

1.0 Addressing

1.1 Subject Discussion

Addresses are one of the most important linkages between GIS data and most other data collected and stored by governments, utilities and the private sector. Address data provide the linkage, or the, key to mapping any data base table that stores address information. Addresses can also be an important link to a wealth of historical data that exist in legacy databases. Chances are there is an address field stored in most records, which may allow for subsequent linkage and matching to addresses stored in the GIS databases. No single data element is more commonly used then the “address”.

With the popularity of GIS, the importance of structuring and maintaining address data has become much better understood. If an organization captures and stores addresses in a proper format, spells street names in a standardized way, and stores house numbers in the proper hundred block sequence, then stored addresses can be more easily linked to the GIS, and associated data can be more readily queried and mapped in the GIS. Stated another way, proper structuring and standardization of stored addresses allows for easy linkage in a GIS environment.

A consistent geographic framework among address components, data elements and GIS map features is needed. This “data model” should be straightforward and understandable and should support all addressing and mapping functions. A properly formatted and structured address should be capable of being mapped or queried using a variety of spatial data set models including road centerline address-ranges, a building, or a property. All address components should be developed, maintained and organized within the framework of this consistent data model.

A variety of government, utility, and private sector applications require the ability to match addresses to a geographic data set to determine the location of the address. Consistency in standardizing and formatting address data facilitates exchange of address-based data that can be mapped against local government, utility, and private sector data sets for a variety of uses:

- E-911 – locate an address and dispatch fire, police, and/or ambulance services
- Public safety investigations such as crime mapping, accident mapping, etc.
- Issuance and tracking of building permits and code enforcement such as health, housing, and zoning.
- Analysis of infrastructure maintenance histories (street repairs, water repairs, etc.).
- Dispatch of work crews.
- Utility one-call (“call before you dig”)
- Economic analysis including employment and sales trends
- Ride sharing and transit planning
- Hazardous material inventories
- Real estate transactions
- Coordination between social service providers and social service clients.
- Voter registration and redistricting
- Inventory of taxable property location and property ownership

1.2 Addressing Issues and Definitions

1. Property addresses - Addresses associated with a property can represent many different “locations” depending on the purpose for storing the address, such as where an owner lives, a bill is sent, or a property is located. In reality, all three types of address could relate one way or another to a property, but they could all be different! Care must be taken when initially defining the intent for storing address information, or in using address information stored in legacy systems because the purpose for why addresses are entered and what the address represents may become blurred over time.
2. Rural Route and Post Office box numbers – GIS data structures and algorithms for address matching cannot translate the geographic location for addresses formatted as rural route and Post Office box numbers (see Geographic or Positional Address discussion below)
3. Address Format – Many organizations structure elements of address fields differently, sometimes combining all elements into one field of varying lengths and other times breaking portions of the address field into separate fields. This can require considerable effort to combine address files from multiple sources in order to restructure the addresses to be compatible and useful within a GIS environment. It is little wonder that one of the primary reasons for standardizing local government address structure and formats in the Commonwealth of PA has been E-911, which needs to consistency between addresses stored by telephone companies and local governments.
4. 3-D Addressing – Many GIS environments represent map features as planar representations (often referred to a planimetric mapping). For example, a building outline is typically mapped by its roofline. There is no graphic representation for each of the building’s interior floors or rooms on a floor. Apartment complexes and commercial buildings in urban areas typically have multiple apartment or suite addresses for a building, meaning there is no graphic equivalent for representing the location of many addresses within the building. In these cases, only a primary building address can be used to locate the address. Even though most GIS systems cannot yet reconcile 3-D addresses, address databases should allow for storing the suite, room, and apartment numbers separately from the “street address” in order to support local government operations such as emergency services, code enforcement, taxation, crime reports, etc. that need refer to the 3-D spaces within a building.
5. Sub-lot Addressing – A taxable property may have multiple addresses associated with the lot. Examples include condominiums and mobile home parks. Again, only one primary tax parcel address can be used to locate the address to a property. A GIS typically ignores multiple addresses assigned to a lot.
6. Aliases - Some GIS environments support the concept of an “address alias” for a building or a lot, allowing a cross-reference between common name and street address (for example “Galleria Mall” might be cross-referenced to its street address). This allows the user to enter the common name and the GIS will still find the address. Aliases or “landmark names” are frequently used for property types like places or worship, schools, parks and commercial business.

7. Address Ranges Assigned to Road Centerline Segments – All GIS environments support storing a range of “from” and “to” street addresses on the left and right side of a road segment between two intersecting streets. This allows finding an approximate location of an address, as the GIS software will interpolate the address based on the length of the road segment and the range of addresses assigned to the road segment. It is important to note that the results of the interpolation assume an even distribution of addresses along the road, which may not be the case in rural counties where small subdivision lots are interspersed among large farm lots.
8. Address Association to Map Features – An address can associate to a vacant undeveloped lot, a single-family residence (one building), or multiple apartments within a building. In a GIS environment, the features associated with addresses are typically mapped in two separate layers: buildings and parcels. This complicates where address information is stored, maintained, and accessed. A cross-reference relational table between building and parcel address is a common and useful solution in order to associate multiple building or structure addresses to a parcel’s one situs address. While the GIS requires one preferred situs address, the cross-reference table allows identification of the parcel’s multiple associated addresses for other information system requirements.
9. Geographic or Positional Address - A pair of geographic coordinates based on a coordinate reference system (map projection) to represent the geographic location for an address. A GIS environment translates an address into a set of geographic coordinates through a process called “geo-coding” or “address matching”. The GIS actually uses the geographic address to map the location of a building or parcel, so addresses must be geo-coded before a GIS can map them. Coordinate based geographic addresses will become even more important given the increasing use of Global Positioning Systems (GPS) and cellular telephones that enable location based emergency and retail services to a mobile public.
10. Mailing or Postal Service Address – An address location assigned and used by the US Postal System to deliver mail to a location. This may or may not be the same address as the situs address, since Post Office boxes and rural route numbers are sometimes used to deliver mail. Also, much confusion also arises between the “town and zip code” used in a postal address (the city reflects the location of the post office that handles the mail and the zip code is a service delivery zone) and the name of the political jurisdiction in which the address is located (which is actually used by the E-911 emergency services to locate an address). For example, a mailing address might reference “Lancaster” because the mail is delivered through the Lancaster Post Office, but the jurisdiction in which the address is located might be “Manheim Township”. It is generally advisable to store the postal city and zip code separately from the political jurisdiction in which the address is located.
11. Physical or Situs Address – The complete set of a street number, street name, city or municipality and state indicating the permanent location of a building or parcel. In Pennsylvania, a municipality has official responsibility for assigning situs addresses. Addresses are sometimes assigned to vacant parcels (because emergency services may be to be dispatched to the vacant lot), but almost always assigned to buildings on parcels. A database of situs addresses should be maintained as the addresses for use by the GIS data model.

1.3 Recommendations

1. Municipalities are encouraged to eliminate all rural route addresses and implement standard street addressing systems in order to comply with E-911 requirements and to facilitate the delivery of goods and services to street locations within their jurisdiction. Municipalities must develop, document, and maintain a street-addressing system defining the methodology used to assign house numbers to parcels and buildings. This methodology must identify the address origin and direction of increasing house numbers, street frontage intervals, and odd and even number conventions. This is the framework around which all new addressing will be assigned for new subdivisions so the long-term adherence to the underlying address system is critical. Addressing grids, increment ranges, base lines and north/south east/west axis, and odd/even conventions can also be stored and managed by the GIS. The GIS can be the tool used to assign new addresses, and track the addresses that are already assigned.
2. Municipalities should follow National Emergency Number Association (NENA) guidelines for assigning street names to new streets and for assigning odd and even house numbers
3. When assigning addresses to buildings or parcels, only the situs address should be used. Billing or owner addresses should be stored in separate fields and not mixed in with the situs address.
4. Avoid storing addresses as single, free format, character address fields because this practice invites entry of non-standard address data such as "Third house on left after the intersection"
5. All street names entered for addresses should be validated against one "official street name" table maintained by the local government. In the case of county governments, the Master Street Address Guide (MSAG) file maintained by the E-911 operations can be a useful resource for validating not only street name spelling but also the valid address ranges for a street.
6. The address data stored in legacy systems should be reviewed for consistency and intent before deciding whether to use the addresses in a GIS. Most users, computer programmers and system designers do not understand the subtle nuances between different address types. This frequently results in mixing billing, situs, and owner addresses in the same field.
7. Local and county government parties should collaborate to assure clean and accurate addresses. This includes GIS, 911, police, fire and all relevant municipal officials who undertake address assignments. Ideally, new addresses should be shown on all final subdivision plans before the municipality accepts the subdivision plan. Amendment of the local subdivision ordinance is a good way to enforce this practice.

1.3.1 Street Centerline Address Ranges

1. Centerlines should be broken at municipality boundaries. Municipal names should be assigned for the left and right side of each road segment in order to define address zones using municipal names. This means the road centerline must be segmented whenever a municipal boundary crosses the road segment.
2. Since municipal boundaries define where address ranges and street names may change on along a road centerline segment, the accuracy of the municipal boundary relative to the street centerline is an important consideration. The consequence of spatially inaccurate municipal boundaries relative to spatially accurate roads is that a segment of road may fall within the wrong municipality and be assigned to the wrong municipal zone. This could result in an address not matching to the road centerline file.
3. All road segments should have attribution to support National Emergency Number Association (NENA) addressing standards. But, the components of the address fields such as directional prefixes and suffixes should only be used if they are part of the official name assigned by the municipality.
4. The “from” and “to” address ranges assigned to each road centerline segment may represent either the theoretical address range for the block (includes the reserved and assigned street numbers) or only the actual assigned street numbers.
5. All street centerline address components should be structured as separate data fields as shown below. Avoid using directional prefixes or suffixes unless they are a part of the official road name. The following standards for field names and data types are from the NENA-02-010 Standard for Line data addresses (Version 1.0, Exhibit 22) for GIS files:
 - LLO, 10 integer. Lowest address on the left side of street segment
 - LHI, 10 integer. Highest address on the left side of street segment
 - RLO, 10 integer. Lowest address on the right side of street segment
 - RHI, 10 integer. Highest address on the right side of street segment
 - PRD, 2 alpha. Street name directional prefix [N, S, E, W, NE, NW, SE, SW]
 - STN, 60 alpha. Street name
 - STS, 4 alpha. Street suffix (use USPS Publication 28 for street type abbreviations)
 - POD, 2 alpha. Street name directional suffix [N, S, E, W, NE, NW, SE, SW]
 - MCL, 35 alpha. Name of municipality on left side of street segment
 - MCR, 35 alpha. Name of municipality on right side of street segment
 - COL, 5 alpha. Combined state (2 character) and county (3 character) FIPS codes for county on left side of street segment
 - COR, 5 alpha. Combined state (2 character) and county (3 character) FIPS codes for county on right side of street segment.

1.3.2 Parcel and Building Situs Addresses

1. Only the official situs address assigned by the municipality should be used to reference a building or property. Postal address should not be used to reference property and building locations.
2. Parcel specific recommendations:
 - Each lot will be assigned one main situs address. These addresses should be unique within the municipality which assigns road names and street addresses.
 - If multiple addresses associate with a lot, store these in a separate data table and associate back to the parcel layer using the Parcel Identification Number (PIN) or Geographic Parcel Identification Number (GPIN).
 - Implement the MULTIADDR field indicating whether the parcel has an associated sub-lot address in the related table.
 - Ideally, all parcels, whether vacant, taxable, or non-taxable should be assigned a situs address by the municipality in order to support dispatch of emergency services to the parcel location.
 - Multiple addresses can associate with a parcel such as situs address, owner address, and billing address. If multiple addresses must associate with a lot, these address fields must be clearly differentiated and documented as to their intended use. The address elements for each type of address should be structured and formatted consistently per the recommendations below.
3. Building specific recommendations:
 - Addressed buildings should each have one situs address as an attribute for the building. This may or may not be synonymous with the situs address for the parcel or lot.
 - Each building should be attributed with the unique PIN or GPIN of the taxable lot on which the building is found.
 - When multiple situs addresses are associated with a building, a unique Geographic Building Identifier Number (GBIN) should be assigned to the building on the building layer and used as the relational key to a related table storing all building addresses.
 - Implement the MULTIADDR field to indicate whether a building has an associated apartment, condo, or suite address in the related table.
4. For buildings and parcel layers, address components should be structured as separate data fields. The following field names and data types (excluding GPIN and GBIN) are adapted from the NENA-02-010 Standard for site/structure addresses (Version 1.0, Exhibit 22). Note: that GBIN only relates to building features, and GPIN only relates to parcel features. Both fields can be used in the building layer in order to create a cross reference between a parcel and all the buildings on the parcel:
 - SAN, 10 integer. Site address number (a.k.a the situs address house number) assigned by the municipality.
 - PRD, 2 alpha. Street name directional prefix [N, S, E, W, NE, NW, SE, SW]. This field should only be used if it is part of the official street name.
 - STN, 60 alphanumeric. Street name assigned by the municipality.

- STS, 4 alpha. Street suffix (use USPS Publication 28 for street type abbreviations, e.g. “AVE”) assigned by the municipality
- POD, 2 alpha. Street name directional suffix [N, S, E, W, NE, NW, SE, SW]. This field should only be used if it is part of the official street name.
- MCN, 35 alpha. Name of municipality that assigned the address.
- STCO, 5 alpha. Combined state and county FIPS codes for county.
- MULTIADR, 1 integer [1 = true, 0 = false]. Flag field to indicate multiple addresses in a related address table.
- GPIN, 13 alpha (see Parcels Section). Unique parcel identifier
- GBIN, 13 alpha (see Buildings Section). Unique building Identifier

1.4 References

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5. *Street Naming and Property Numbering Systems*. Margaret A. Corwin. Planning Advisory Service Report Number 332. American Planning Association. 1978. pp.46.
6. *Postal Addressing Standards Publication 28*, November 2000. US Postal Service. Copy available at: <http://pe.usps.gov/cpim/ftp/pubs/pub28/pub28.pdf>. A copy of the standards can also be obtained from http://www.usps.gov/ncsc/lookups/abbr_suffix.txt
7. *Guideline: Codes for Named Populated Places, Primary County Divisions, and Other Locational Entities of the United States, Puerto Rico, and the Outlying Areas*. FIPS Publication 55-DC3, updated 1998. National Institute of Standards and Technology (NIST), US Department of Commerce. FIPS codes for state and counties can be obtained from <http://www.itl.nist.gov/fipspubs/co-codes/states.htm>. FIPS codes for Publication 55-DC3 can be researched and retrieved at <http://www.nist.gov/itl/fipspubs/55new/nav-top-fr.htm>
8. The web site for the National Emergency Number Association (NENA) is <http://www.nena9-1-1.org>. For E-911 related standards regarding terminology, data exchange, etc., a good web reference is found at http://www.nena9-1-1.org/9-1-1_Standards_Development/nena_recommended_standards.htm. The recommendations regarding formatting of address elements for road centerlines and situs addresses was extracted from NENA-02-010 Exhibit 22 Version 1.0 GIS Data Model Format (pp.65-73). A copy of the standard can be obtained from http://www.nena.org/9-1-1TechStandards/Standards_PDF/NENA_02-010.pdf.
9. Kansas Geospatial Addressing Standard, 37 pp. Final Edition published October 29, 1999. A copy can be obtained at <ftp://gisdasc.kgs.ukans.edu/gishelp/docs/standards/address.pdf>

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