



Comptroller of the Treasury

Quarterly Fiscal Affairs Report



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State law directs the Comptroller to report on the state's fiscal affairs periodically. In this report, we provide a look at Geographic Information Systems.

Mapping the State

When Christopher Columbus set off for India in 1492, he was quite lucky to find America – his map was missing an entire continent.

Maps today have charted all of the continents and much more, and they are no longer limited to the paper versions used by European explorers. Maps are now electronic and the advancements made in their degree of precision, detail, and sophistication is remarkable.

“Maps tell us so much more than how to get from A to B, or where C is in relation to D. They can be tools of power and snapshots of history.”

Jerry Brotton

In the last few decades, one kind of map technology, Geographic Information System (GIS), has been used by individuals and organizations for many purposes, such as:

- Calculating how long it takes a person to drive from his or her house to a driver license station, polling place, or hospital.
- Estimating the property damage from a tornado.
- Identifying high-density areas of crime and designing police patrol routes around them.

The Comptroller's Office was one of the first state agencies to use GIS, when it was used for redistricting following the 1990 U.S. Census. The use of the mapping technology has expanded into many other areas over the past three decades, but its essential function remains unchanged: GIS is a tool for the government to use to uphold our core values. GIS allows us to increase the *accuracy*, *efficiency*, and *reliability* of government by collecting uniform, up-to-date data across the state. Additionally, GIS provides *transparency* and *accessibility* by making this data available to the public.

In short, *GIS makes government work better*, and this quarterly affairs report defines GIS, explains why it matters, and describes how the Comptroller's Office currently uses the mapping technology in three main areas: local government redistricting, property assessments, and city annexations.

What is GIS?

GIS stands for Geographic Information System. GIS captures, stores, and analyzes data in relation to the Earth's geography; it shows the physical locations of practically anything.

All GIS maps begin with a base map created with aerial photos. A person

By stacking layers on top of each other, GIS can show just about anything located just about anywhere.

looking at a GIS map may not realize that the rivers, lakes, cities, and roads they see are actually different sets of data layered on top of each other; however, GIS loads different "layers" over the base map depending on the type of data the map will ultimately show. It can draw county lines on top of the base map, for example, and then overlay cities. Data can vary from different points – schools, polling places, Walmarts – to lines, such as roads and creeks. Maps can also include filled-in areas, like electoral districts, state parks, and school districts.

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A Brief History of GIS

The Comptroller's Office began experimenting with the precursors of GIS in the late 1960s. In 1966, a state contractor flew over Tennessee and took aerial photos to begin creating a uniform base map of the state. In 1968, the Comptroller's Office first uploaded data into an IBM mainframe and proved that redistricting could be done by a computer.

- In 1997, the Comptroller's Office began converting all paper maps of county property data into an electronic format. Tennessee was the first state in the country with a statewide, digital map of all of its properties.***
- In 2000, the Comptroller's Office began using GIS for census purposes. In recent years, the Comptroller's Office has been recognized by the U.S. Census Bureau for accurate and high quality data, which the federal government has incorporated into its national census system.***
- In 2016, the Comptroller's Office merged property assessments, GIS mapping, and property tax appeals into one computer program, IMPACT. Currently, 83 of 95 counties use the state's IMPACT system.***

Why GIS Matters

Now consider for a second the mapping situation without GIS.

Rather than one central map on a computer, imagine all 95 counties in Tennessee with their own paper maps, and *different* paper maps for everything: one map for cities and roads, one map for

water and sewer lines, and yet another map for county commission districts. Furthermore, think of the time and money involved in updating each map by hand, reprinting it, and redistributing it every time something changed.

GIS both eliminates an enormous stack of paperwork and streamlines the communication of data. With GIS, all governmental levels (local, state, and federal) can more efficiently share vast quantities of information in an electronic format that is easy to retrieve, easy to update, and easy to analyze.

Mapping in Practice

The Comptroller’s Office uses GIS in three main areas: local government redistricting, property assessments, and city annexations.

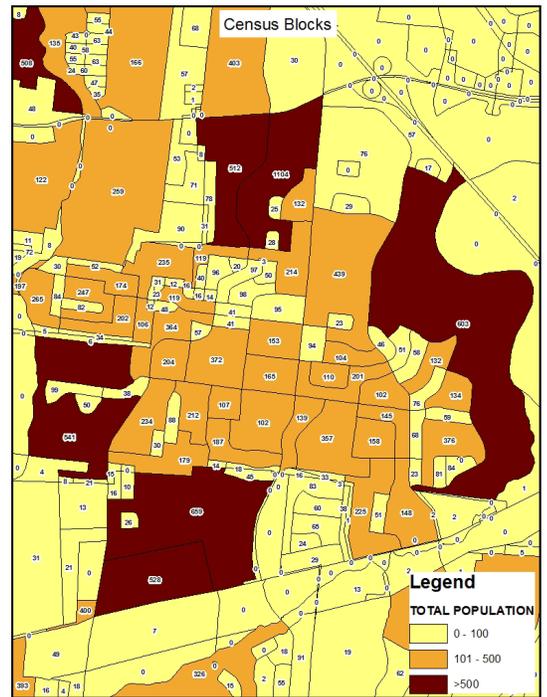
Local Government Redistricting

Redistricting is an integral part of our democracy, as it is fundamentally connected to the right to vote. The redistricting process is a challenging, once-in-a-decade event that is like a puzzle centered on the following question: **How can one large geographic area – a county, a city, or a state – be split into smaller areas with equal populations?**

In 2015, an estimated 6.6 million people lived in Tennessee. That population is divided into “puzzle pieces” – in this case, census blocks. A census block, put simply, is a unit of land bounded by physical features, like a street, a road, or a creek.

In rural areas, a census block may be very large geographically, but contain only a few people; one census block may stretch over 100 acres and several farms, but contain only six people. In urban areas, however, a census block may be much smaller geographically while holding significantly more people. For example, a city block containing an apartment complex of 600 people may count as one census block.

By examining a map of each area, the Comptroller’s Office inspects every census block by hand. As cities grow, rural areas are developed, and subdivisions pop up, the Comptroller’s Office constantly makes recommendations to split census blocks into smaller, more manageable areas. With almost 250,000 census blocks across the state, tracking



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the inflow and migration of millions of people is a momentous task. *Without GIS, the Comptroller’s Office would be filled with employees keeping track of those 6.6 million people with stacks of paper and calculators.*

Once an area has been split up into census blocks, the Comptroller’s Office begins putting the puzzle back together so district lines can be drawn. To do so, the Comptroller’s Office must arrange the puzzle pieces – census blocks of varying sizes and populations – into districts that fit within the frame, such as a county or municipality, *and have equal populations*.

In practice, “equal” population means that all districts in the area deviate by no more than 10 percent, as outlined in a Supreme Court ruling. For some rural areas, this requires remarkable precision: for example, several county commission districts in Tennessee vary from their ideal value by only one person. GIS technology is so advanced that the computer does most of the complicated computations; GIS calculates population totals whenever a district is drawn or revised, giving decision makers accurate information in real time.

The Comptroller’s Office provides technology and support for all 95 county election commissions and administrators of elections and helps to create and maintain the boundaries for:

- 844 county commission districts for 1,636 commissioners;
- 1,976 voting precincts; and
- 1,984 polling places.

And, like most things done with GIS, the final product belies the work involved: in the end, county commission districts and precincts are often printed and displayed on a simple paper map.

Property Assessments: Parcel Mapping

No one likes property taxes – in fact, they are consistently considered the “most hated tax” – but they are one of the primary sources of revenue for local governments in Tennessee. Correctly calculating property values upon which those taxes are based is a long and involved process, and the first step in the process is parcel mapping.

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A parcel is just a unit of property: a house, for example, or a shopping mall or tire plant. Within Tennessee, there are about 3.5 million parcels, and all of them are compiled on the GIS parcel map maintained by the Comptroller’s Office. Given the number of constant changes – merging lots, dividing large properties – maintaining an up-to-date map of every property in the state is no small feat.

While the Comptroller’s Office does not appraise the value of the parcels, the state consolidates property appraisal data from county property assessors into a centralized computer system called IMPACT. This system integrates the appraisal data for each property with the property’s geographic location on the GIS parcel map. Thus, a person can simultaneously look at a property’s physical location on a map and access that property’s appraisal data, such as the acreage, improvement value, square footage, plumbing fixtures, and other information. Without combining GIS and property data into one system, counties would need about 39,500 paper maps to keep track of their parcels.

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Although counties in Tennessee participate in IMPACT to varying degrees, the Comptroller's Office is involved to some extent with all 95 counties:

- **Eighty-six counties receive direct support from the Comptroller's Office.**
 - 61 counties use the state's IMPACT system, and send updated parcel mapping information to the Comptroller's Office every week.
 - 22 counties use the state's IMPACT system, but still keep paper maps. Once a month, the counties scan and send their updated maps to the Comptroller's Office, which digitizes the data and uploads any changes into IMPACT.
 - Three counties use their own appraisal and GIS systems, but receive support from the Comptroller's Office for GIS. Once a week, the counties submit updated parcel data to the Comptroller's Office.
- **Nine counties maintain their own appraisal and GIS systems.** At least once a year, the counties submit their data to the Comptroller's Office so that the state has a complete picture of all parcels in Tennessee.

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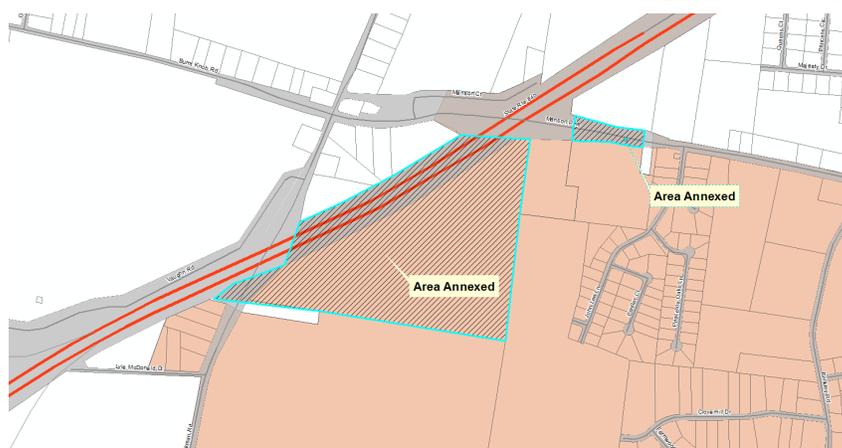
the system to appraise and assess public utilities and transportation properties, such as water service providers, electric companies, telephone providers, railroads, and airports. IMPACT is also used in the review of property tax exemption applications submitted by religious, charitable, and educational organizations, and in the resolution of disputes over property assessments.

At the local level, property assessors also use GIS during field reviews, when they visit the property. Thus, assessors get three pictures while on site: the property in front of them, a picture of the property at an earlier date through GIS, and assessment data through IMPACT. By combining all of this technology, assessors can easily see if a property owner has built a barn or added a room to the house since the last assessment.

With its many functions and uses, IMPACT is a vital system for the Comptroller's Office, and is another example of how GIS provides a fundamental, if overlooked, service that supports many important government functions.

City Annexations

Like most other states, city annexations occur in Tennessee, and while some annexations involve large areas, many are as small as a single house on one acre.



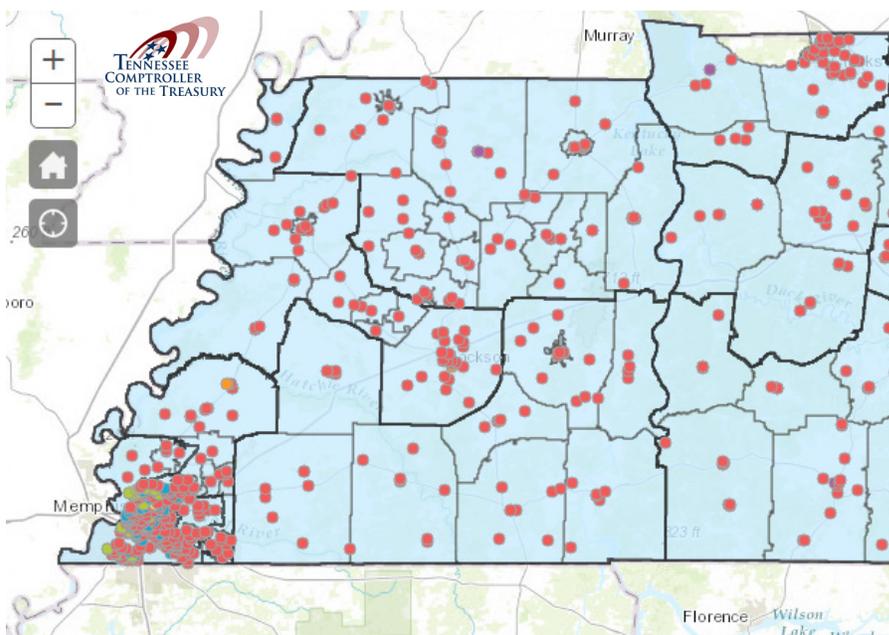
Regardless of their size, annexations change the map of a city, and these changes affect such public affairs as taxation and electoral district boundaries. To collect property taxes, cities first need to know who is responsible for paying them, and municipal mapping defines who lives within the city limits. Annexations also change city population totals, and eventually affect county commission district boundaries and voter precincts when they are redistricted.

By law, municipalities are required to submit records of all annexations to the Comptroller's Office, which then updates city boundaries in its GIS system.

Special Projects

In addition to redistricting, property assessments, and city annexations, the Comptroller's Office also uses GIS for a wide variety of special projects:

- In 2016, the Comptroller's Office worked with the Tennessee Wildlife Resources Agency and several local governments on the Cumberland Plateau Elk Restoration Zone. By using parcel data, the Comptroller's Office identified almost 11,000 pieces of property within the elk zone.
- In 2015, the Comptroller's Office released education-related legislative profiles that overlay state Senate and House districts with school districts. The interactive, searchable, and clickable maps provide a wealth of information about school funding, school performance, and student demographics for every public school and school district in Tennessee.
- Also in 2015, the Comptroller's Office helped a county with its goal to locate a polling place within 15 minutes of all of the county's voters. The Comptroller's Office used GIS to identify optimal polling place locations to minimize driving time for voters.



Beyond the Comptroller's Office

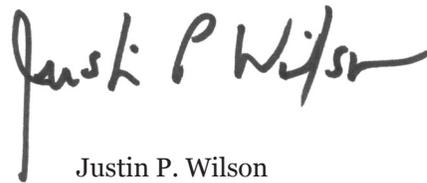
Although the Comptroller's Office was one of the first state agencies to start using GIS, many other agencies use mapping in their day-to-day operations. Several of them use data maintained and provided by the Comptroller's Office. For example:

- **The Tennessee Wildlife Resources Agency** uses the Comptroller's parcel data when purchasing land for conservation purposes.

Mapping the Future

Although the current GIS system is already state of the art, the Comptroller's Office is always striving to improve. Currently, the Comptroller's Office and the Administration are working together to enhance the electronic map of Tennessee called the TNMap. The TNMap contains an unprecedented variety of data, from high school and college graduation statistics to historical sites, Civil War battlefields, water quality data, and even daycare locations.

In addition to collecting and sharing data, the future of GIS includes endless data analysis possibilities. Eventually, the Comptroller's Office may be able to model property values, and predict population and property trends that tie into a county's fiscal health. The availability and accessibility of this data will help to ensure public safety, promote economic development, protect the environment, and support local officials in making local decisions – in other words, it will make government work better.



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