# Lake County Enhances Fire Rescue Response Zones with GIS and Network Analyst

*A Case Study*

## Highlights

- Clear understanding of resources
- Better means to validate service demand needs
- Improved decision-making
- Better, faster, smarter response times

## Return on Investment (ROI)

- More informed strategic planning for costly public safety improvement
- Savings to county staff time by automating digital maps instead of hand drawn paper maps
- Saving lives by saving time

## Contact Us

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Lake County, FL has recently taken advantage of the current lull in development to spend time creating an automated process using GIS and ESRI's Desktop ArcGIS and the Network Analyst Extension to re-evaluate and enhance Fire Rescue Response Zones, create a Model to ensure ease of updates in the future, and give the County a more valid and intelligent decision-making tool for resource management and life-saving community risk assessment.

**Background:**
Historically, Lake County was a largely rural agricultural county of approximately 1156 square miles with 14 small municipalities. The 1990 population was approximately 150,000. But by 2007 it had more than doubled to a population of over 300,000 with a peak of 6,235 new house construction building permits per year in 2006. The county GIS Division had just been formed in 1998 and began its parcel mapping project in 1999, so most other large GIS projects were not started until that crucial layer was available. That meant that most reference maps were done by hand at a relatively small scale and used merely to supplement other resources.

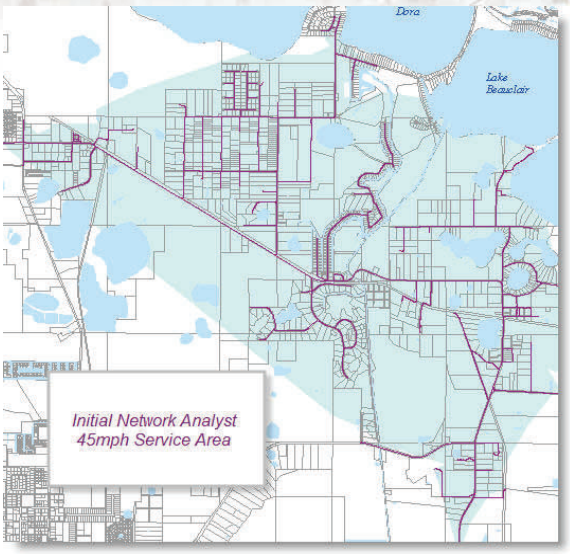
**The Issue:**
Lake County Department of Public Safety's Fire Rescue Response Zone maps were such hand drawn maps – usually a separate map for each fire station. They were based mainly on historic and local knowledge of senior command staff and/or long tenured firefighters at the stations. Updates were infrequent and had to be replicated on multiple maps of varying sizes. There was always the potential for maps to get out of sync or updates not carried through the whole series, and the base maps on which they were drawn were constantly out of date as new infrastructure was continually being added through new development and road construction.

**The Solution:**
Once the parcel layer was completed and the GIS staff was free to pursue additional projects, Fire Rescue turned to GIS to help solve their problem of out of date maps. Specifically, the Fire Rescue Response Zones failed to adequately validate the most effective and efficient use of their resources. The obvious choice was to employ ESRI's Desktop ArcGIS and the Network Analyst Extension to create a series of Service Areas, or Response Zones, for each of the fire stations in Lake County.

The first step was to ensure proper connectivity in the county's Streets layer. Intersections were connected where appropriate, and eliminated in such places as along limited access highways and Florida's Turnpike, which runs through the heart of Lake County. The Streets layer was then processed into a Street Network Dataset within a File Geodatabase. From there, Service Areas were created for each fire station for 5 and 10 minute drive times based initially on a 45mph driving speed using the Network Analyst extension.

**Additional Issues:**
But despite the population growth in recent years, Lake County still has large rural areas. The average farm is approximately 100 acres, home sites of 5 and 10 acres are not unheard of, and there are many parcels of land 20 acres or more. While the Service Areas created by Network Analyst were a better solution than the historic methods of Response Zone map-

ping, they still did not show the whole picture. They created a region that encompasses all accessible streets and worked well in the denser populated urban areas, but large rural tracts of land tended to be split by the region boundaries, and Lake County address locations are tied to structure locations – not driveway entrances.

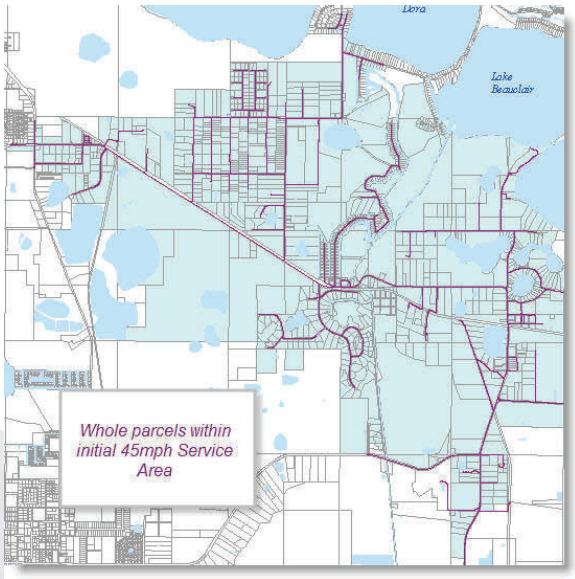



A structure located at the back of a large parcel might be in one Response Zone while the driveway entrance might be in another, and barns or other out-buildings could be in a third. This could not only potentially confuse jurisdiction, but also complicate additional analysis of population, structure distribution, and other statistical analysis tied to parcel data.

**A Better Solution:**
To address the problem of Service Areas bisecting parcels, the decision was made to go a step further and enhance the regions created by Network Analyst. Each Service Area region, individually, was compared to the Parcel layer and parcels were selected whose centroid fell within the Service Area. These selected parcels then were dissolved to create new, parcel boundary-based Response Zones.

This ensures that each parcel falls within one, and only one, Response Zone. Fire Rescue management could then make further manual adjustments to include or exclude parcels based on actual ingress/egress access constraints.

These new polygons provide Fire Rescue with a clearer picture of what is in each Response Zone and which fire station is responsible for what area. They can then make better decisions about primary and secondary response units and mutual aid agreements with the municipalities, and aligning the Response Zones with parcel boundaries also allows analysis of other data within each zone. Census block population data, Call analysis, and other, parcel related data, can be mined for use in reports. It also offers property owners and insurers a clearer understanding of which Response Zone properties are within in an effort to lower fire insurance premium rates and improve the County's ISO public fire protection class.




By using ArcGIS Model Builder functionality to create a model of this process, most of the basic steps in the workflow can be automated for easy updates in the future if new fire stations come on line or populations shift requiring new or adjusted Response Zones. The work can be accomplished by the currently assigned Data Technician employed by Fire Rescue Department. This allows for this Fire Rescue position to work directly with his decision makers - freeing up GIS Analysts for more complicated projects.

By enhancing the initial Network Analysis service areas to create less ambiguous parcel-based Response Zones allows for a clearer understanding of existing resources and provides for a better means to validate service demand needs. This will result in an improved decision-making process when strategically planning for costly public safety improvements that directly impacts the safety and welfare of all of Lake County's citizens, including the "boots on the ground" – our firefighters who carry out the fire rescue service mission.