Upgrading a City's Land Base

Jacksonville Beach Uses ArcGIS Survey Analyst

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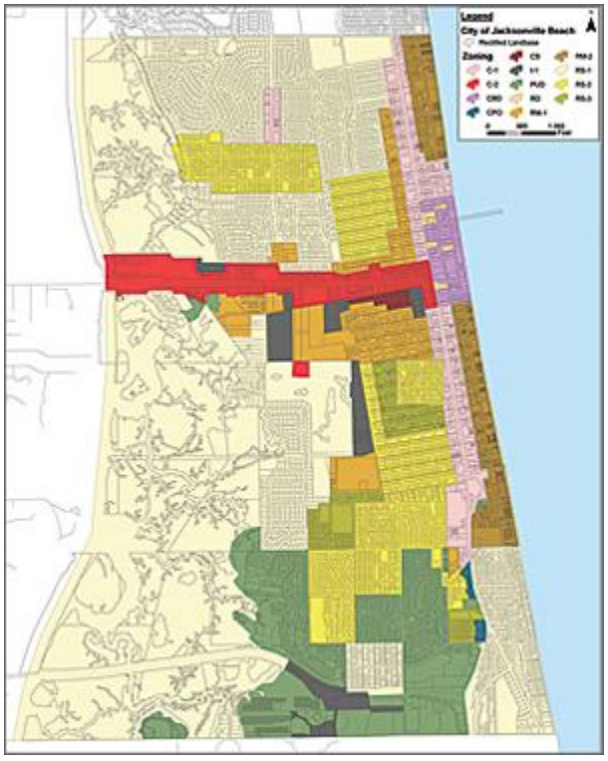
Highlights

- ArcGIS Survey Analyst improves property line and right-of-way information.
- With GPS benchmarks and control points collected in the field, the team improved existing parcel information.
- Land-base enhancements have led to improved planning and public safety services.

Inaccurate documentation of property boundaries poses many problems for local governments in the United States. Spatial inaccuracies within a land base can lead to the inadvertent placing of utilities or other publicly owned facilities on private property when originally intended for placement in a right-of-way. Moreover, erroneous parcel information can often lead to disputes over property lines.

The City of Jacksonville Beach in northeast Florida experienced some of these problems because of significant spatial and attribute inaccuracies in its land base. Large numbers of parcel boundaries and right-of-way lines did not correspond to their known dimensions or locations, preventing the city from providing a variety of public services with a high level of confidence and precision.



A new and accurate zoning layer resulted from the updated land base.

"Without accurate parcel and right-of-way information, the city couldn't move forward with its infrastructure projects on a timely basis," says Donald F. Terrell, senior network administrator for the City of Jacksonville Beach's Information Technology Division. "A more precise land base would allow us to leverage this information among multiple city departments and introduce new applications and improved services."

Going Beyond the Typical

Typically, local governments have tried reconciling boundary lines using enhanced aerial photography, or orthophotography, and other planimetric data to visually place the location of parcels. But the city knew that its particular needs required going beyond this method. In an attempt to develop an accurate land base and public support, the city began exploring its options.

As it happened, staff at the local City of Jacksonville office of the facilities and infrastructure consulting firm of Reynolds, Smith and Hills, Inc. (RS&H), had another idea for the city. The firm proposed that the city improve its land base using the tools in ArcGIS Desktop software with its ArcGIS Survey Analyst extension, which features the Cadastral Editor workflow.

Cadastral Editor allowed the city and RS&H to create a topologically integrated geodatabase, or cadastral fabric, made up of lines, line points, points, and polygons that represent each parcel layer. Once the existing parcel data was integrated into the cadastral fabric, new fields containing the dimensions of each parcel segment were generated by the software. These dimensions were then compared with known dimensions collected in the field and corrected using Cadastral Editor's coordinate geometry (COGO)-based data entry capabilities.

Data Cleanup and Field Collection

Prior to building the cadastral fabric, the team first performed a massive cleanup effort on the existing parcel data. The most common data issues involved pseudo nodes, overshoots, undershoots, and densified arcs:

- Pseudo nodes are arbitrary nodes located along the parcel vertex, which split parcel lines into multiple segments. Without correcting pseudo nodes, the dimensions would be split between segments, causing multidirectional distortions in the parcel shapes.
- Undershoots occur when the parcel line is too short, leaving a gap.
- Overshoots occur when the parcel line is too long, leaving a dangling node.
- Densified arcs are a sequence of many straight lines that are connected to make a curve.

These issues might have become a major concern when building the polygon layer of the cadastral fabric, since the Cadastral Editor does not create polygons unless parcel line segments are all connected at nodes, and the fabric only supports true arcs. However, RS&H sidestepped all these issues by acquiring one of ESRI's developer samples, the CurveConversion Command, which converts densified arcs into the required true arcs.

Concurrently with the data cleanup effort, the team also collected GPS benchmarks, monuments, and known locations of points—such as manholes, fire hydrants, and light poles—from high-resolution aerial photography provided by the city. Using this information, the team created a 14-section grid, dividing the project at major roadways. The team collected points using a Trimble GeoXH GPS unit coupled with a Zephyr antenna, providing submeter horizontal accuracy. These points were then postprocessed prior to incorporating them into the fabric to ensure subfoot horizontal accuracy.

Fieldwork for Jacksonville Beach's land-base upgrade included collecting GPS points.

Parcel Rectification

The team began parcel rectification once the clean data and control points were built into the cadastral fabric. With nearly 15,000 parcels to rectify, RS&H designed a workflow that maintained the 14 grid sections and created a separate fabric for each one. This step streamlined the quality control and assurance process.

At the project's onset, the team set a five-foot tolerance on the parcels and identified three status categories: in-progress, review, and historical. In-progress parcels were those that still needed to be edited, while review parcels were those that had been edited but did not fall within the five-foot tolerance or were missing dimensions. The historical parcels were edited and within the five-foot tolerance. The initial analysis of the data involved identifying parcels that exhibited the correct dimensions and marking them as historical. Parcels in the review category were plotted on an aerial background and given to the city for final approval or direction for further correction.

While rectifying the parcels, the team used high-resolution aerial photography as the base layer to ensure proper placement of city blocks after they were disconnected and edited. It was extremely important to maintain and correct right-of-way information when reconnecting the parcel blocks. The accuracy of parcel corner points and dimensions was maintained within five feet.

A Proven Success

The City of Jacksonville Beach's land-base upgrade using ArcGIS Desktop software with its ArcGIS Survey Analyst extension is now benefiting the city's public safety and planning initiatives in a variety of ways. The police department is now using the new information to create more accurate maps for its emergency dispatch units and computerized enhanced 911 emergency services system. These improvements are possible due to the more accurate right-of-way dataset, which allows the creation of a more precise street centerline shapefile used in the geocoding process. In addition, the improved land base is being used by the city's planning and development, public works, and electric departments to make better decisions regarding the location and placement of utilities, as well as to better manage the city's assets.