



# Geo-Enabled Elections

**What is GIS?** A geographic information system (GIS) is a software program that uses a variety of data sources to create, manage, and analyze data in a visual geographic context. GIS integrates data locations (such as the addresses where people are registered to vote) with geographic information (such as a map of where voters live). GIS helps users understand relationships between data sets in a map format.

## Getting Started with GIS

### What you will need

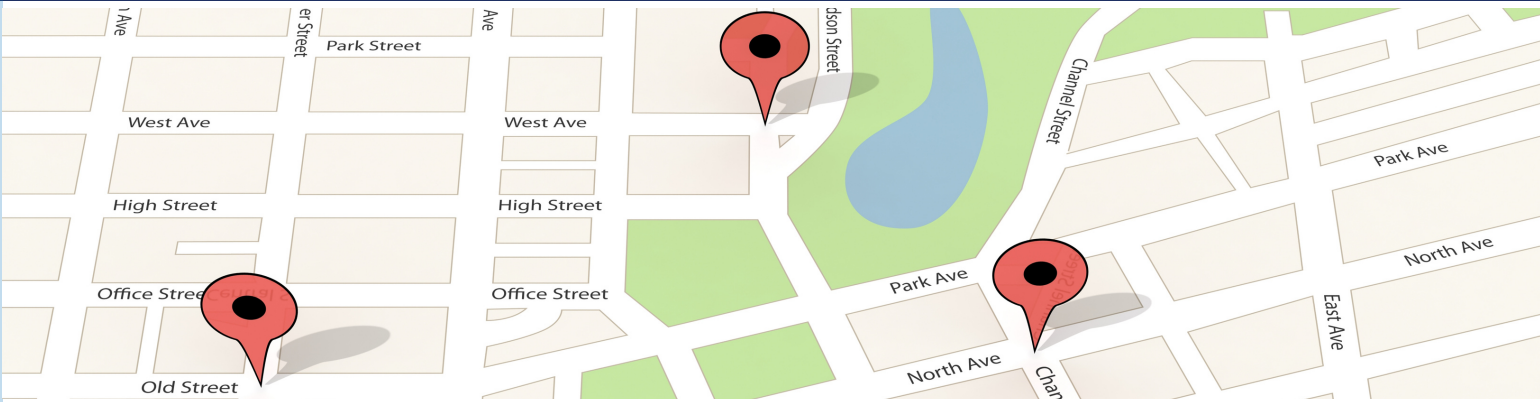
You will need to identify and secure the resources necessary to create and maintain a GIS database to get started. Many agencies already utilize GIS for other services such as public safety or land records. Identifying existing resources and key stakeholders already using GIS in your jurisdiction can streamline the process of integrating GIS into election administration. If you are starting the process from the beginning, the essential elements to build a GIS database are software, hardware, and data.

### Software

There are many different free and commercial GIS software options for election officials. Determining which GIS software to use will depend on the size of your budget, the technical ability of users of the database, and the level of technical support needed to troubleshoot the software. Just like any other purchase, all purchasing policies and procurement rules should be followed when selecting GIS software.

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## Hardware

GIS databases can take up a lot of storage space, depending on if the database is web-hosted or if the data is stored on a remote server. Before any software purchase, assess all personal computers, servers, and network connectivity to ensure they can support a GIS database.

## Data

A GIS database comprises multiple datasets, referred to as layers, stacked on top of each other in a single interactive map. What distinguishes a GIS map from a paper or printed map is the ability to see all of the different data layers separately, in subsets, or together.

## Creating Layers

### Base Layer

A base layer, made up of satellite imagery and geographic features, gives the other layers in a GIS database context. The U.S. Census Bureau Topologically Integrated Geographic Encoding and Reference (TIGER) data can be a great starting point for creating a base layer. TIGER/Line shapefiles can be found on the U.S. Census Bureau website <https://www.census.gov/geographies/mapping-files/time-series/geo/tiger-line-file.html>, and include:

- Topography maps
- Aerial photos
- Road centerlines
- Highways, streets, and water features
- Census tracts
- Census blocks

## Address Point and Property Layers

GIS databases rely on a comprehensive set of addresses. Property boundaries can be used with aerial images from a base layer to associate address points to buildings and land. Adding a zoning layer can help identify business addresses. Examples of address point and property layers include:

- Land record situs addresses
- Tax assessor parcel boundaries
- Zoning data
- U.S. Postal Service delivery addresses and zip codes
- Public safety agency emergency route addresses
- Building & Safety permits
- Public works road signs
- Voter address lists

It is common for names of geographic features such as highways, roads, and streets, to be inconsistent when comparing multiple address datasets. For example, Ocean View Ave. vs. Oceanview Ave., HWY 95 vs. Highway 95, 2nd St. vs. Second St. Working with different address point layers will include determining naming protocols and standardizing addresses among datasets.

## Voting Precinct Layer

Creating a voting precinct layer requires knowledge of how to use GIS software. If you are not familiar with using GIS, it is a best practice to identify other qualified individuals within your organization or hire a private contractor to assist with creating a voting precinct layer. The basic steps of creating a voting precinct layer include:

- Locating the latest set of precinct legal descriptions
- Locating maps showing precinct boundaries
- Creating polygons of the precinct boundaries using GIS software

A polygon is a plane figure, usually with three or more sides that connect to each other. A GIS polygon is the area on a map used to represent the shape and location of different types of data. For example, voting precincts, cities and districts can all be represented by polygons.

## Voting Precinct Layer (continued)

Jurisdictions define precinct boundaries in various ways, such as census data blocks, metes and bounds, or other methods. The process of drawing the shapes of precinct boundaries is referred to as creating polygons for a shapefile. GIS professionals may not have the specialized background to create the voting precinct layer from reading complex legal descriptions, so this step may require the collaboration of multiple professionals to complete. Once you have created the voting precinct layer, it usually only needs to be updated if boundaries are changed.

## Geopolitical Geography Layers

Many geopolitical district datasets already exist and only need to be located and uploaded into the GIS database. Congressional and state legislative districts may be available from state redistricting organizations. The U.S. Census Bureau also maintains a repository of states' congressional and state legislative district boundaries. Examples of departments that keep and maintain local shapefiles are information technology, building and safety, planning, assessors, or dedicated GIS departments. Examples of geopolitical geography layers include:

- Government-based geography boundaries (e.g., counties, cities, towns, etc.)
- Political-based geography boundaries (Congressional, state legislative, and other statewide elected district offices)
- Local political-based boundaries (e.g., schools, hospitals, services districts, etc.)

## Address Point Data

Address points and geographic data can be found in U.S. Census Bureau TIGER data, US Postal Service data (ZIP+4), assessor and land use data, and emergency management systems or 911 databases. Third-party datasets may contain other features outside of your jurisdictions. You can filter the datasets, so only useful information is included in your GIS database.



## Election Administration

Once you configure your GIS database, it can be used to increase the accuracy, efficiency, and transparency of election administration.

### Geocoding

Using GIS, you can overlay all layers to examine addresses, precincts, and districts for accuracy. A process known as geocoding will assign a point on the map for every address in a street file. These points can be compared to other information contained in the GIS workspace to identify discrepancies. Geocoding is a valuable tool to validate changes made to precinct and district boundaries in election management systems. See the EAC's Local Election Officials' Guide to Redistricting for additional information: [https://www.eac.gov/sites/default/files/2021-08/LEO\\_Guide\\_to\\_Redistricting.pdf](https://www.eac.gov/sites/default/files/2021-08/LEO_Guide_to_Redistricting.pdf).

### Selecting Polling and Drop Box Locations

Adding GIS layers such as population data and public transportation routes can assist election officials with strategically locating polling places and drop boxes in areas where they are accessible to voters. Locations can also be pre-assessed by examining aerial photos of parking lots and accessible paths of travel before traveling to locations to confirm they meet accessibility requirements.

### Polling Place Look-up Tools

Helping people find their voting location is an important part of election administration. You can use a GIS database to create address-specific look-up tools, similar to other familiar map applications. The look-up tools can be configured with location-finding features, such as displaying how far a polling place is from a current location and guidance on reaching the polling place on foot, by vehicle, or with public transportation.

### Polling Place Wait Time Management

A GIS database can also track how long it takes to vote at polling locations and assist with resource management decisions. Poll workers must collect timing data and upload the information into a centralized database. Data can either be shared in real-time on web apps accessed during voting hours or stored and analyzed at a later date to inform resource allocation or site selections in future elections.

## Public Education

When designing web-based information systems, election officials should keep in mind that many voters either do not have access to the web or are not skilled in using the web. Any information available via the web should also be available via other means. Election officials should also review their web-based information systems for usability and accessibility.

## Elected Representative Look-up Tools

Voters do not always know who their representatives are or how to contact them. A GIS database can help voters find who represents them at every level of government. Representative look-up tools should be configured based on addresses and no other personally identifying voter information, so all people can find their representatives, even when not registered to vote.

## Ballot Look-up Tools

Election officials can help voters be informed about candidates and issues before voting occurs. Because what is on a voter's ballot is determined by where they live, GIS address look-up tools can help voters find ballot information for all contests they are eligible to vote.

## Election Results Reporting

There are many ways to display election results on websites. Posting election results in PDF reports with cumulative data for an entire jurisdiction is a common practice. However, PDFs are not always useful or accessible for election analysts, candidates, voters, and the media. GIS can be used to visually display election results by voting precincts, or other geopolitical boundaries, to help better analyze election data.

The National Institute of Standards and Technology (NIST) published the Election Results Reporting Common Data Format Specification Revision 2 in March 2020 to assist election officials with standard methods for election results reporting. These formats will increase transparency and reduce costs to election jurisdictions by reducing the complexity in election management. Read more: <https://pages.nist.gov/ElectionResultsReporting/>.

