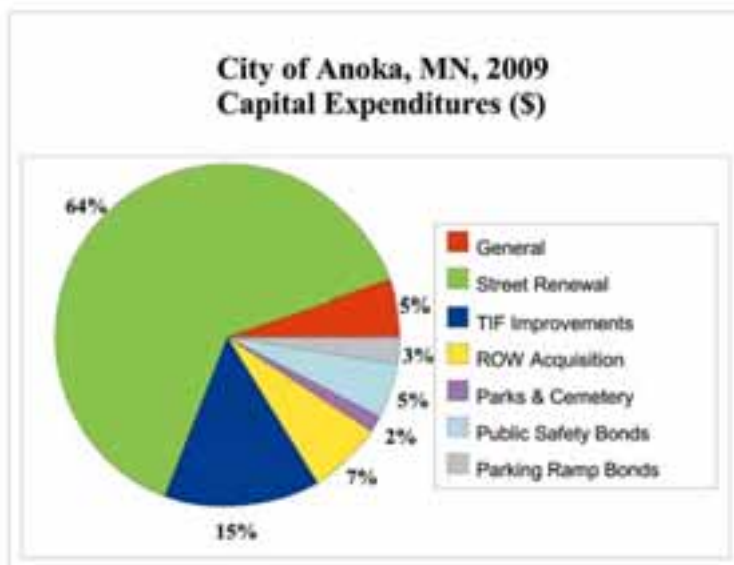
32% — 9% — 7% — 3% — 50%

On the capital revenue side, the largest source is the $2.5 million captured from (TIF) districts, accounting for 50%. TIF district parcels are identified in the parcel file. Special Assessments also came directly from the tax parcel file. Intergovernmental revenue was distributed based on the formula used by the granting agency.

**City of Anoka, MN, 2009
Operating Expense ($)**

12%

17%

19%

- General Government
- Public Works
- Parks & Recreation
- Public Safety
- Interest on Debt

8%

45%

The largest operating expense category in Anoka is for Public Safety, at 45%. To distribute this cost, it was estimated that 50% of the regular police expenses were attributable to police calls, and the remaining 50% was based on the overall need for a police presence in the city, including routine patrolling to protect both people and property. Therefore, 20% was allocated based on population, 10% to employment, and 20% to the property market value. Finally, fire expense was allocated separately by fire call locations. For parks and recreation the expense was distributed mainly based on population, but to a lesser extent based on employment. Public works was distributed based on the amount of locally maintained streets and sidewalks. General government was a bit less obvious: we used population, market value and employment.

**City of Anoka, MN, 2009
Capital Expenditures ($)**

64%

5%

3%

- General
- Street Renewal
- TIF Improvements
- ROW Acquisition
- Parks & Cemetery
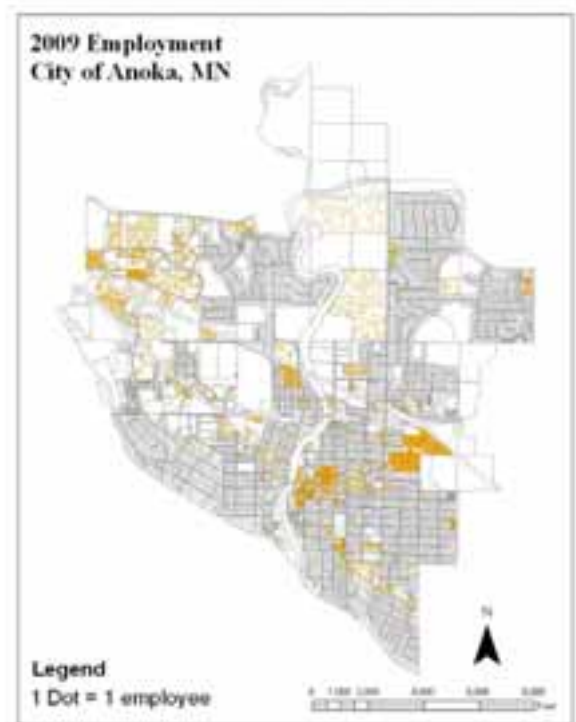- Public Safety Bonds
- Parking Ramp Bonds

5%

2%

7%

15%

Most of Anoka's capital expenditures are for street renewal, at 64%. The city is systematically renewing streets, neighborhood by neighborhood, with new base, pavements and curbs and gutters. This is paid for with special assessments, grants, and excess TIF revenue. Another large portion of the capital expenditures is to upgrade land in the TIF districts.
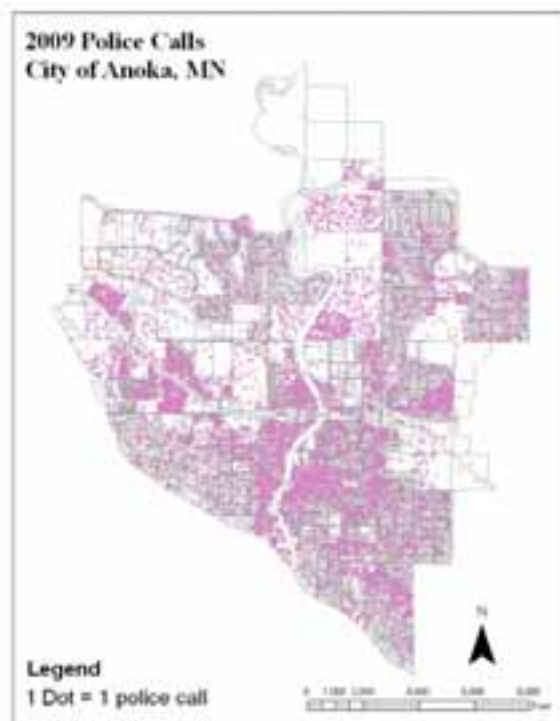
This has been a very brief explanation of the allocation methodology. The important thing was that everything was allocated down to the parcel level so that the results could be summarized by land use as well as a number of other factors.

Examples of Spatially-Distributed Factors and Allocations
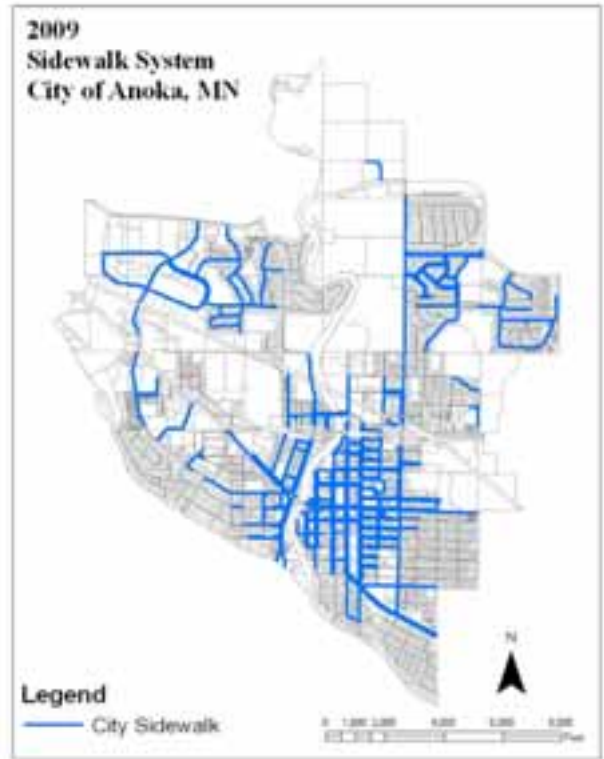
The maps below show the distribution of some of the allocation factors and the resulting distribution of some of the revenues and expenditures.
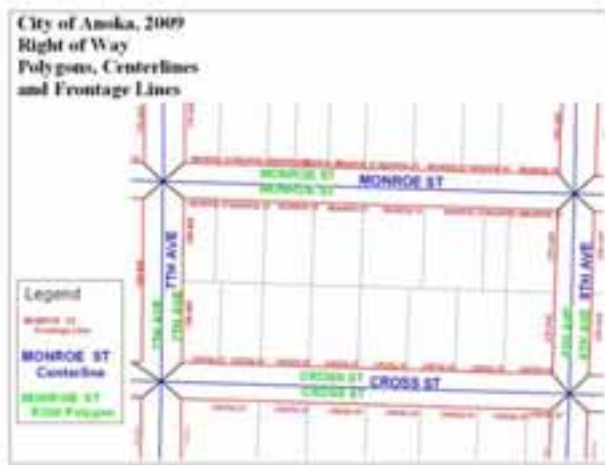

Population was estimated by using the known counts of housing units by type and using per unit multipliers supplied by the company named Excensus. Our unit counts were based on the tax parcel list and an inventory of apartment units from the city, which licenses all multi-family rental units. Employment numbers came from a city survey of all businesses, including home-based businesses.
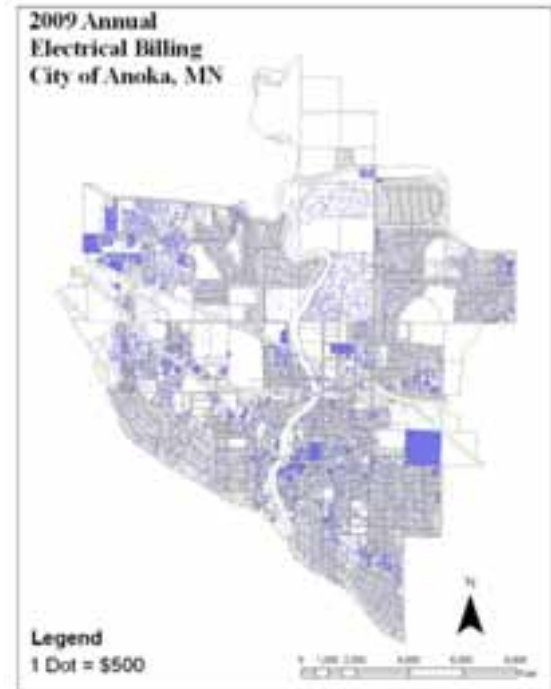

The distribution of police calls was determined by taking a database of all of the police calls for one year was address-matched to the parcel addresses. In the case of calls to intersections or to blocks, these were matched to the location and then allocated to parcels within the vicinity of the call. The same matching was done for fire calls.

2009
Road Jurisdiction
City of Anoka, MN

Legend
Jurisdiction
— County
— Local
— Municipal Street Aid
— State Highway
— US Highway

2009
Sidewalk System
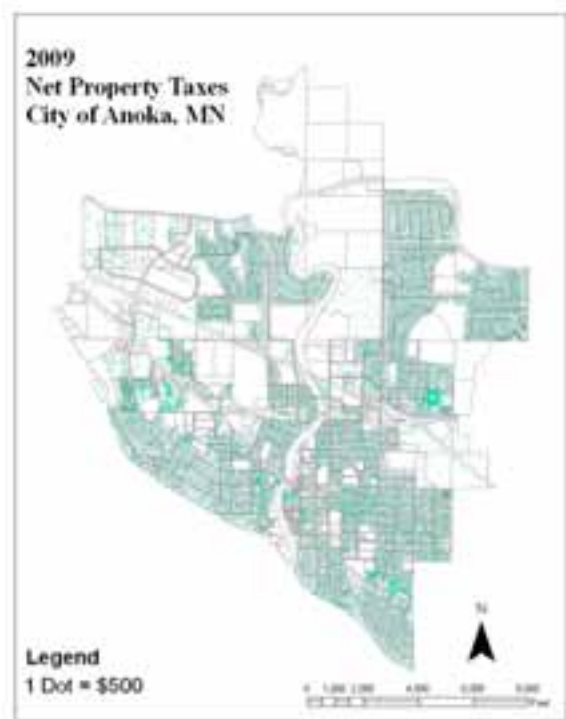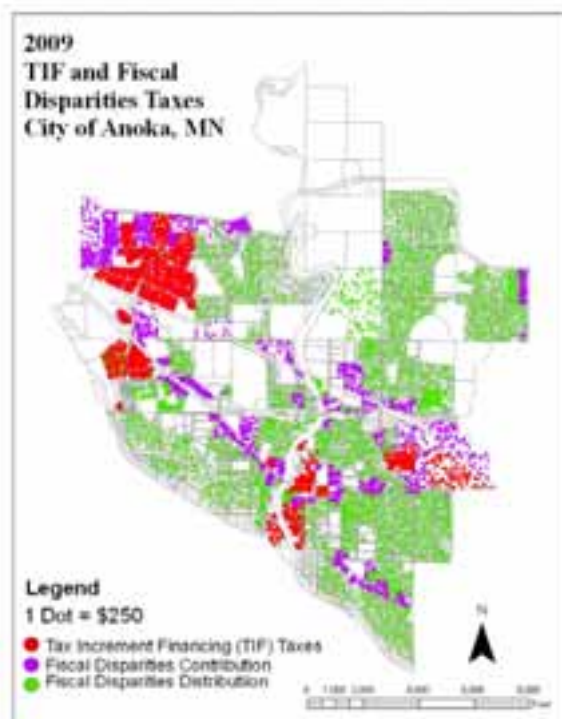City of Anoka, MN

Legend
— City Sidewalk

Public Works is also a significant operating expense, which varies greatly by land use type, especially residential. The parcel map from the county shows only shows the taxable parcels, with blank spaces between the blocks for the right of way. For this project, using the centerlines to split the blank areas down the middle and closing them off at intersections created right of way polygons. With the centerline data of road name, class and jurisdiction, this data was shared with the adjacent right of way polygons and parcels using topology.

City of Anoka, 2009
Right of Way
Polygons, Centerlines
and Frontage Lines

Legend

Electrical billing was also a very important database to be address-matched, since it represented over $1 million in revenue out of a $10 million operating budget.

As discussed earlier, under operating revenue, Tax Increment Financing (TIF) and the Fiscal Disparities law have a big impact on how property taxes are collected from land uses. The following maps show the captured TIF revenue, and the Fiscal Disparities contributions from the commercial / industrial land uses and the distribution to the residential land uses, resulting in the Net Property Taxes.
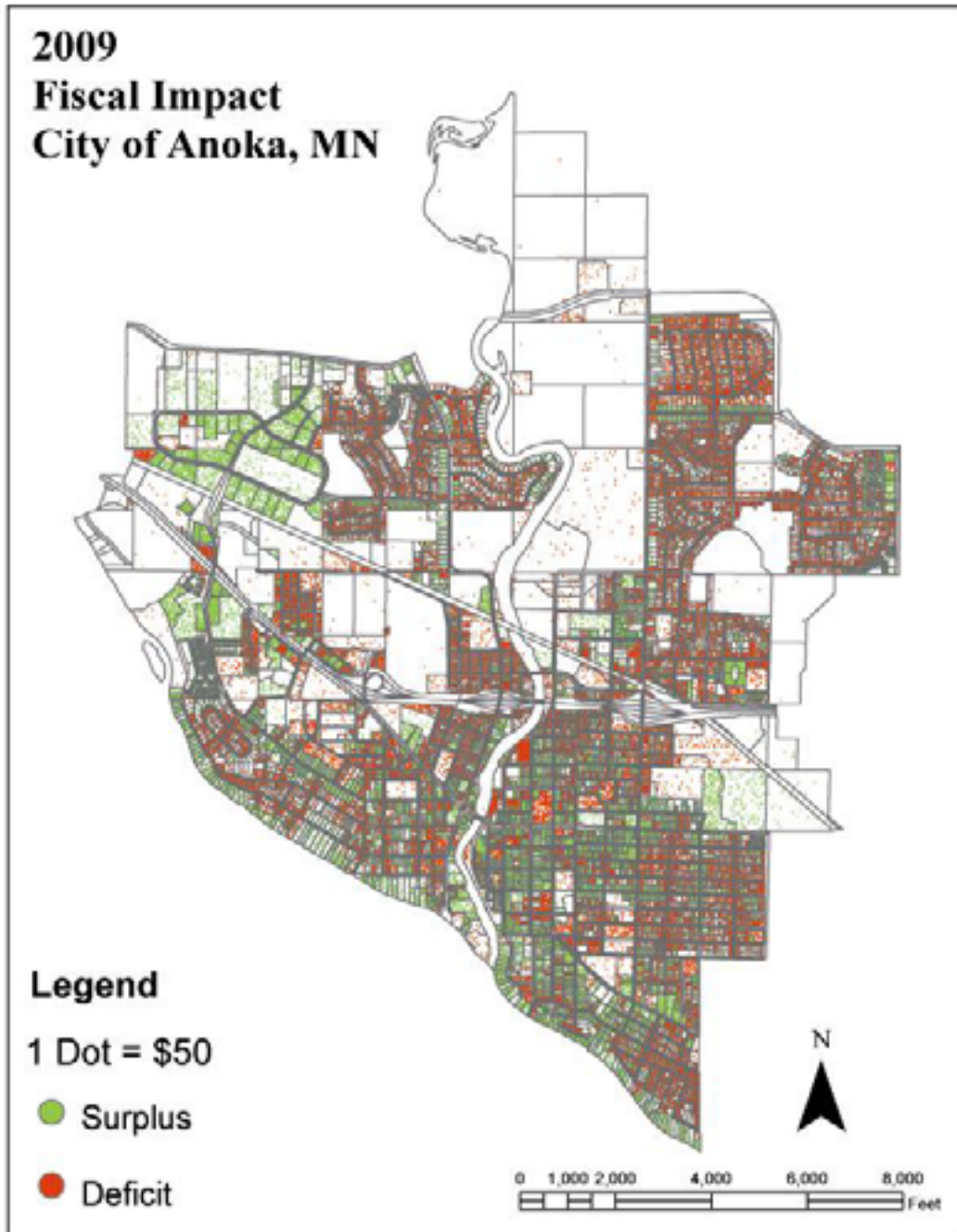

The above are only a few examples of the factors and allocations of revenues and expenditures. The important thing is that they are all distributed down to the parcel level.
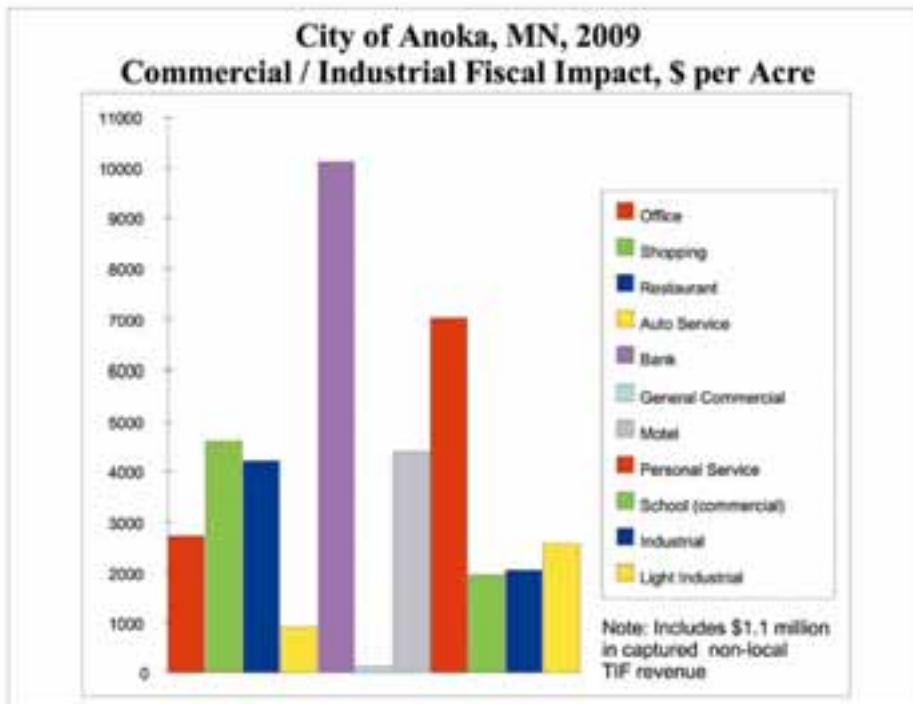
The purpose is not to single out any one parcel for analysis, since some of the factors are estimates only, as in the case of population. Rather, the purpose of the parcel level of data collection is so that the results can be cross-tabulated by land use, homeowner status, age of structure, neighborhood, building square footage, and so many other characteristics. It is not just fiscal impact that can be measured, but also the amounts and types of police calls to land uses and neighborhoods.
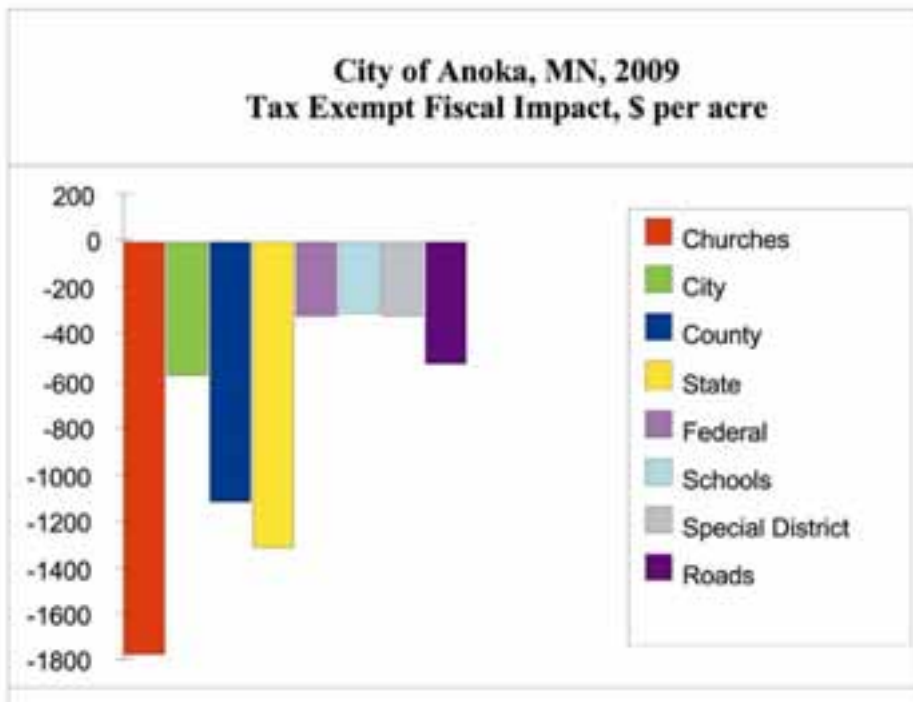
Fiscal Impact

The Fiscal Impact of the combined operating and capital budget is shown on the following map. Each red dot indicates $50 of deficit; each green dot is $50 of surplus. Charts also follow that show the impact by land use type. Everything could also be shown by operating and capital categories. Since Tax Increment Financing (TIF) has such a dramatic impact on Anoka's results, we could also show what the results would be without TIF. Unfortunately, that is beyond the scope of this article.

2009
Fiscal Impact
City of Anoka, MN

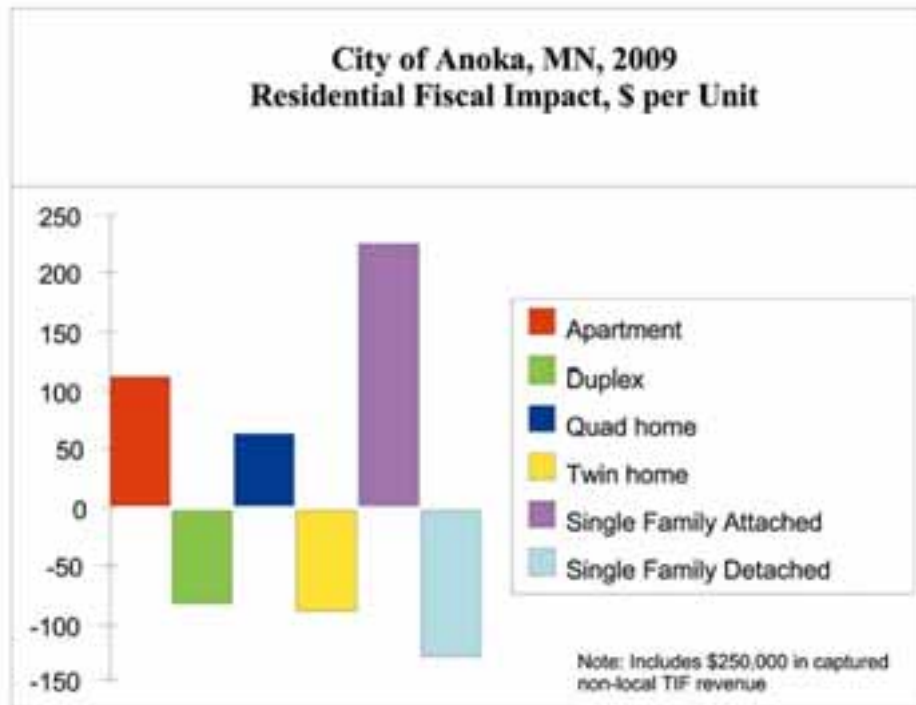Legend
1 Dot = $50
● Surplus
● Deficit

The tables that follow summarize the total Fiscal Impact findings. This data is summarized; in actuality there were 60 land use categories. There are so many ways the data could be shown; these are just a few examples.

Note that not all commercial and industrial uses have the same impact; there are big differences. Since the graph shows results per acre, commercial results are somewhat exaggerated because they tend to be more compact in land area than industrial. Another thing to remember is that many of these uses are in TIF districts, and bring in extra non-local revenue from the school district and county.

The city has many tax-exempt land uses. Including roads, nearly half of the land area of the city is tax exempt. That was a big consideration in this project. No other Fiscal Impact method includes a study of tax exempt. All of these uses generate a deficit, with churches and charitable institutions having the greatest on a per acre basis. The city is a county seat and therefore county and state uses generate deficits even greater than that of the city itself.

Lastly, the city has several different residential land use categories, with over 2500 apartments, 3500 single family detached, nearly 300 duplexes, and close to 700 single family attached residences. The results are skewed somewhat because some of the apartments and single family detached are in TIF districts and bring in non-local revenue.

Should these results be used by other cities? Not necessarily. Every city is unique and has its own set of revenues and financing policies, such as Anoka's electrical utility and TIF districts. The Fiscal Disparities law is unique to the Twin Cities metropolitan area in Minnesota, and has the effect of providing more revenue to cities with more low and moderate-income residents.

This project was completed with ArcGIS Desktop, and some earlier capabilities of PC ArcInfo and ArcView. The project took approximately 6 months to complete. About half the time was spend creating the GIS database. The remainder was spent working with city staff to properly allocate the data from the city's annual financial report, with input from the finance director, police and fire departments, assessor, planners, public works staff, economic development committee, and the city council. The city is using the data to guide a large redevelopment project for the city and to prepare its long-term financial plan.

In summary, the GIS method of fiscal impact analysis attempts to model the ideal "transaction processing" system as well as the ideal "enterprise GIS". The method includes all land uses, including tax-exempt, and all revenue and expenditure categories. The problem

with other methods is that population is not the only factor; there are many other factors and they are measurable and distributable with GIS. Each city is unique, and the best data comes from the city itself.

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