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GEOFILE SOURCE MATERIALS AND STANDARDS: A PROCEDURAL APPROACH

Abstract: An intrinsic component of all Computer Assisted Dispatching (CAD) systems is the geofile. The geofile is a tabular database of street names, address ranges, and cross streets which is associated with a variety of district information. The effectiveness of the CAD system is limited by the data it accesses. In the past, public safety agencies have not used accurate sources of data or the appropriate standards when building a geofile. The purpose of this paper is to present a procedural framework for the collection of accurate geofile source material. Also discussed are basic data standards that should be used in every geofile.

INTRODUCTION

There are severe consequences associated with using a geofile which is constructed from inaccurate source materials or with inappropriate data; the cost can be human life. Precious dispatch time will be wasted if a street name and address are associated with the wrong jurisdiction or dispatch district. The publicity associated with emergency response failures will severely damage the relationship between the public safety agency and the community. An inadequate and inaccurate database will severely impede the overall effectiveness of the CAD system. The following options are available to a public safety agency in this position: build a new geofile, modify the existing geofile with the CAD software, or live with an ineffective CAD system.

The optimal solution is to build a new geofile according to basic data standards and from accurate source material. Unfortunately, agencies may not choose this option due to the associated time and expense. An attempt is usually made to modify the geofile with the CAD software. This is a time consuming process which yields, at best, limited improvement. For these reasons, the geofile should be constructed correctly from the beginning.

The purpose of this paper is to present a procedural framework for the collection of accurate geofile source material. The geofile is comprised of two distinct data elements: the street network and the district boundaries.

The body of this paper is organized according to the procedural approach diagramed in Figure 1. Also discussed are basic data standards that should be used in every geofile.

STREET NETWORK

The street network portion of the geofile is comprised of three basic data elements: the street name, address ranges, and cross street names. Table 1 is a sample geofile of the street network data elements. Each record in the geofile lists the low and high addresses that are defined by a pair of intersections for a unique street name. The even and odd address ranges can be distinguished through either the field assignment, separate records, or a boolean field. A pair of intersections is defined as either two cross streets, two district boundaries, or a cross street and a district boundary. Each record is associated with the low and high cross street names, if applicable.

As indicated in Figure 1, source materials need to be evaluated and collected for two categories of street network data: the street names, and the address and cross street names. These source materials can be evaluated and collected concurrently; however, address ranges and cross streets should not be associated with the street names until the source of the geofile street names has been decided. Otherwise, the street name and cross street names will have to be modified during the geofile build process or after the geofile is complete; this is an arduous task which can corrupt the quality of the final geofile.

Street Name Source Materials

If the CAD system supports an enhanced 9-1-1 (E 9-1-1) interface, the geofile street names must agree with the street names in the Master Street Address Guide (MSAG) database. This will save dispatching time during an emergency. The E 9-1-1 system provides the dispatcher with the caller's location by searching the Customer Data File for the specific address associated with that telephone number, and the MSAG for the dispatching agency associated with that specific address (1). If the street name and address do not match the data in the geofile, the dispatcher must assign units without assistance from the CAD system.

A current copy of the MSAG file should be requested from the phone company as soon as the public safety agency decides to build a geofile; expect a lag of at least two months between request and delivery.

FIGURE 1
GEOFILE BUILD PROCEDURE

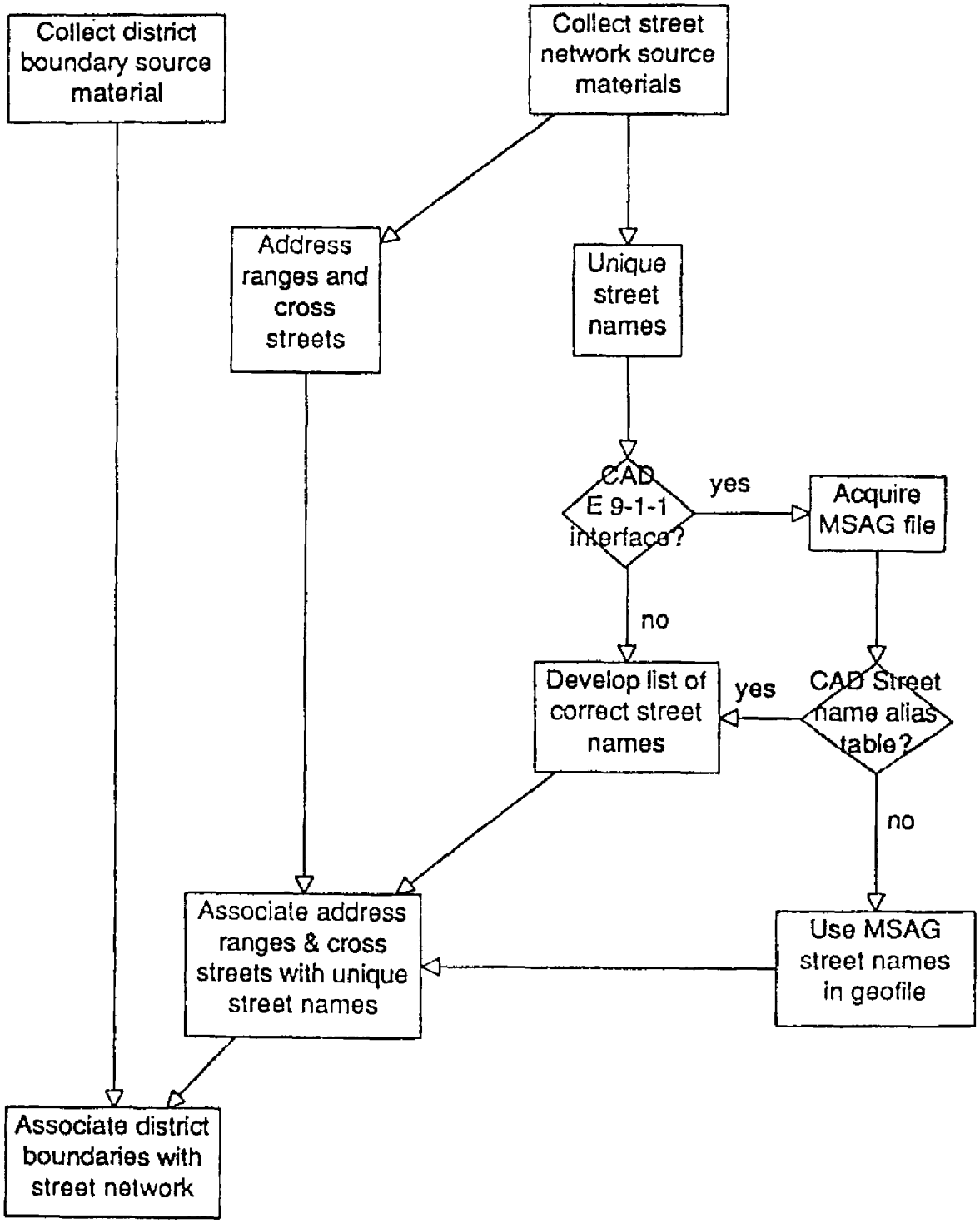


TABLE 1
SAMPLE GEOFILE: STREET NETWORK DATA ELEMENTS

Street Name			Address Low	Address High	Cross Street Low		Cross Street High	
Aldrich	Av		7800	7998	Parkside			
Aldrich	Av		7801	7999	Parkside			
Alhambra	Dr		7500	7698	Rhone	Ln	Mark	Ln
Alhambra	Dr		7501	7699	Rhone	Ln	Mark	Ln
Alhambra	Dr		7700	7738	Mark	Ln	Silver	Ln
Alhambra	Dr		7701	7739	Mark	Ln	Silver	Ln
Alhambra	Dr		7740	7998	Silver	Ln		
Alhambra	Dr		7741	7799	Silver	Ln		
Amazon	Dr		7500	7698	Ganges	Ln	Sher	Ln
Amazon	Dr		7501	7699	Ganges	Ln	Sher	Ln
Anita	Ln		7500	7698			Sher	Ln
Anita	Ln		7501	7699			Sher	Ln
Anita	Ln		16300	16348			Juliette Low	Dr
Anita	Ln		16301	16349			Juliette Low	Dr
Anita	Ln		16350	16398			Juliette Low	Dr
Anita	Ln		16351	16399			Juliette Low	Dr
E Edinger	Rd		7500	7698			Sher	Ln
E Edinger	Rd		7700	7848	Sher	Ln	Parkside	
E Edinger	Rd		7850	7998	Parkside			
Ganges	Ln		16100	16298	Volga	Dr	Amazon	Dr
Ganges	Ln		16101	16299	Volga	Dr	Amazon	Dr
Glencoe	Av		7700	7998	Silver	Ln		
Glencoe	Av		7701	7999	Silver	Ln		
Heil	Dr	S	7500	7538			Rhone	Ln
Heil	Dr	S	7501	7539			Rhone	Ln
Heil	Dr	S	7540	7738	Rhone	Ln	Silver	Ln
Heil	Dr	S	7541	7739	Rhone	Ln	Silver	Ln
Heil	Dr	S	7740	7998	Silver	Ln		
Heil	Dr	S	7741	7999	Silver	Ln		
Holt	Av		7800	7998	Parkside			
Holt	Av		7801	7999	Parkside			
Juliette Low	Dr		7500	7678	Anita	Ln	Sher	Ln
Juliette Low	Dr		7501	7679	Anita	Ln	Sher	Ln
Juliette Low	Dr		7680	7798	Anita	Ln	Sher	Ln
Juliette Low	Dr		7681	7799	Anita	Ln	Sher	Ln
Kim	Ln		16200	16298			Rhone	Ln
Kim	Ln		16201	16299			Rhone	Ln
Macdonald	Av		7800	7998	Parkside			
Macdonald	Av		7801	7999	Parkside			

The standard format is a list of unique street names associated with the lowest and highest addresses, although the format and detail of the MSAG varies by telephone company. It is preferable to receive the MSAG database as a digital file rather than a hardcopy printout; this will facilitate automated processing of the file for purposes of evaluation.

The MSAG files are renowned for street name and address errors. There are typographical errors, multiple street name spellings, unstandardized abbreviation conventions, and incorrect or missing addresses. The ideal procedure is to request corrections and additions to the MSAG upon initial review; however, the majority of communications agencies find the telephone company unresponsive to their requests.

If you are confident that the telephone company will be responsive, the typographical errors should be corrected, multiple street names deleted, and abbreviation conventions standardized. In order to save project time, a list of correct street names can be used to build the geofile while the telephone company makes corrections and additions to the MSAG. The MSAG should be reviewed a second time to guarantee that the street names agree with the geofile.

If the telephone company will not respond in a timely manner, the geofile street names are dependent on the sophistication of the CAD system. The MSAG should be used as the source for street names, regardless of the existing errors, if the CAD system does not support a street name alias table. This is the only way to guarantee a direct match in the geofile for emergency calls. The dispatchers can either be trained to use the MSAG spellings, or the associated information can be double entered under the preferred spelling. When the MSAG database lists multiple spellings of the same street name, use the street name that is correct or associated with the most accurate address range.

There are two available options if the CAD system supports a street name alias table: use the correct street names in the geofile and incorporate the erroneous MSAG spellings in the alias table, or use the MSAG as the source for geofile street names and incorporate the correct street names and multiple MSAG spellings in the alias table. Both options will result in a direct match between E 9-1-1 calls and the geofile. The benefit of using correct street names in the geofile is that of data integrity. The benefit of using the MSAG street names as the geofile standard is that the agency is not under pressure to complete the alias table; the 9-1-1 calls will match the geofile regardless of whether or not the alias table is complete. The street name alias table can also be used to incorporate commonly abbreviated streets.

The correct street name is the one on the street sign. Maps are not a recommended source for correct street names. The best sources for correct street names are the senior dispatchers. If the dispatchers are uncertain, the agency should commit the resources to drive the streets.

Street Name Standards

The complete street name is comprised of four possible components: prefix, name, type and suffix (see Table 2). The standard abbreviations for prefixes and suffixes are listed in Table 3.

TABLE 2
STREET NAME COMPONENTS

Prefix	Name	Type	Suffix
	Aldrich	Av	
	Alhambra	Dr	
	Amazon	Dr	
	Anita	Ln	
E	Edinger	Rd	
	Ganges	Ln	
	Glencoe	Av	
	Heil	Dr	S
	Holt	Av	
	Juliette Low	Dr	
	Kim	Ln	
	Macdonald	Av	
	Mark	Ln	
	Nancy	Dr	
	Parkside		
	Rhone	Ln	
	Sher	Ln	
	Silver	Ln	
	Star	Av	
	Volga	Dr	

TABLE 3
STANDARD DIRECTIONAL PREFIX AND SUFFIX ABBREVIATIONS

Direction	Abbreviation
East	E
West	W
North	N
Northeast	NE
Northwest	NW
South	S
Southeast	SE
Southwest	SW

The following words are examples of street types: Avenue, Circle, Court, Drive, Highway, Lane, Place, and Road. Discreet location designations are not considered street types: for example, Building, Business, and Office. The standard abbreviations for the street type are dependent on the number of characters allowed by the CAD system; the street type field is typically two or four characters in length.

If the CAD system supports an E 9-1-1 interface, use the beginning letters of the street type in the MSAG until the street type field is filled. For example, if the MSAG abbreviates all occurrences of the circle street type "CIR," and the CAD system is limited to a two character street type, the abbreviation in the geofile will be "CI." This standard will guarantee a direct geofile match for emergency 9-1-1 calls.

The name component of the complete street name is also dependent on the number of characters allowed by the CAD system; the name field is typically twenty characters long. The names in the geofile should precisely match the names in the MSAG. If the name exceeds twenty characters, use the first twenty characters in the geofile. This standard will guarantee a direct geofile match for emergency 9-1-1 calls.

Address and Cross Street Standards

The address ranges in the geofile should be full hundred blocks rather than exact address ranges. There are two exceptions to this rule: when a street is intersected by another in the middle of a hundred block, or when a street is intersected by a district boundary in the middle of a hundred block.

One reason for using hundred block address ranges as the standard for geofile address data is that it gives the database flexibility with regard to new developments on existing streets. A geofile that reflects exact address

ranges becomes a snap shot in time. The result is that the dispatching agency will be committed to spending a great deal of time updating the geofile to account for new developments.

Another reason for using full hundred blocks is to account for calls for service which are referred to by the hundred block rather than a specific address. The dispatching system will not be able to find a match in the geofile if the low addresses end in a number which is greater than 0 or 1. The dispatching system will be able to match calls for service that are referred to by both real and hypothetical addresses.

The third reason for using hundred blocks is that the majority of maps with address information are not very current or accurate. Although the hundred block may be readily interpolated, the addresses assigned to each parcel are not necessarily correct. The use of exact address ranges in this instance will also result in future editing of the geofile.

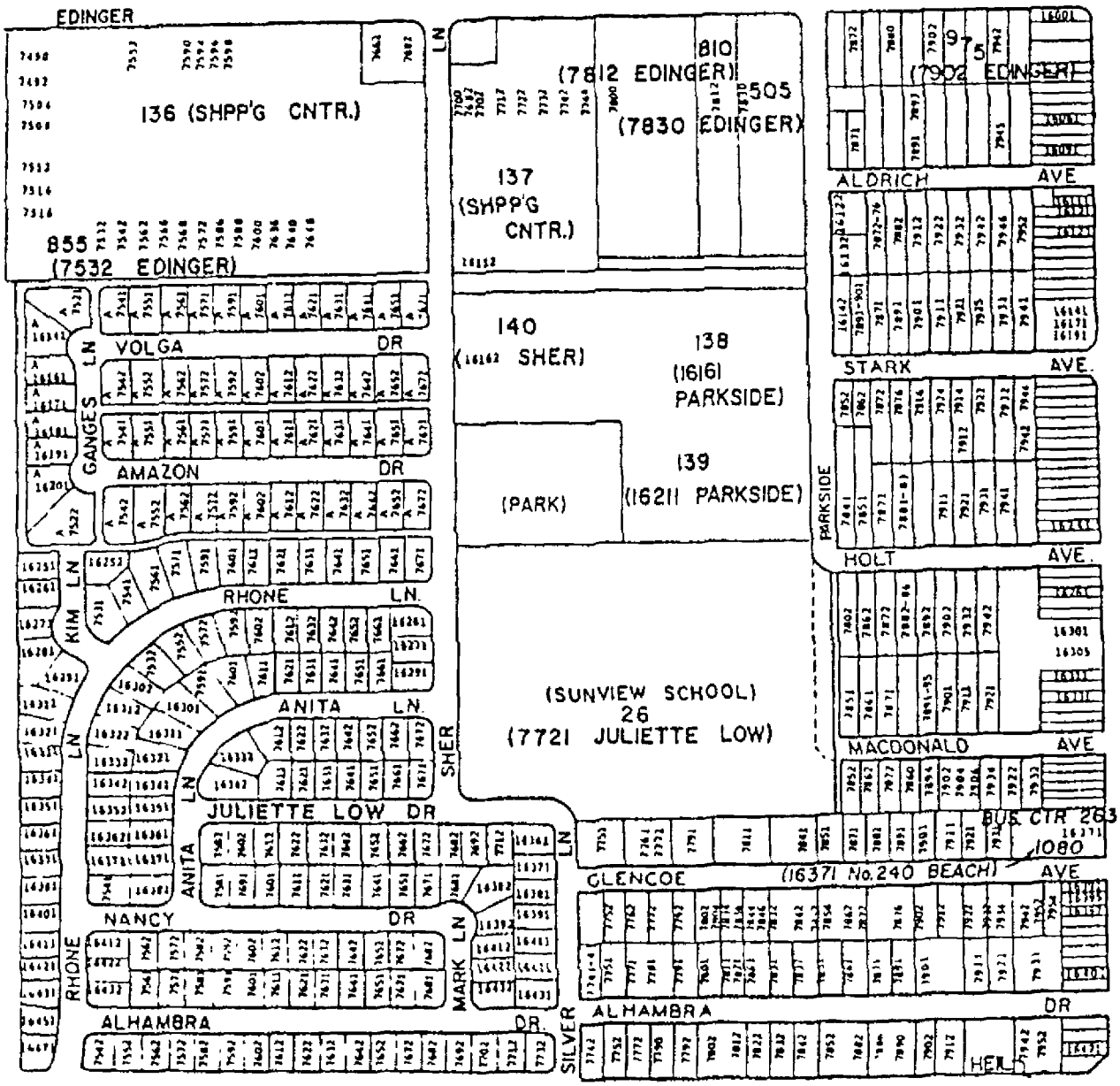
Address and Cross Street Source Materials

The address and cross street information may be presented in either tabular or map format. It may be necessary to acquire multiple source materials in both formats in order to cover the entire jurisdiction. The jurisdiction is the geographical area serviced by the dispatching agency; for example, it may be a single city or an entire county with many cities (2).

It is not a simple task to locate address and cross street data in either map or tabular format. Organizations that typically publish and maintain address and cross street information are planning departments, assessors' offices, registrar of voters, utility companies, public engineering departments, private engineering firms, the local Postal Service office, and other public safety agencies. The level of cooperation that a public safety agency can expect from other organizations with regard to the collection of address and cross street source material is highly correlated with pre-existing, established relationships.

Maps are the preferred format for address and cross street information. Figure 2 is a sample address and cross street map that was used to derive the geofile street network data listed in Table 1. The data can be readily interpreted, verified, and augmented or corrected. Tabular listings can be used as source material if the agency is unable to locate maps. The listing must provide the address range and cross street names by unique street name.

FIGURE 2
SAMPLE ADDRESS AND CROSS STREET MAP



The public safety agency must evaluate the accuracy, currency, and detail of the source material before the geofile is built. The process of converting the hard copy source material to a digital database will not improve the accuracy of the data. The best method of verification is direct comparison with reality; drive some of the streets while referring to the source material.

The source material is not limited by the geofile hundred block standard; the addresses can be generalized to the hundred block level. If there is a gridded street pattern in the jurisdiction with a standard addressing scheme, it is not necessary to collect detailed address source material. Simply write the standard hundred block for one street in each cardinal direction on a map with street names. If there is a standard side for odd and even addresses, the source material need only portray the exceptions to this rule.

It will be difficult to locate existing source materials for newly incorporated areas or regions experiencing a high growth rate. In the absence of these materials, acquire an uncluttered base map with accurate street representation and write the address ranges and street names on the map from field observation. If the map scale precludes legible transcription of the data, enlarge the map on a copier. If there is not an available base map, sketch the street pattern and write the address ranges and street names on the diagram.

DISTRICT BOUNDARIES

As indicated in Figure 1, the source material for the district boundaries can be collected and evaluated while the street network materials are being collected and converted to the geofile format. The public safety agency needs to evaluate the existing district boundaries according to the number of district overlays allowed by the CAD system, areas of recent development and growth, the ability of the system to meet analytical needs, and imminent annexations. The district boundary source material should not be associated with the street network until all of the street network source material has been converted to the geofile format.

Standards

A typical CAD system will allocate fields for multiple district boundary layers: for example, city codes, police beats, police statistical districts, fire districts and map reference number. The city codes identify whether or not the addresses associated with a unique street name are in a city. The police beats and fire districts are used to determine which units to dispatch to an

event. An event "comes to the attention of the agency by a complaint call, or from activity initiated by an officer in the field" (2, p. 1-3).

Dispatch districts that are in areas of recent development and growth should be subdivided. This may also necessitate the subdivision of associated statistical districts. The size of the largest statistical district in populated areas should not exceed five square blocks. The usefulness of statistical districts increases with decreasing size; event data associated with the statistical districts can be generalized, but the level of detail can not be increased.

Annexations will either require the modification of districts along the edge of the municipal boundaries, or necessitate the creation of new districts to cover this area. There is a lag between the association of districts with the street information in the geofile and the installation of the geofile on the CAD system. The district boundaries should reflect annexations that will occur within six months.

Source Materials

Most dispatching agencies have existing district boundary source material. Usually the boundaries are drawn on a general reference base map of the jurisdiction with a thick colored pen. The purpose of these maps is to place the district boundaries within a relative geographical context. The precise relationship of the district boundaries with regard to the street network is maintained in the minds of the dispatchers; the precise district boundaries need to be defined on source material for conversion to geofile format. The district boundaries can be defined on a map, a written document, orally described, or a combination of the above.

If maps are being used, the district boundaries must indicate whether addresses on both sides of the street are included in one district and omitted from the adjacent district, or if the addresses are split between adjacent districts. The intersection of a street by a district boundary causes that record to be divided.

The scale of the base maps should be relatively small. The use of detailed maps significantly increases the amount of time required to draw the district boundaries, the amount of time to associate the boundaries with the street information, and the number of errors. If the geofile is being processed from a digital street network, such as a DIME or TIGER file, a plot of the updated street file can be used as the district boundary base map. This method increases the precision of the boundary location because the street file is a graphic representation of the geofile street data.

The geofile cannot account for situations where an event on the pavement of a street is in a different response district than the property on either side of the pavement. The dispatchers will have to be trained to recognize these areas, and dispatch accordingly.

SUMMARY

A geofile which allows the CAD system to reach optimum effectiveness is created according to basic data standards and with accurate source material. The geofile is the reason for the CAD system. If the geofile is inadequate, the entire CAD system is inadequate.

Why are there so many examples of CAD installations with dissatisfied customers? The importance of the geofile is either not properly emphasized, or is overshadowed by other decisions involved in installing a new CAD system. The evaluation and collection of source material is a tedious and problematic process. It is my hope that the standards and guidelines presented in this paper will ease some of that frustration.

ACKNOWLEDGMENTS

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