

Garbage In, Garbage Out—Maintaining the Integrity of E9-1-1 Data

Creating a Foundation for Wireless E9-1-1

By Sam Wallace

Consider how many 9-1-1 emergency calls come in to any given dispatch center where the caller in question is uncertain of the exact street name to give the dispatcher. Any person calling 9-1-1 may be under extreme duress and cannot think clearly and easily to convey where they are or what is wrong. It's also possible that a person who needs emergency assistance is in an area they are unfamiliar with. In these situations, precious time is spent trying to glean the proper information needed to direct emergency personnel—time that can have a serious affect on whether or not emergency services can reach a situation before it's too late!

When you consider the amount of time that can be lost *just* in the simple transfer of information between a 9-1-1 caller and a dispatcher, one can't help but wonder what *other* kinds of barriers can possibly arise that hinder the response of emergency personnel and equipment. Specifically, barriers that hinder the flow of *information* from a 9-1-1 caller to a public safety answering point (PSAP), and then from the PSAP to emergency personnel.

For instance, what if a caller identifies the road they are on, but that road doesn't exist in the 9-1-1 road database, and is, for all intensive purposes, unknown to any of the emergency service personnel? Real estate developments occur each year locally, and on average municipal and county governments are hard pressed to keep up with them *and* maintain an airtight method of updating the proper databases. Not to mention the fact there is no guarantee any such updated information, if made, would flow through the various governmental departments and finally come to refresh the 9-1-1 road inventory with any kind of accuracy or in any timely manner.

An example of this is Wood County, Ohio (the Bowling Green area). In August 1999, Wood Co. hired Digital Data Technologies, Inc (DDTI) to drive every road in the county with a global positioning system (GPS) to map the county's road centerlines and to acquire geo-referenced addresses for every structure in the county. One result of the project was the discovery of 173 miles of roadway that the county databases were unaware of. Never mind the federal dollars being lost to the county by not being able to claim these roads... What's truly significant is that prior to August 1999, 173 miles of roadway in Wood Co. were not receiving the full power of 9-1-1 service!

The Importance of a Complete and Accurate Road Inventory

The idea of not being aware of roads in a specific 9-1-1 coverage area exposes a related void in 9-1-1 information across the country: the concept of an incomplete and inaccurate

road name database. If it's possible for actual paved roads to be unaccounted for in general road name searches and routing applications, there is no doubt that road names are either missing from 9-1-1 databases or just simply inaccurately stored. Where would a dispatcher send emergency units if the road name a caller identifies were not in existence within the 9-1-1 system data? How much time will be lost trying to figure out just where the emergency is?

Granted, many communities have a fairly good idea of which streets are where—particularly a small community with personnel who have lived there all their lives. However, not all communities experience little to zero growth over a given time. In fact, many communities have witnessed their quiet rural towns grow into giant suburban areas within the process of only couple years. It's not outside the realm of possibility that an *entire county* can be covered with sprawling suburban development within a short time. And with many mini-communities evolving outside of municipal boundaries, sheriff and township emergency services are finding themselves adrift in a sea of unrestrained development. In these situations, the void of true information about a jurisdiction's road inventory can significantly hurt the ability of emergency services to respond to those who are in need.

Base Mapping Data: The Backbone of E9-1-1

The reality of incomplete and inaccurate road inventories is all too common in the world of countywide centerline mapping. Unfortunately, those occurrences are not the only informational barriers to enhanced 9-1-1 service that manifest themselves when the geographic data of a county comes under scrutiny. In a time when the E9-1-1 community is “abuzz” with the possibilities that modern technology can provide in terms of life saving applications, the realization of those applications is a much more difficult task. Applications such as wireless 9-1-1 automatic location identification (ALI), automatic crash notification (ACN), automatic vehicle location (AVL), and address-specific routing can significantly improve dispatcher decision making and response to calls for service. However, the dreams of implementing such technologically based applications are significantly limited by the lack of geographic data needed to fuel such endeavors.

Insufficiencies in the geographic data an agency tries to employ to power these applications are the predominant barriers in implementing them. The core of what makes these applications so powerful to 9-1-1 is the ability of these new techniques to automatically manipulate and analyze large amounts of data with great speed. Hence, extremely specific and accurate information can be delivered to dispatch personnel in a mere fraction of the time it would take those individuals to determine that information manually.

For instance, a call comes in to a PSAP and 9-1-1 personnel quickly enter the address into the computer aided dispatch system (CAD). In less than a second, the specific address and surrounding area are immediately viewable on a computer terminal—complete with precise routing directions for the nearest emergency unit, digital aerial photos for reference, and any other data an agency may desire (i.e., fire zones, law dispatching zones, mapped unit locations, etc). This is a wealth of information that has

already accounted for anomalies such as alternate road names, road closings, and nearest emergency unit locations—all within the blink of an eye. Unfortunately, the technology involved in making things like wireless 9-1-1 and AVL beneficial require very accurate and robust geographic data—the kind of data that many emergency agencies don't have.

Often, a public safety agency has only the barest of geographic data sets, specifically in terms of base mapping. In order to implement the kinds of applications which improve dispatcher decision making and emergency response, an agency must have an extremely accurate and complete base map enhanced by a high resolution digital orthographic air photo of an agency's jurisdiction. The base mapping (i.e., road centerlines) provides the foundation on which all applications can be built, while the ortho-photos provide an additional visual reference from an aerial perspective. The problem is: if that foundation is flawed, then the effects on those applications can be great enough to render them impossible. As they exist today, most base maps are not only inaccurate, but they are also incomplete (as seen earlier in terms of road inventories).

Standard methods of obtaining or creating a road centerline base map for a political entity (i.e., mapping from aerial photos), have proven to be insufficient for implementing advanced 9-1-1 applications. Essentially, base maps that don't accurately represent every single curve, bend, break, overpass/underpass, intersection, divided section, traffic control, etc., are insufficient. And any base map that cannot bring those features within a foot or two of the actual road centerline of every single road in an emergency response coverage area will not be enough to do the things required by wireless 9-1-1 ALI, AVL, ACN, and automated routing. In addition, to do any advanced applications, base mapping must have all the necessary attribute information like: the length of road segments, mile markers and their geo-referenced locations, the side of road an address occurs on, X/Y/Z coordinates (latitude and longitude) of any point on a road, verified correct road names and their spellings, any alternate names that may be associated with that road, etc. It's the depth and detail of such data that makes it what is called an "intelligent centerline," and thus gives software the power to truly *enhance* 9-1-1 service.

Addressing: The Key to Unlocking the Power of E9-1-1

While the road centerline data of an emergency jurisdiction can make or break an agency's attempts to improve 9-1-1 service with new technology and methods, the address inventory of the jurisdiction can also seriously weaken and/or shut down attempts to implement E9-1-1 improvements. Within government, no matter what the department or jurisdiction, nearly all the data of a political entity has some kind of address component to it. Whether it is demographic data, socioeconomic data, crime analysis data, gas/water/electric/waste utility service data, transportation data, tax data—the list goes on—all that data has an address by which every constituent of a political entity is catalogued. Consequently, it is that address that provides the links that associate all that data together in ways that bring the real power of information to government, and more specifically to E9-1-1.

Unfortunately, various departments within a government tend to develop their own "master address database" independently, which usually results in several master address

lists within one government. These lists may use differing standards/formats, and generally contain varying levels of accuracy and completeness. Consequently, each department may believe its own master address is the only one that is “correct,” which spawns compounding inconsistencies and inaccuracies that wreak havoc on attempts to implement address-specific emergency routing and the like.

Emerging Problems of E9-1-1 Addressing

Thus, in terms of addresses relating to E9-1-1 service, two problems have emerged: the use of address ranges in E9-1-1, and the lack of *one* true, field verified and geo-referenced master address database. The first of these problems, the common use of address ranges in E9-1-1, is a problem that has not manifested until recently when more advanced applications in 9-1-1 service are being required. The problem with address ranges is that, by their very nature, they are only a best-guess estimation of how and where addresses occur within an emergency jurisdiction. The range takes the first and last addresses of a given road, and based upon the location of those two addresses, places the remaining address of that road along the centerline in an ordered fashion that endeavors to “best fit” the addresses. This interpolation of addressing is called geocoding, and has been useful in the past when exact addressing has not been available.

However, geocoding an address range can only be accurate to a certain point and doesn't truly represent reality. An example of this occurs in the cases of apartment/condominium complexes. If such a phenomenon occurs on a road (which is *very* common in any community across America today), an address range would take the addresses encompassed in an apartment/condominium complex and string them out along the road with all the other addresses on that road. Given that there could be dozens of addresses in one or more of these complexes, and that the road itself could be several miles long, then the spread of addresses along that road could be quite significant. So when a 9-1-1 call comes in on that road, the address in question could be returned as being no where near the actual residence, all the while eating up valuable response time in searching for the address. Similarly, it is not uncommon to have residential lots sporadically grouped near each other on a road or separated by large tracts of land.

In addition, address ranges don't take into account the inconsistencies in the actual addressing of a road. Things such as odd/even addresses falling on the wrong side of the road, or grandfather plots maintaining an old address that does not fit within the current addressing sequence. All this points to the fact that an address range does *not* represent the reality of where an address actually occurs on a road. Add to that the possibility that not all the addresses assigned to a road are correct or even accounted for, well, then one can envision all the life-saving time and effort that can be wasted just getting emergency personnel to the right location.

The second problem that emerges when considering the address information of a government and its various departments is the existence of multiple “master” address databases. Which one is the true master address list? Which one is accurate and complete enough to employ it in uses where mistakes can cost lives? The answer is simply none of them. No matter if it's a master tax list, postal, or even a current 9-1-1

list, the fact remains that none of the addresses have been field verified for accuracy and generated into a complete and total listing. Nor, have they been geo-referenced with an X/Y/Z coordinate for exact location on Earth.

In Warren Co., Ohio, after having all its road and address inventories mapped, it was revealed that the county had 27,733 more addresses than estimated. A significant number of addresses were not accounted for in the county's various databases, including the one for 9-1-1.

Realizing Enhanced 9-1-1

When it comes to geographic data, one GIS cliché that always stands out simply reads: garbage in/garbage out. Rather, the quality of information dictates the value of a system. This is well exemplified in the situation of E9-1-1 today. There are technologies and software out there that make the future of E9-1-1 look like the ultimate in emergency service. But all those applications are wasted if complete and accurate data is not there to fuel the system as a whole. The road inventories, base mapping, and address inventories of an E9-1-1 coverage area *must* be complete, very accurate and maintained regularly. Anything less would be hurting an agency's ability to provide E9-1-1 service to all who need it.

Thus, 9-1-1 agencies must strive to obtain the best data they can to improve and truly enhance the flow of information in emergency service. Once an agency has the strong data to drive the E9-1-1 system, then the sky is the limit.

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