A RISK TOO GREAT: USING UNMANAGED GIS DATA FOR EMERGENCY NOTIFICATION

GIS Data Management: A Critical Step for Ensuring Notification Accuracy and Reducing Risk

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GIS DATA MANAGEMENT: A CRITICAL STEP FOR ENSURING NOTIFICATION ACCURACY AND REDUCING RISK

INTRODUCTION

In public safety and emergency management circles, few topics have received more attention over the past few years than emergency notification technology and practices. The public is more aware than ever of the availability of these types of systems. In today's world of mobile devices and social networks, citizens now expect their local public safety agencies to be at least as "connected" as they are, being able to notify individuals rapidly.

At the heart of the ability to meet these expectations lies the need for accurate and reliable address and telephone data. These data must not only be present, but also placed correctly on a digital map for proper inclusion (or exclusion) within selected notification areas.

This paper examines one source for these data--commercial databases—with a goal of examining the real accuracy of these widely available telephone number lists with regards to proper placement on a map. Accuracy comparisons will be made between data acquired straight from a commercial vendor, and from a professional GIS provider where the data has been geo-coded and scrutinized.

The findings will help guide emergency managers and public safety officials in making critical decisions on the type and quality of household data underlying their emergency notification system.

MANAGED VERSUS UNMANAGED DATA

To better understand the issue, we must first define the difference between "managed" and "unmanaged" GIS data.

UNMANAGED DATA

Commercial list providers (and some notification vendors) offer for sale household-level data that includes name, address zip, etc. In addition to postal data, XY-coordinates (latitude-longitude) can generally be appended to each household record. These coordinates are intended to provide spatial location information. However, as these databases are most frequently used for commercial purposes such as direct mail, only minimal effort goes into ensuring the appended coordinates actually match the physical address. Since there is little manipulation with regards to placement on a map, we refer to this type of data as being "unmanaged."

MANAGED DATA

Managed data begins with the same commercial list as unmanaged data. However, significant additional effort is made to fine tune and precisely identify the physical location of each address record. Records are standardized, cleansed, compared to U.S. postal street data, and subjected to other

stringent verification processes. These additional steps define the difference between managed and unmanaged data.

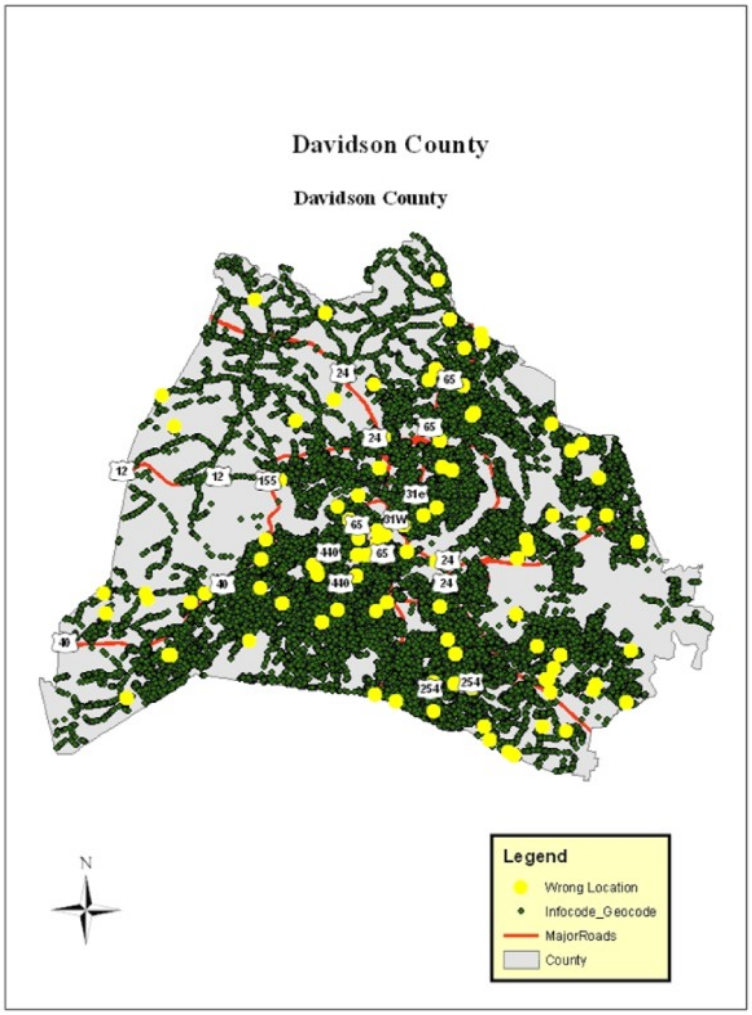
The hypothesis is managed data will produce significantly more accurate results than unmanaged data, becoming a much more reliable source for use by public safety officials. Will the hypothesis hold true? To explore differences in these data, a test case was developed for Davidson County (Nashville), TN. Analyses were conducted and conclusions were drawn.

A TEST FOR ACCURACY: DAVIDSON COUNTY, TENNESSEE (NASHVILLE)

To delve into differences between managed and unmanaged data, a commercial data source was acquired for Davidson County, TN (Nashville). The 2000 square mile area was chosen for a variety of reasons including: convenience and familiarity, central U.S. location, representative demographics, and mix of urban, suburban and even light rural areas. Such diversity provides for a better test bed for evaluating potential accuracy.

The data file obtained from a well-known commercial list vendor was plotted on a map using the XY coordinates included in the file as a location indicator. Then, the data was subjected to the various improvement processes associated with a "managed data" approach. Finally, results between the two approaches were compared.

FIGURE 1



FINDINGS

Out of approximately 170,000 records analyzed and manipulated, approximately 17,000 were placed on the map inaccurately prior to applying "managed" data processes. Thus, the data file exhibited an error rate of 10%. Figure 1 illustrates this finding.

Figure 2 provides additional insight. An example point, determined to be inaccurate, was selected and investigated further. In the case presented, the single map location actually contained not one phone record, but 35 phone records all assigned to the wrong location. Other types of errors were identified where households were placed at the wrong location.

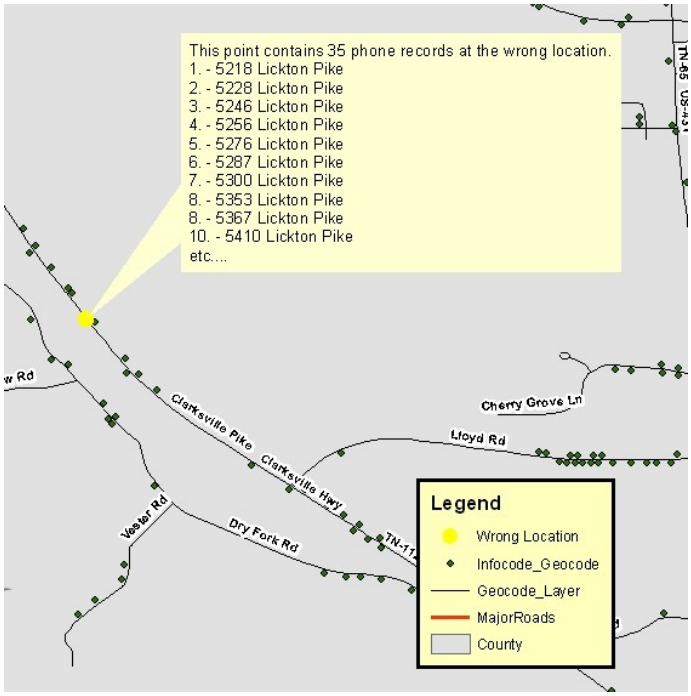


FIGURE 2

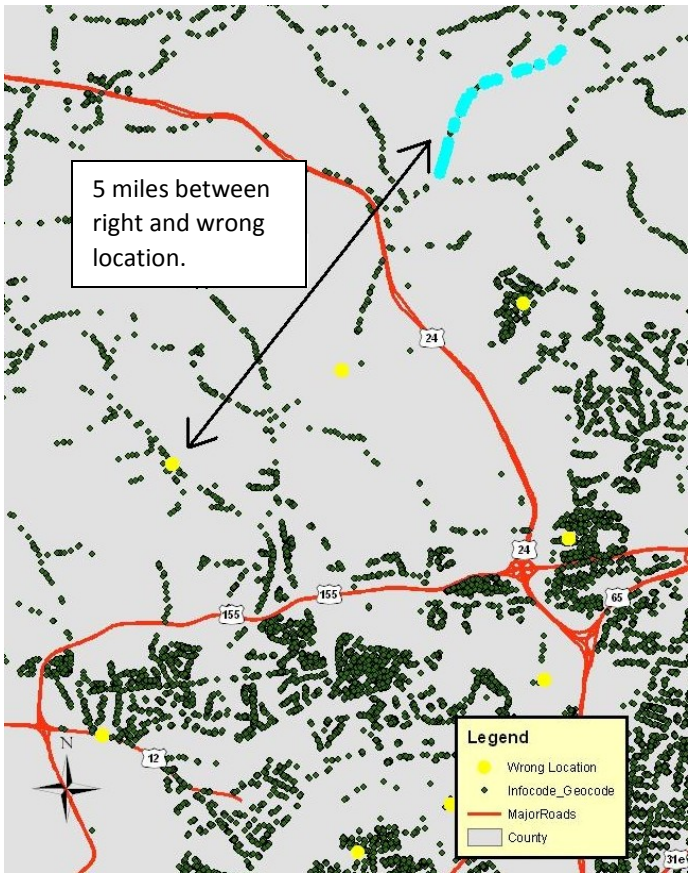


FIGURE 3

Just how far off were they? To answer this question, a random sample of inaccurate records was drawn. Calculations were then made to determine the average distance between the right location and the wrong one. On average across the entire sample, inaccurate records were off by approximately 3 miles. Some records were off by as much as 5 miles (see Figure 3).

Such findings indicate a significant portion of the commercial database contains inaccurate location information, and the inaccuracy is potentially large enough to be problematic for public safety purposes.

NOT GOOD ENOUGH

Based on the results of this case study, 10% of a commercial database contains inaccurate location information. The question remains: is that really so bad? When used for commercial or non-emergency purposes, this level of error rate is most likely acceptable. However, when used for emergency notification purposes, unmanaged commercial data introduces significant risks. These risks tend to fall within one of the following two categories.

EXCLUSION ERROR (HOUSEHOLDS THAT SHOULD HAVE BEEN NOTIFIED, BUT WERE NOT)

Inaccurate spatial data could mean households that should have been selected within a notification area were overlooked and consequently did not receive a critical alert. Several problems emerge from exclusion errors.

STILL IN HARM'S WAY

The most obvious problem when residents are missed in notifications is that citizens are left uninformed to the hazards of the current critical situation. Missed evacuation notices,

unheeded boil water notices, unheard shelter-in-place instructions--all can present serious consequence to people. Even if the number is few, residents who do not receive proper instructions can find themselves in serious danger—a problem that could have been avoided with complete and accurate household data.

FIRST RESPONDER BURDEN

When citizens find themselves in dire circumstances because they did not receive notifications, first responders must expend energy and resources to address citizen needs. . For serious events, first responders may be required to perform house-to-house evacuations or individual rescues, unnecessarily placing themselves in dangerous situations.

Even when notifications are used for less acute situations, missed public alerts due to inaccurate data can cause significant headaches. For example, in California, when weather conditions are ripe for wildfires, residents are required to move vehicles from narrow streets in order to allow fire engines to navigate their way to outbreaks. One large West Coast County utilizes its notification system to inform residents when these danger levels are high. One can only imagine the problems and delays caused by only a handful of vehicles left parked on the street because of missed notifications.

LEGAL LIABILITY & POLITICAL FALLOUT

While public safety issues are of the utmost concern, there are nevertheless other negative consequences of missing residents in notifications due to inaccurate GIS data. Among them are potential legal liability and damaging political fallout from poor public relations.

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"Lawsuits, both civil and criminal, against public safety agencies have become much more frequent in the last 25 years, with the advent of more Section 1983 usage and as our society, in general, becomes more litigious in nature. This is a growing problem in all areas of public safety work regardless of the size or location of your agency" says PSSG, a public safety-oriented advisory firm. [1]

With public safety officials utilizing a database suspected of containing significant errors, the environment is ripe for litigation. Accusations may range from basic "negligence" to full-blown discrimination. Though such suits are not currently widespread, the risk is clearly present.

In addition, public safety agencies are not immune to the political and public relations impact of certain residents not receiving a notification message. The media is adept at uncovering and disseminating unfavorable sound bites from local citizens. Negative publicity, though arising from a small number of people, can snowball to detrimentally impact a department's reputation. By supplying an emergency notification system with inaccurate data, the odds for producing negative publicity and harmful political fallout are increased dramatically.

[1] http://www.pssg.net/liability/liability.shtml

INCLUSION ERROR (HOUSEHOLDS THAT WERE MISTAKENLY INCLUDED IN A NOTIFICATION)

The second type of error that can occur when commercial GIS data is insufficiently managed is an "inclusion error." In this case, unaffected or undesired households are included in an emergency notification alert. While some may feel it is better to "over-notify" than "under-notify," there are nevertheless several problems caused by this type of error.

CLOGGING OF NOTIFICATION INFRASTRUCTURE

Many public safety agencies utilize on-premise emergency notification systems for alerting the public. In this deployment model, the computer server and telephone lines converge in a local operations center. These systems typically have connected to them a limited number of telephone lines which are dedicated to making emergency notification calls.

In crisis situations, telephone lines are precious resources to be managed with care. Extraneous calls to unwanted households consume limited resources unnecessarily, serving only to extend the time required to get the message to the right individuals.

TASKING OFPUBLIC COMMUNICATIONS

In today's world of instant communications and social media, information can spread rapidly across citizens in a viral manner. This can be both a positive and a negative outcome in emergency management. On one hand, rapid spreading of accurate information can be an aid to emergency services. On the other, the wide dispersion of misinterpreted or inappropriate information can be an obstacle to successful emergency response.

With regards to emergency notifications, delivering alerts to people outside of the desired audience may have unintended consequences on public communications. For example, personal emergency alerts can spark a wildfire of communications between the individual in the affected area and others. Citizens begin calling on land lines and mobile phones, eating up needed communications bandwidth. Clearly, adding to the existing communications traffic by including people in an automated notification who should not be receiving it does not help the situation.

Emergency communications networks may also be impacted. In urgent situations, people are more likely to place calls to 9-1-1 or other government resources in order to obtain information. Including undesired citizens in a callout adds to this possible bottleneck as well.

CLOGGING OF PHYSICAL INFRASTRUCTURE

In certain situations, inclusion errors can have a detrimental impact on the physical infrastructure's ability to handle traffic. In evacuation notifications, for example, those who are in the most eminent danger ideally are prioritized over others in order to minimize egress bottlenecks. However, including extraneous individuals in a notification callout will add to the traffic burden unnecessarily. Clogging the roads and bridges with people who are not in harm's way only serves to impede the progress of those who are.

COST CONSIDERATIONS

It is evident from our analysis and discussion the risk of using commercial data "out of the box" is high. However, a reasonable question still remains: "What is the *cost* of reducing this risk by adding a managed data process to the equation?"

The table in Figure 4 illustrates highly conservative cost examples for commercial data (one time licensing cost only). It further displays the typical InfoCode price for this data, including processing and correcting on a quarterly basis. Finally, it presents the additional cost per record for acquiring the processed and corrected data from InfoCode versus purchasing it directly from a commercial vendor. From this, we see the additional cost per record for managed data ranges from just under four cents to less than one cent, depending on the number of records.

Cost Comparisons: Unmanaged vs. Managed Data

Number of Records	Cost for Unmanaged Data (One Time Only)	Cost for Managed Data (Includes Quarterly Update)	Additional Cost Per Record
75,000	$2250	$5000	3.7 cents
150,000	$3750	$5500	1.2 cents
250,000	$5000	$6000	0.4 cents

FIGURE 4

All risks must be managed and evaluated relative to resources expended; using managed data certainly may be cost-prohibitive for certain agencies. However, accounting for the risks discussed here and the potential liability costs of dealing with any number of them, we believe significant incremental value is generated when investing a relatively small amount in managed data for emergency notification purposes.

CONCLUSION

We believe managed citizen data (i.e. processed and corrected) offers significant advantages over unmanaged citizen data (i.e. straight from the commercial provider) for emergency notification purposes. Our analysis of one carefully-chosen representative U.S. county illustrates commercial data sources include a significant numbers of errors that could cause a variety of problems and liabilities for public safety officials. When dealing with public safety, the risks of using unmanaged address data are simply too great to ignore.

About InfoCode

InfoCode Corp. provides data management, software development and GIS implementation related to public safety, public utilities and local government. Each customer served by InfoCode has access to a team of programmers and analysts with unique qualifications in their fields, resulting in unparalleled customer service and results.

InfoCode was launched in 1992, specializing in land-based data management for the real estate industry. As this data management evolved with the growth of GIS technology, InfoCode has expanded to serve the database, server, and network management needs of government agencies from coast to coast. As a TeleAtlas reseller (for map data) and an InfoUSA reseller (for commercial telephone data), InfoCode can accommodate any combination of client and commercial data to provide the ENS end-user with a custom approach to its geocode.

InfoCode was founded by Jim McLeod, Jr., a graduate of the University of Tennessee-Knoxville who now serves as president of the company, overseeing the day-to-day operations of the business, developing new products and services, and seeking out new business partnerships.

InfoCode

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