

Michigan NG9-1-1 GIS Best Practices

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1. Introduction

In 2025, the State of Michigan, Department of Technology, Management & Budget, Center for Shared Solutions, Geospatial, Web and Data Services Division, in collaboration with the local jurisdictions, continued efforts to prepare the State of Michigan for the implementation of Next Generation 9-1-1 (NG9-1-1). This standard and best practices document is the result of one such effort that focused on GIS data preparation for NG9-1-1. Changes to this Standard occur on a regular basis and a Change Log can be found in [Appendix A](#).

1.1 Background

Accurate and complete GIS data is critical to the operation of an NG9-1-1 system. Locally developed GIS data will be used for routing 9-1-1 calls to the appropriate Public Safety Answering Point (PSAP) and to support the dispatch of emergency services providers. This requires the GIS data to be standardized for use in NG9-1-1.

The majority of authoritative GIS data in Michigan is created at the county or other local levels of government to meet local government needs, including 9-1-1 purposes. In 2012, DTMB and the State 911 Office established the NG911 GIS Repository System and Program for the sharing of GIS data between local and state government for the purposes of aggregating addressing data for NG911 systems. Through data validations built within the repository systems, local governments maintaining the GIS data can make the updates necessary to meet 911 data standards. Along with certain addressing and street naming variations across the 83 counties in Michigan, there are also variations in how the addressing information is mapped. This document can be leveraged statewide to consider some of the latest best practices for addressing to continue to make addressing more uniform across the state.

1.2 Purpose of the Michigan NG9-1-1 Best Practices Document

The purpose of the Michigan NG9-1-1 GIS Data Standard is to establish a uniform, common data model for the required NG9-1-1 GIS layers in the State of Michigan. The National Emergency Number Association (NENA) sets standards for implementing and managing 911 systems, including the data used in public safety systems to support emergency response, particularly as it relates to NG9-1-1. NENA has identified the following GIS data layers as required for NG9-1-1 call routing and dispatching emergency services:

- Road Centerlines
- Site/Structure Address Points
- PSAP Boundaries
- Service Boundaries (PSAP, law enforcement, fire/rescue, emergency medical services)
- Provisioning Boundaries

Data is maintained locally using a combination of NENA GIS standards but also standards needed by Computer Aided Dispatch systems. In 2012, the State of Michigan 911 Office in partnership with DTMB Center for Shared Solutions launched the Michigan NG911 GIS Data Repository. A data schema and standards were developed following the NENA standards at that time and through upgrades to the Repository, the data standards for the Repository have evolved based on NENA standards at the time of upgrades. The GIS office within DTMB manages the Repository and support for the aggregation of the local GIS addressing data into seamless statewide NG911-ready GIS datasets to serve as the authoritative location-based data for the NG911 Core Services. The functionality of the GIS Repository system includes dozens of data validation tools that help support the local GIS departments maintaining the data to quality control their data at any stage of their data maintenance process. This benefits those maintainers of the data to be able to identify where changes might need to be made to meet NENA GIS Data standards for NG911. The NG911 Core Services provider pulls the GIS data from the GIS Repository regularly. The repository currently uses the NENA GIS Data Model, version 2a [1], as the main database standard and will continue to adhere to the latest NENA GIS Data Models that are released in the future. By applying addressing best practices for NG911, this standardization and validation of addressing data via the repository will also make data more standardized for all addressing business needs across local

government departments. Many counties in Michigan have begun to make their addressing data openly available for public use and the standardized addressing makes it easier for all users to integrate the authoritative address data in a consistent manner across all systems needing addressing information.

This document also provides recommendations and best practices for creating and maintaining the Road Centerline and Site/Structure Address Point GIS data layers to meet Michigan's NG9-1-1 GIS data requirements and quality control processes for all of the required NG9-1-1 GIS data layers.

1.3 Sources of this Standard

The Michigan NG9-1-1 GIS Data Standard is built upon the NENA Standard for NG9-1-1 GIS Data Model v2a [1] and includes all required GIS data layers and their elements.

2. Considerations for GIS Data Development and Maintenance

2.1 General Considerations

Not all attribute fields are required for the ECRF and LVF to function. Having a strategy to populate these optional fields over time will help keep costs in check while making the best use of available resources. A good local data development and maintenance plan should be created at the earliest stages to ensure the best use of available resources and address data. Considerations when developing such a plan are discussed throughout Section 10, Considerations for GIS Data Development and Maintenance.

2.1.1 Metadata

Metadata is information about the dataset that explains the who, what, where, when, why, and how. This information is important when sharing data with others so that the recipient clearly understands what the data contains and who to contact if there are additional questions. Minimum metadata to consider providing with the data include:

- Identification information (abstract, purpose for creating)
- Date updated (date when changes were last made to the data)
- Point of Contact (person, position, organization, contact information)
- Reference system information (datum, coordinate system, projection)

Metadata for NG9-1-1 GIS data layers will be published by the authoritative data provider for the GIS data maintained by the organization. The State of Michigan will manage and publish metadata for the aggregated statewide NG9-1-1 geodatabase within the statewide repository.

2.1.2 Use of Orthoimagery versus GPS Data Collection Devices

The availability of current, high resolution orthoimagery can provide a cost-effective way to create spatially accurate address points, add new road centerlines, or compile changes in existing road centerlines. Road centerline compilation and address point placement that is done in the office is much more efficient than sending staff into the field with GPS units to collect geospatial coordinates for addressed locations and road alignments that clearly exist in the orthoimagery. Consider limiting GPS use to collect locations for:

- Subaddresses
- Sites, structures, and new roads not yet present in the existing imagery
- Sites, structures, and road centerlines that are not clearly discernible in the existing imagery

The State of Michigan has a statewide aerial imagery program, the Michigan Statewide Authoritative Imagery and LiDAR (MiSAIL) program. This is a statewide aerial acquisition contract, managed by DTMB

where state and local government partner on the collection of update imagery. The MiSAIL program provides assistance coordinating the acquisition of digital orthoimagery across Michigan on a continuing 4-5 year cycle, at a reduced cost for participants in the program. Participants choose the products that meet their needs, manage their projects, and distribute their orthoimagery and other products. Participating in MiSAIL is a cost-effective option for acquiring high resolution orthoimagery for maintaining and updating the required NG9-1-1 GIS data layers.

While existing orthoimagery may provide an excellent resource for mapping existing features, updated imagery is necessary to capture new roads and addressed features.

2.2 Considerations for Road Centerlines

2.2.1 Accuracy of Boundary Data (for alignment/segmentation at boundaries)

Boundary data is essential for accurate NG9-1-1 data. Overlapping boundaries can create issues when segmenting data. This is especially important when aligning Road Centerlines with state and county boundaries. When aligning and segmenting Road Centerlines with any boundary, the local jurisdiction should always check with the entity responsible for maintaining that boundary alignment to ensure the correct boundary is being used.

2.2.2 Limitations of CAD Software

Each CAD software has its own requirements when dealing with road centerline data. In some cases, CAD software may require 0-0 ranges, while others may not. Some CAD software may also allow for Z (height) values which will affect how road centerlines are split at over/underpasses. Currently, not all CAD software programs can natively ingest GIS data in NENA's NG9-1-1 GIS Data Model [1] format (upon which the Michigan NG9-1-1 GIS Data Standard is based) and may require the use of abbreviations or different parsing of the street names and addresses. These best practices do not take into account each CAD software vendor's solutions, and therefore the data developer should always refer to CAD software requirements when updating Road Centerlines.

2.3 Considerations for Site/Structure Address Points

Organizations developing Site/Structure Address Points need to carefully consider the level of positional accuracy desired and the resources available, not just for initial data development but long-term data maintenance. In general, address point placement methodologies that result in more spatially accurate points require more resources to create and maintain them.

2.3.1 Placement Method (e.g., Structure, Site, Property Access, Parcel, Geocoding)

Some address point placement methodologies require minimal resources while others are very resource intensive. Consider starting with a less spatially accurate placement method and over time gradually improve the spatially accuracy of the address points as resources allow. For example, use available parcel data to generate address points from parcel centroids and then as resources permit, use orthoimagery to move the address points onto the sites and structures. This allows for quick creation of a Site/Structure Address Point layer that can be used immediately in 9-1-1 applications. Similarly, if using orthoimagery to place address points but field research is required for an address that cannot be clearly discerned on the imagery, create a temporary address point using the parcel centroid location if the parcel upon which it is located is known or create a Property Access point at the driveway entrance to the addressed property if the driveway is visible in the orthoimagery. Population of the Placement Method attribute is recommended in these situations to provide data users with information on the address point's positional accuracy.

2.3.2 Amount of Subaddress Detail Needed

Costs increase directly with the amount of subaddress detail that is collected. When determining the amount of subaddress detail needed, consider how 9-1-1 applications will use the data and how precise the address point location needs to be. At a minimum, enough subaddress detail should be provided to route 9-1-1 calls to the appropriate PSAP and get first responders to the correct location. Consider beginning with a low level of subaddress information and increase in granularity as time and resources permit. For example, collect subaddress information that will at least get responders to a specific building. Additional subaddress detail may be needed where a large site or building is split by an Emergency Service Boundary and subaddresses at that location are served by different responding agencies.

2.3.3 Limitations of CAD Software

It is important to understand the limitations and requirements of your CAD software as currently not all CAD software programs can natively ingest GIS data in NENA's NG9-1-1 GIS Data Model [1] format and may require the use of abbreviations or different parsing of the street names and addresses. Some optional fields may not be recognized and therefore population of those fields could be postponed. Consider the CAD software's ability to use stacked points, subaddress data in a related table structure, or even recognize subaddresses as unique addresses. Also consider whether the CAD software can differentiate between the Placement Methods or requires a specific Placement Method (e.g., Property Access versus Structure). For example, a structure located far from the road it is addressed off of may benefit from having two address points: a Property Access address point at the driveway entrance and a Structure address point on the structure. If the CAD software cannot differentiate between the points, it may be preferred to only show one point.

2.4 Considerations for PSAP, Emergency Service (Service), and Provisioning Boundaries

Organizations developing these GIS data layers need to understand that these layers often are not identical to the legal county, city, village, or other administrative boundaries within Michigan. Existing agreements between PSAPs that define their areas of responsibility, particularly in areas where the boundary differs from the administrative boundaries, need to be properly reflected in the GIS data layers.

2.4.1 Accuracy of the PSAP and Emergency Service Boundaries

There should be no unintentional gaps or overlaps within the PSAP Boundary layer or the Emergency Service Boundary layers. Gaps in PSAP boundaries prevent the ECRF from identifying which PSAP to route a call should a civic or geodetic location fall within that gap. Similarly, if a civic or geodetic location fell within an area where PSAP Boundaries overlapped, the ECRF would not be able to identify which of the PSAPs to route the call. Similarly, gaps and overlaps within an Emergency Service Boundary would prevent the ECRF from determining the correct Service Provider.

Boundaries with unintentional overlaps also create issues when segmenting data. For example, Road Centerlines segmenting at these boundaries would result in attribution conflicts for the segment in the overlapping area, including the address, area, and 9-1-1 attribution elements.

GIS Data Providers must work together to resolve any discrepancies in these layers such that there are no unintentional gaps or overlaps.

2.4.1.1 Required Field Population

The following fields are required to be populated in the service boundaries. The NGCS should be consulted to determine specifics as the values relate to the NG9-1-1 system.

- Agency Identifier (Agency_ID): A Domain Name System (DNS) registered domain name which is used to uniquely identify an agency.
- Service URI (ServiceURI): The Uniform Resource Identifier (URI) used for call routing that defines the URI of the specific service. The values are provided by the NG9-1-1 Core Service Provider.
- Service URN (ServiceURN): The Uniform Resource Name (URN) used to select the service for which a route is desired. The values are defined by RFC5031; NENA-STA-010 [12] defines the domain of allowed values.
- Agency vCard URI (AVcard_URI): A vCard is a file format standard for electronic business cards. *While the field is currently required, it is being considered for deletion in future versions of the NENA NG9-1-1 GIS Data Model.*

2.4.2 Accuracy of the Provisioning Boundary

There should be no unintentional gaps or overlaps within the Provisioning Boundary layer. Overlapping boundaries would result in multiple GIS Data Providers being able to submit GIS data for the same area which could result in duplicate GIS features (e.g., Road Centerlines, Site/Structure Address Points) in the overlapping area. GIS Data Providers must work together to resolve these discrepancies such that their Provisioning Boundary covers the entire extent of their geographic area of responsibility but does not extend beyond their coverage area into a neighboring jurisdiction's geographic area of responsibility.

3. Quality Control of Next Generation 9-1-1 GIS Data

Quality Control is an all-encompassing management approach that combines technical, qualitative and human resources to evaluate the quality of GIS data to meet the requirements of a system. Each GIS data layer, individually and in relation to each other, is analyzed to determine where integrity issues exist.

Integrity issues for NG9-1-1 GIS data is categorized into two categories: critical and non-critical. Critical issues will cause issues with the NG9-1-1 Location Validation and Emergency Call Routing Functions and will not be accepted into the NG9-1-1 Core Services components. Non-critical issues have the potential to cause issues with both of these functions, however additional features within the system will ensure the calls are correctly routed. Non-critical errors may be identified by the NG9-1-1 Core Services Provider but will not prevent the data from being provisioned into the system.

Prior to and during transition to a NG9-1-1 system, quality control between the 9-1-1 GIS data and the E9-1-1 routing databases, ALI and MSAG, must continue to be quality controlled through data synchronization. It is important to utilize the legacy street name elements within the Road Centerline and Site/Structure Address Point datasets for synchronization with the legacy E9-1-1 databases. Integrity issues identified during the data synchronization process may need to be resolved through updates to the ALI and/or MSAG and the GIS data.

The process for quality control can be dependent on a variety of factors, however the major factors are the software utilized to perform the analysis and the format of the GIS data. For NG9-1-1, 98% is often cited as a benchmark for resolution of GIS data errors and ALI to Road Centerlines errors, with a goal to continually improve the GIS data and achieve 100% resolution of all errors. Accuracy requirements should be discussed with your NGCS Provider.

The statewide NG9-1-1 GIS repository, managed by DTMB, includes dozens of validation checks and cross feature reports that outline any non-standardized data within the system.

3.1 Definitions of Commonly Used Quality Control Terms

3.1.1 Street Name Elements

Description: All the NENA CLDXF Standard [13] (fully spelled out) street name fields and/or all the legacy (abbreviated) street name fields in both the Road Centerline and Site/Structure Address Point feature classes.

CLDXF: Street Name Pre Modifier, Street Name Pre Directional, Street Name Pre Type, Street Name Pre Type Separator, Street Name, Street Name Post Type, Street Name Post Directional, Street Name Post Modifier, Direction of Travel

Legacy: Legacy Street Name Pre Directional, Legacy Street Name, Legacy Street Name Type, Legacy Street Name Post Directional

3.1.2 Zone

Description: Any field or combination of fields used to ensure location uniqueness.

CLDXF: May include Country, State (A1), County (A2), Incorporated Municipality (A3)

Legacy: May include MSAG Community Name and ESN

3.1.3 Address Elements

Description: All the address and subaddress elements including Address Number Prefix, Address Number, Address Number Suffix, Building, Floor, Unit, Room, Seat, Additional Location Information.

3.2 General Quality Control

The following checks should be performed during quality control on all GIS data layers using the Michigan Geographic Framework Data Gateway tools for uploading GIS data to the NG911 GIS Repository:

- *Field format validation:* Check to identify where fields are not formatted to meet the Michigan NG9-1-1 GIS Data Standard.
- *Unique Identifier:* Check to identify duplicate unique identifiers within individual or all source feature classes.
- *Missing mandatory field values:* Check to identify where mandatory field attribution, as defined in the Michigan NG9-1-1 GIS Data Standard, is missing.
- *Field values outside of domain:* Check to identify where field values are outside of the acceptable domain values as defined by the Michigan NG9-1-1 GIS Data Standard.

3.3 Boundary Quality Control

Includes Provisioning Boundary, PSAP Boundary and Emergency Service Boundary; may also include County Boundary, Incorporated Municipality Boundary, Unincorporated Community Boundary, and Neighborhood Community Boundary where available.

The following quality control checks are performed for NG9-1-1 purposes by the Michigan Geographic Framework Data Gateway tools for uploading GIS data to the NG911 GIS Repository

- *Boundary has gap:* Check to identify where gaps exist between polygons in each boundary feature class.
- *Boundary has overlaps:* Check to identify where overlaps exist between polygons in each boundary feature class.
- *Boundary does not cover the Provisioning Boundary:* Check to identify where an Emergency Service Boundary does not cover the Provisioning Boundary in its entirety.

3.4 Site/Structure Address Point Quality Control

The following quality control checks are performed for NG9-1-1 purposes by the Michigan Geographic Framework Data Gateway tools for uploading GIS data to the NG911 GIS Repository:

- *Address found multiple times:* Check to identify where site/structure addresses occur multiple times in a single Site/Structure Address Point dataset. This check analyzes all the street name elements, address elements and zone(s) to determine duplication of address points.
- *Site/Structure Address Point outside Provisioning Boundary:* Check to identify where site/structure address points exist outside of the Provisioning Boundary.
- *Site/Structure Address Point multipart geometry:* Check to identify features that contain more than one geometry.
- *Site/Structure Address Point zone attribution against intersecting polygon attribution:* Check to identify discrepancies between a site/structure address point's zone attribution (incorporated municipality) and the associated boundary (incorporated municipal boundary) it intersects within a buffer distance around the site/structure address point.

3.5 Road Centerline Quality Control

3.5.1 NG9-1-1 Quality Control Check

The following quality control checks are performed for NG9-1-1 purposes by the Michigan Geographic Framework Data Gateway tools for uploading GIS data to the NG911 GIS Repository:

- *Road Centerline segments have overlapping address range values:* Check to identify where road segments have overlapping address ranges in a given zone. The zone must be defined by the governing entity.
- *Road Centerline outside Provisioning Boundary:* Check to identify where road segments exist outside of the Provisioning Boundary.
- *Road Centerline segment crosses a boundary layer:* Check to identify where road segments cross a boundary and a split should occur. All boundaries where attribute values change should be included in the quality control. Includes, but may not be limited to: Incorporated Municipality Boundary, County Boundary, Provisioning Boundary, Emergency Service Boundary.
- *Road Centerline segment not snapped to adjacent segments:* Check to identify where road segments are not snapped to an adjacent segment.
- *Road Centerline has stacked segments:* Check to identify where road segments are stacked.

3.5.2 Local 9-1-1 Mapping Quality Control Check

The following quality control checks should be performed for 911 mapping system purposes by each local entity:

- *Road Centerline segment FROM value is higher than the TO value:* Check to identify where road segment address ranges have a higher FROM value than TO value.
- *Road Centerline segment has incorrect line directions:* Check to identify where road segments are drawn in the opposite direction of addressing.
- *Road Centerline has range gaps:* Check to identify where theoretically/potentially ranged road centerlines have address range gaps; zero ranged roads are ignored. *Only ran on counties with potential ranging.*
- *Road Centerline segment parity issue:* Check to identify where a road segment has a mixture of even and odd address ranges on the same side of the segment and conflicts with the Parity Left and Parity Right field values.

- *Road Centerline segment has zero in address range value:* Check to identify where road segment address ranges have a zero in one address range value and the other has a nonzero value.
- *Road Centerline zone attribution against intersecting polygon attribution:* Check to identify discrepancies between a road centerline's zone attribution (incorporated municipality) and the associated boundary (incorporated municipal boundary) it intersects within a buffer distance around the road centerline.

3.6 Site/Structure Address Point to Road Centerline Quality Control

Site/Structure Address Point to Road Centerline Quality Control is considered a warning for the purpose of NG9-1-1.

- *Fail on full street name:* Check to identify where the site/structure address point's street name elements and road segment's street name elements are not identical.
- *Fail on zone:* Check to identify where the site/structure address point's address number and street name elements match the road segment but are not found in the same zone.
- *Fail on address range:* Check to identify where the site/structure address point's street name elements and zone match the road segment, but the address number falls outside of the road segment's address ranges.
- *Fail on block:* Check to identify where the site/structure address point's street name elements, zone and address number match the road segment, but the site/structure address point does not fall on the correct block.
- *Fail on parity:* Check to identify where the site/structure address point's street name elements, zone and address number match the road segment, but the site/structure address point falls on the wrong side of the road segment.

3.7 Synchronization of ALI and MSAG to GIS Data

In order to transition to NG9-1-1 the ALI to Road Centerline synchronization rate must be at or above 98%, however the NG9-1-1 Core Service Provider may allow a lower initial synchronization rate in agreement with the PSAP for the transition. Currently, the State of Michigan is building these validation tools into the NG9-1-1 GIS Repository. The tools will include many of the following validations, if not all.

3.7.1 ALI to Road Centerline Synchronization

- *Fail on full street name:* Check to identify where the ALI street name elements and road segment's street name elements are not identical.
- *Fail on zone:* Check to identify where the ALI address number and street name elements match the road segment but are not found in the same zone.
- *Fail on address range:* Check to identify where the ALI street name elements and zone match the road segment, but the address number falls outside of the road segment's address ranges.

3.7.2 ALI to Site/Structure Address Point Synchronization

- *Fail on full street name:* Check to identify where the ALI street name elements and site/structure address point's street name elements are not identical.
- *Fail on zone:* Check to identify where the ALI address number and street name elements match the site/structure address point but are not found in the same zone.
- *Fail on address range:* Check to identify where the ALI street name elements and zone match the site/structure address point, but no exact address number match can be made.

- *Fail on address number suffix:* Check to identify where the ALI address number, street name elements and zone match the site/structure address point, but no exact address number suffix match can be made.

3.7.3 MSAG (Low and High) to Road Centerlines

- *Fail on full street name:* Check to identify where the MSAG street name elements and the road segment's street name elements are not identical.
- *Fail on zone:* Check to identify where an MSAG address range (high or low) and street name elements match the road segment but are not found in the same zone.
- *Fail on address range:* Check to identify where the MSAG street name elements and zone match the road segment, but no exact address range value match can be made.

3.7.4 MSAG and ALI Examples

Transition to NG9-1-1 requires alignment of the MSAG and ALI to the GIS data to ensure the E9-1-1 records can be located with the Road Centerlines and Site/Structure Address Points.

Counties should strive to standardize the abbreviations of Highways to ensure interoperability of datasets between counties. The standardization should occur in the GIS Data, if needed, and the MSAG database. The most common abbreviations are:

- County Highway = CO RD
- State Highway = M
- United State Highway = US

Each Next Generation Core Service provider has a defined process to update MSAG records in bulk. If a bulk update is needed reach out to the provider and request an update.

It is vitally important that the GIS Data Provider and local MSAG Coordinator work closely together to ensure the legacy MSAG database and GIS data remain aligned as long as there is a legacy MSAG database for the PSAP. If an ALI Discrepancy Report (DR) occurs the MSAG Coordinator should confirm with the GIS Data Provider that the record is a valid address and ensure proper abbreviations are maintained.

There are cases in Michigan where surrounding counties MSAG and ALI records are contained within the PSAPs records. In these cases, the GIS Data Provider should determine which ESNs are outside their PSAP and provide the list to the GIS Data Management service provider to ensure those records are not geocoded within the Next Generation Core Service providers system.

The use of non-USPS abbreviations for types is allowed to standardize the Legacy Street Name Type values to the MSAG and ALI. Incorrect types, not specific to the abbreviation, found in the MSAG and ALI should be updated to match the actual type as issued by the Addressing Authority. Example: If a street name type is issued as Crescent (CRES) but the MSAG has an additional type of Street (ST) the MSAG should be updated to remove the ST.

Below are examples from an MSAG where street name updates are required:

Original MSAG Street Name	Updated MSAG Street Name
CTY HWY 441	CO RD 441
HWY 68	M 68
US HWY 223	US 223
23 AV RD	23 AVENUE RD
NO 5 RD	NUMBER 5 RD
ADAMS TR	ADAMS TRL
BLUEBERRY RDG DR	BLUEBERRY RIDGE DR
FOREST PK BLVD	FOREST PARK BLVD
ALMA AV	ALMA AVE

3.8 Quality Control Exceptions

Exceptions are flags at the feature level that notify QC checks to omit the feature from a specific check. Features may have multiple exceptions. The use of exceptions should only be used to accommodate real-world situations that are identified as errors in the quality control process. Caution should be used when setting exceptions for features within a GIS dataset and should only be used when there is a viable exception that will cause an error to be identified. While there is no single specific process of implementing exceptions and the use of exception codes, the typical process is to add an exceptions field to each GIS data layer and populate with a defined code for each needed exception at the feature level.

The State of Michigan is currently building the capability to utilize feature level exception in the NG9-1-1 GIS Repository.

4. Parsing Street Names and Addresses into the Michigan Standard

Parsing addresses into their appropriate Address elements is not complicated. The Address Number is the integer portion with anything preceding the integer being placed in the Address Number Prefix field and anything following the integer being placed in the Address Number Suffix field. Most confusion arises when parsing addresses that are based on local addressing grids. Table 4-1 provides examples of how to parse address numbers into their appropriate fields.

Table 4-1 Example Parsing of Address Numbers

Address Number Prefix	Address Number	Address Number Suffix	Street Name Pre Modifier	Street Name Pre Directional	Street Name Pre Type	Street Name Pre Type Separator	Street Name	Street Name Post Type	Street Name Post Directional	Street Name Post Modifier	Legacy Street Pre Directional	Legacy Street Name	Legacy Street Name Type	Legacy Post Directional
	9510						Haley	Road				HALEY	RD	
	2221						26th	Avenue	South			26TH	AVE	S
	26601			West			Huron River	Drive			W	HURON RIVER	DR	
	7414	1/2		North	United States Highway		23				N	US 23		
	209	A		North			Birdsall	Drive			N	BIRDSALL	DR	
	8178						Saint James	Drive				ST JAMES	DR	
	25715				County Road		407					CO RD 407		
	102			East			Old State Route 28				E	OLD M 28		
	765		Old		County Road		553					OLD CR 553		
N	4327				State Route		95					M 95		
W	8328			South			Spring Lake	Lane			S	SPRING LAKE	LN	

Parsing street names into their appropriate Street Name elements usually is straightforward and mirrors how the Street Name is parsed in legacy 9-1-1 databases. Most confusion arises when populating the Street Name Pre Modifier, Street Name Pre Type, Street Name Pre Type Separator, and Street Name Post Modifier elements as these are new fields not found in legacy 9-1-1 databases that were based on the USPS Publication 28 [5] postal addressing standard. Of these four new fields, the Street Name Pre Type field will be the one most used, mostly

for numbered routes. The other three fields are not commonly used but must be populated if the address parsing rules apply. When parsing it is most important to ensure all street name parts maintain their correct order. It is recommended to avoid assigning new Street Names that require usage of the Street Name Pre Modifier or Street Name Post Modifier fields.

If translating from legacy street name values to fully spelled out Civic Location Data Exchange Format (CLDXF) the recommendation is to translate legacy pre directional values to fully spelled out pre directional values then post directional values, post type values and then determine for each street name where the elements should be placed in the remaining fields in the fully spelled out format. The Street Name field must always be populated.

Details on each Street Name element are provided in Section 3, Road Centerline – Data Element Details within the MI NG9-1-1 GIS Data Model. The NENA CLDXF Standard [13] defines the detailed civic location data elements needed for address data exchange. Review of the document is strongly recommended as it provides an in-depth discussion of address parsing for NG9-1-1 purposes.

Table 4-2 provides examples of how to parse Street Names into their appropriate fields. Footnotes immediately follow the table to explain the parsing of Street Names that have special considerations.

The table below provides examples of parsing the CLDXF fields. The legacy street name fields should also be maintained as most state and local government business processes utilize these fields in the legacy format including the CAD in the dispatch center and the legacy 9-1-1 systems.

Table 4-2 Example Parsing of Street Names

Street Name Pre Modifier	Street Name Pre Directional	Street Name Pre Type	Street Name Pre Type Separator	Street Name	Street Name Post Type	Street Name Post Directional	Street Name Post Modifier	Direction of Travel	Legacy Street Pre Directional	Legacy Street Name	Legacy Street Name Type	Legacy Street Post Directional
				Country Villa						COUNTRY VILLA		
				Saint Albert the Great	Drive					ST ALBERT THE GREAT	DR	
				Saint James ¹	Drive					ST JAMES	DR	
				O'Riley ²	Highway					O'RILEY	HWY	
				Law & Courts	Drive					LAW & COURTS	DR	
	North			Meridian	Road			N		MERIDIAN	RD	
	West			Chicago	Boulevard			W		CHICAGO	BLVD	
				South Brooke ³	Circle					SOUTH BROOKE	CIR	
				East Lake ³	Drive					EAST LAKE	DR	
				North Hills ³	Boulevard					NORTH HILLS	BLVD	
East ⁴	North			Territorial	Road				E	NORTH TERRITORIAL	RD	
		Interstate			96					I 96		
		State Highway			115					M 115		
		State Highway			10					M 10		
		State Highway			14		Turnaround			M 14 TURNAROUND		
		State Highway		89 & 43 ^{2,3}						M 89 & M 43		
		State Route		89/43 ^{2,3}						M 89 & M 43		
		State Route		68 33 ³	Highway					M 68 33	HWY	
		County Road			506					CO RD 506		
Old		County Road			553					OLD CO RD 553		
		County Highway			209					CO HWY 209		
		County Road		AD Feely	Street					CO RD AD FEELY	ST	
		County Road		AD			Feely Street ⁴			CO RD AD FEELY	ST	
				Rue ⁵	De Vin					RUE DE VIN		
				Old Plank	Road					OLD PLANK	RD	
Old ⁷				Plank	Road					OLD PLANK	RD	
	South	Trail	of the	Lakes						TRAIL OF THE LAKES		
		Lake	of the	Woods		West				LAKE OF THE WOODS		W
				Tip of the Thumb ⁸	Drive					TIP OF THE THUMB		
				Spirit of the Woods ⁸	Road					SPIRIT OF THE WOODS	RD	
				Miles	Street	North				MILES	ST	N
				East	Street	South				EAST	ST	S
				Hunters Vista		Northeast				HUNTERS VISTA		NE
				Bert	Road Trail ⁹					BERT ROAD	TRL	
				Mill Road	Court ⁹					MILL ROAD	CT	
				Lohr	Road		Access			LOHR ROAD ACCESS		
	West			Washington	Avenue		Frontage Road		W	WASHINGTON AVE FRONTAGE RD		
				Main	Street		Extended ¹⁰			MAIN STREET EXT		
		Interstate			96			westbound ¹¹		I 96 WB		
		United States Highway			23			northbound ¹¹		US 23 NB		

NOTES:

¹ All street name field values must be fully spelled out to remove confusion and ambiguity. This is important as abbreviations could have multiple interpretations. For example, "ST" could be Saint, Street, or Sandra Theresa (someone's initials).

² Special characters are allowed in NG9-1-1 Street Name fields which have a field type of Printable ASCII characters (decimal codes 32 to 126) or UTF-8 character sets. Consult with your Core Service Provider regarding their recommendation for current 9-1-1 and CAD system requirements.

³ When the Street Name is the name of a place, geographic feature, landmark, or other similar feature, the directional is included in the Street Name field and is not parsed as a Street Name Pre Directional (requires local knowledge as to whether the directional is part of the name of the place, geographic feature, landmark, or other similar feature).

⁴ When two directional words occur together before the Street Name and the second directional is not the name of a place, geographic feature, landmark, or other similar feature, the first occurrence is a Street Name Pre Modifier and the second is a Street Name Pre Directional.

⁵ Some street names are a combination of two route numbers or a route number and a local street name. When the street name is a combination of two route numbers, the jurisdiction is placed in the Street Name Pre Type and both route numbers are placed in the Street Name, typically separated by '&', '/', or 'and' (note: the separator used should be consistent across the jurisdiction). When the street name is a combination of a route number and a local street name, both are placed in the Street Name. Alternatively, the first name is parsed normally and the second name is placed in the Street Name Post Modifier. In all cases, consult with your Core Service Provider regarding their recommendation for current 9-1-1 and CAD system requirements.

⁶ Foreign language (e.g. French, Spanish, Italian) equivalents of Street Name Pre Types and Street Name Pre Type Separators are parsed into these fields and not in the Street Name field.

⁷ A Pre Modifier must be separated from the Street Name by either a Street Name Pre Directional or a Street Name Pre Type unless the Street Naming Authority has established a local practice where words such as "The" or "Old" that precede a Street Name are placed in the Street Name Pre Modifier field so the Street Name can be placed properly in an alphabetized list.

⁸ Since "Tip" and "Spirit" are not valid Street Name Pre Types and is not in the NENA *Street Name Pre Types and Street Name Post Types Registry* or USPS Publication 28, Appendix C1 [5], it is included in the Street Name.

⁹ When two Street Name Post Types occur after the Street Name, both are placed in the Street Name Post Type. However, if local addressing rules consider the first occurrence part of the Street Name, the first occurrence is included in the Street Name field and the second is parsed as a Street Name Post Type.

¹⁰ Since "Extended" is not in the NENA *Street Name Pre Types and Street Name Post Types Registry* or USPS Publication 28, Appendix C1 [5], it is parsed as a Street Name Post Modifier.

¹¹The traveling direction on divided roads is parsed as a Direction of Travel (in lowercase).

5. Road Centerline Recommendations and Best Practices for GIS Data Development and Maintenance

5.1 General Best Practices

The Quality Control checks described in Section 3, Quality Control of Next Generation 9-1-1 GIS Data, provide valuable information into how the validation software looks at the Road Centerline layer to identify integrity issues and ensure consistent, valid data throughout the dataset. Ensuring that the data meets the requirements of the Road Centerline QC checks and the synchronization of the ALI and MSAG to the Road Centerline layer will eliminate unnecessary rework and ensure that the data meets the required specifications for the NG9-1-1 Location Validation and Emergency Call Routing Functions. Quality control is a continuous process. The data maintenance plan for the Road Centerline layer must include these QC checks and at a minimum, resolution of all errors that are identified by the NGCS.

Road centerlines should be compiled from current orthoimagery or a high-quality data collection device and attributed using source data with reliable attribution. The accuracy of the Road Centerline layer is only as good as the least accurate data source or data collection device that was used to create it.

Additional guidance from NENA can be found in the NENA Information Document for GIS Data Stewardship for Next Generation 9-1-1 (NG9-1-1) NENA-INF-028.2-2023 [16].

5.2 Road Centerline Digitizing Direction

5.2.1 Limited Access Roads

Limited access roads typically have some type of physical barrier (e.g., concrete wall or curb, metal barrier, grassy median, ditches) separating the opposing traffic flow. These should be digitized with two centerlines, each representing a different direction of travel. A single centerline is used when there is only



Figure 5-2 Road Centerlines digitization with direction of travel

5.2.4 Unaddressed and Private Road Digitization

Addressed roads with parity issues and unaddressed local or private roads should be digitized following the direction of the local addressing grid. If a local addressing grid does not exist, they should be digitized in the same direction as other nearby road centerlines.



Figure 5-3 Unaddressed driveway digitization following address grid

5.3 Road Centerline Segmentation

Road segmentation is an important consideration during development and maintenance of the NG9-1-1 Road Centerline layer. Roads should always be split in the following cases:

- Road intersections
- Boundaries: County, Incorporated Municipality, PSAP, Emergency Services, ESN, MSAG Community
- Other boundaries: Unincorporated Community, Neighborhood Community, Postal Community (only if these Optional fields are being maintained in the Road Centerline layer)
- Change in the Street Name
- Change in the addressing grid
- Change in other attribute values: One-Way, Speed Limit, Road Class (only if these Optional fields are being maintained in the Road Centerline layer)

5.3.1 Overpasses and Underpasses

In Michigan it is standard practice to not split road centerline at intersections where two roads physically come together at the same elevation (at-grade intersections). Figure 5-4 shows the same junction of ramps as in Figure 5-5, but the road centerlines do not carry proper elevation attributes and therefore are only split at true at-grade intersections so as not to interfere with other business uses such as vehicle routing. Arrows along a road centerline indicate the end of that road centerline (i.e., a split).



Figure 5-4 Road Centerlines Without Elevation Attribution

An alternate practice is to split road centerlines at intersections where two roads physically come together at the same elevation (at-grade intersections). Grade is the vertical position relative to ground level. This practice will not affect the functionality of the LVF or ECRF. To maintain vehicle routability in a road network, road centerlines must either contain elevation attributes (expressed as grades) or be split only at intersections where each intersecting road centerline is at the same grade. Recognizing the impact that splitting road centerlines at intersections may have on internal uses of an RCL layer, it is recommended that these best practices are followed:

- If road centerline elevations are maintained externally, splitting them at intersections should not affect other business uses and they may be split at the discretion of the 9-1-1 GIS Data Provider. For example, the proper attribution of elevation in Figure 5-4 allows the road centerlines to be split at all

intersections (regardless of whether the two intersecting road centerlines are at the same grade), if desired.

- If road centerline elevations are maintained internally, splitting them at intersections should not affect other business uses and they may be split at the discretion of the 9-1-1 GIS Data Provider. For example, the proper attribution of elevation in Figure 5-5 allows the road centerlines to be split at all intersections (regardless of whether the two intersecting road centerlines are at the same grade), if desired.

One advantage of splitting road centerlines at intersections where two roads physically come together at the same elevation is that a geocoded location will then have cross-street information in systems such as CAD. Aside from considering other internal uses of the RCL data, it is a general best practice to represent the road centerline as it appears physically. Intersections in RCL data tend to represent physical intersection of roads. Roads that are not at-grade are not physically connecting; therefore, the two should not be split where they intersect without the proper elevation attribution.

Relative elevation (grade separation) is represented in the figures below as grades 0, 1, and 2. The labels represent the “from elevation” and “to elevation,” respectively.



Figure 5-5 Road Centerline Segments with Elevation Attribution

Figure 5-5 shows a junction of ramps where the road centerlines carry proper elevation attributes and therefore can be split at all intersections (regardless of whether these are true at-grade intersections) without affecting other business uses such as vehicle routing. Arrows along a road centerline indicate the end of that road centerline (i.e., a split).

5.3.2 Segmenting Roads Special Cases

In most cases, roads should not be split at driveways, unnamed roads, or parking lots. There are some situations where splitting a road centerline at these intersections may be beneficial for routing first responders, particularly in rural areas where there are not many addressed properties or where an addressed structure may not be visible from or is located a long distance from the road. Breaking a road centerline at these intersections allows the address ranges to be refined and provide more accurate geocoding results.

Special consideration is needed for segmentation at intersections with unaddressed alleys. Generally, if an alley is named and routable, the intersecting street should be broken. However, these named alleys should be assigned a very low speed limit (e.g., 5 or 10 mph maximum) to deter automated routing of vehicles down them. Inclusion of unaddressed alleys is a local decision and should consider the capabilities of the local CAD software.

There are often specific requirements for roads segmentation based on the needs of the local CAD software and attributes that may need to be carried in the Road Centerline layer to support CAD functionality. Consultation with the Core Services Provider and understanding the requirements of the local CAD software is necessary to determine when additional segmentation may be needed.

5.3.3 Changes in Addressing Grids

Road centerlines in the areas of Michigan that use local addressing grids require segmentation where the address range prefix changes. This can occur anywhere along a road centerline and not necessarily at an intersection with another road. Some of the local addressing grids in Michigan include directionals (N, S, E, W) in the address range prefix, representing a number of blocks in one direction, and then a second direction, from a starting point.

Sometimes the entire Address Number Prefix changes such as when a road changes direction. For example, in Figure 5-6 below, where County Road 440 is generally running N/S, the Address Number Prefix is **N**. However, when County Road 440 turns and begins running in a more E/W direction, the Address Number Prefix changes to **E**. County Road 440 requires segmentation when the Address Number Prefix changes from **N** to **E**.

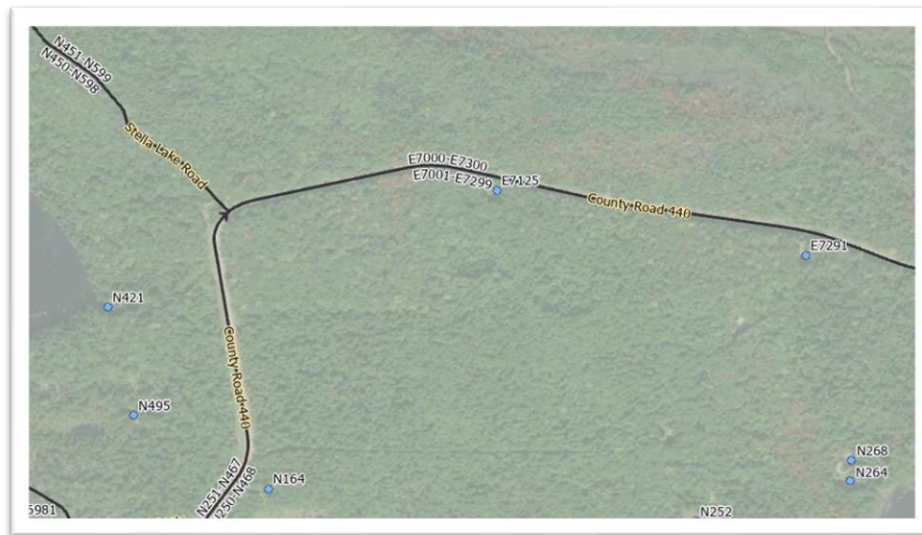


Figure 5-6 Addressing Grid Change – Address Number Prefix

Not all local addressing grids in Michigan include directionals in their grid system. In Figure 5-7 below, the address ranges for the N/S section of North Breezeland Road start at 1200/1201 while the address ranges for the E/W section of North Breezeland Road start at 34800/34801. Not only is there a large gap in the address ranges, the direction of increasing addressing is away from each other. North Breezeland Road requires segmentation where the address ranges change due to the local addressing grid numbering.

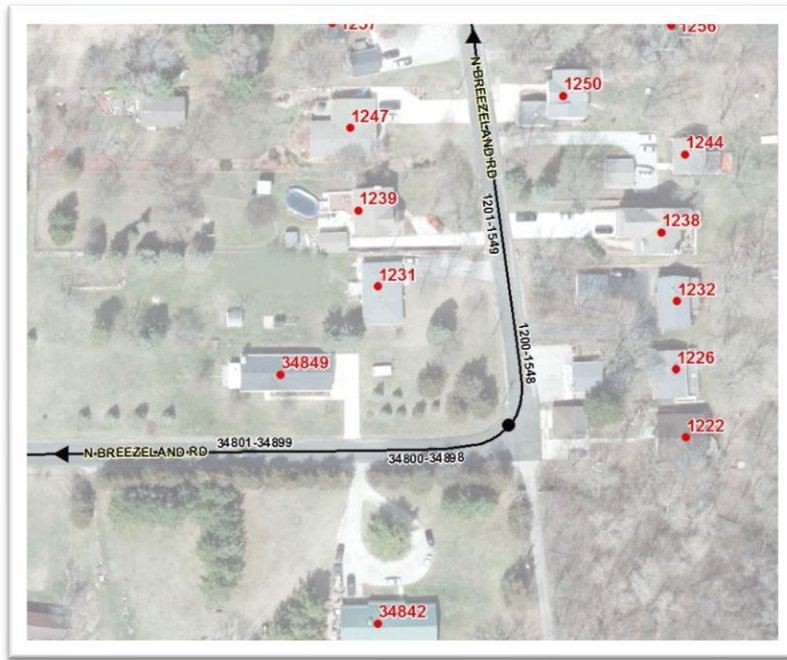


Figure 5-7 Addressing Grid Change – No Directionals in Address Number

5.3.4 Segmentation and Alignment at Boundaries

Aligning Road Centerlines at boundaries is essential for providing accurate locations for the NG9-1-1 Location Validation and Emergency Call Routing Functions and other 9-1-1 applications that rely upon geocoded locations derived from the Road Centerline address ranges. Road Centerlines must be aligned and snapped to boundaries with different jurisdictions or emergency service responsibilities so that the geocoded locations fall within the correct jurisdiction, PSAP, and Emergency Service Provider boundaries.

Road centerline splitting is critical when Required field values such as Country, State, County, Incorporated Municipality, or PSAP Boundary change as these values impact call routing.

To reduce the amount of road centerline splitting, some 9-1-1 Authorities have adopted best practices recommending Public Safety agencies develop jurisdictional boundaries that coincide with existing/natural centerline breaks such as intersections, bridges, etc.

If a Road Centerline is contiguous with a boundary (e.g., County Line Road), it must be aligned with the corresponding boundary, node for node. This is especially critical for Emergency Call Routing where the slightest deviation may result in a geocoded location being placed into the wrong PSAP Boundary polygon and then the call being routed to the incorrect PSAP.

Agreement on exactly where these boundaries are located is necessary for emergency response and data maintenance responsibilities. It is recommended that a “stitch point layer” be created that represents the location of points where GIS data from one jurisdiction ends and where the GIS data for the adjacent jurisdiction begins. These would be points where road centerline segments would be snapped to and the vertices where polygon boundaries between neighboring jurisdictions would need to align and be snapped to. Counties and local municipalities must agree on the location of these points both within Michigan and between their neighboring states. These points do not need to represent formal or legal boundaries but instead represent their agreed upon location for data maintenance purposes.

When aligning road centerline data with these neighboring jurisdictions, counties and other states, care should be taken to ensure that there are no spatial overlaps or gaps in the data. Working directly with the neighboring jurisdictions will greatly reduce these issues with the data.

In some cases, a PSAP Boundary does not align with a County Boundary due to the agreed upon response areas. Road centerlines must be split at the PSAP boundary and the County Boundary, regardless of how close they may be located to each other. Figure 5-8 below shows Tolan Road split at the Alpena and Alcona County line. Even if the addresses in Alcona County were within the Alpena County PSAP Boundary, Tolan Road must still be split at the county boundary to accommodate the Area Name elements (e.g., County, Incorporated Municipality).

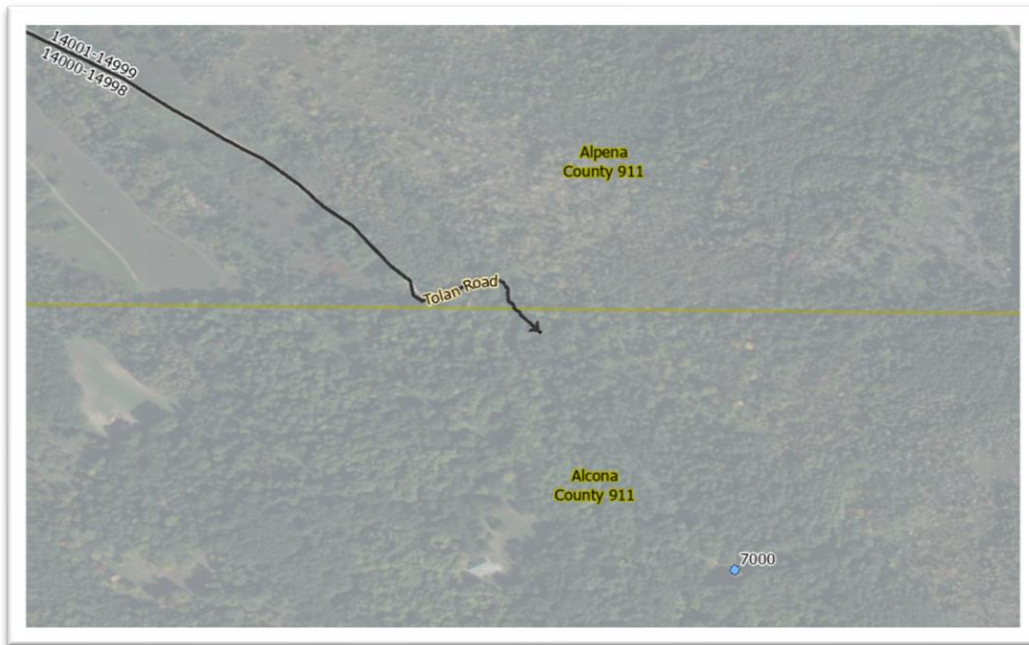


Figure 5-8 Road Dead-Ending in Adjacent County

5.4 Naming and Addressing

5.4.1 Address Ranges

For use in NG9-1-1, the address ranges on adjacent Road Centerlines with the same street name that are within the same jurisdiction must not have unintentional gaps and overlaps. In Michigan, intentional gaps often exist at jurisdictional boundaries (e.g., ranges change from 3 digit numbers to 4 digit numbers) and at changes in the local addressing grid. When a street name extends over a boundary, the address ranges should be checked to confirm that there are no unintentional gaps or overlaps in the address ranges. Any issues should be brought to the attention of the local Addressing Authorities for resolution so that the address ranges properly reflect the addresses each PSAP is responsible for on the Road Centerlines within their PSAP Boundary.



Figure 5-9 Address Ranges with Intentional Gaps

There is no NENA requirement for address ranges to be populated as potential address ranges (also known as theoretical or buffered ranges) or as actual address ranges. There are pros and cons with each method, although potential address ranges generally require less maintenance. Consultation with the Core Services Provider and understanding the requirements of the local CAD software and other local GIS needs may impact which address range method to use.

Currently, some jurisdictions utilize 0-0 address ranges to accommodate local CAD software requirements such as on the median side of limited-access roads or within a large intersection of a divided road where there is no gap in the assigned addresses on each side of the intersection. In general, 0-0 address ranges should be avoided as 0-0 ranges may conflict with some quality control processes (e.g., duplicate 0-0 address ranges with the same Street Name). On rare occasions, an address range may need to start with 0 if the first assigned address has a value less than one (e.g., $\frac{1}{2}$, $\frac{1}{4}$, .5).

5.4.2 Different Street Names on Each Side of the Road Centerline

Though uncommon, there are some roads along jurisdictional boundaries that have been assigned different street names on each side of the road. This can be confusing to responders and require GIS data to be falsely portrayed in order to include both street names for use in the NG9-1-1 Location Validation and Emergency Call Routing Functions. Rather than trying to make the GIS data fit the situation, the Street Naming Authorities should work together to come to agreement on a single street name that can be used for both sides of the street. If a common resolution is unable to be obtained, it is recommended that two Road Centerlines be created and placed slightly offset (parallel) to each other, representing their direction of travel, and be brought back together at a single point at intersections. Each alignment would be populated with the Street Name as assigned by its Street Naming Authority and addressed only on the

side of the road with that Street Name. Stacked Road Centerlines are not recommended as they may cause issues with local CAD systems.



Figure 5-10 Left-Right Street Name Differences

5.4.3 Road Centerline in a Different Jurisdiction than the Addressed Properties

On occasion, jurisdictional boundaries may parallel and fall along one side of a Road Centerline rather than being coincident with the Road Centerline. For NG9-1-1 Location Validation and Emergency Call Routing purposes, the Road Centerline attributes must reflect the addressed properties on each side of the Road Centerline, regardless of where the physical roadway is located.

5.4.4 Interstates/Highways

Interstates and limited-access highways are named with their jurisdiction and route number. Travel direction (e.g., northbound, southbound, eastbound, westbound) is often not part of the official street name but is important for responders and other service providers that need to know which side of the highway a location is associated with. It is recommended that the travel direction be included in the Direction of Travel in lowercase as “northbound”, “southbound”, “eastbound”, or “westbound”.

Example: I96 EB and I75 NB

Street Name Pre Type:	Interstate
Street Name:	96
Direction of Travel:	eastbound
Street Name Pre Type:	Interstate
Street Name:	75
Direction of Travel:	northbound

5.4.5 Ramps and Interchanges

Ramp and interchange naming can be a particularly challenging. It is strongly recommended that as much information as possible be put into the Street Name field for ramps, including the FROM road, TO road,

travel direction, designation as an on ramp or off ramp, and exit number as appropriate. Ramps should be single segments unless a physical barrier exists that splits the ramp for separate travel directions.

The following ramp naming convention is recommended, with everything placed in the Street Name field:

<Ramp/Exit #> <FROM Street> <travel direction> / <TO Street> <travel direction>

Where:

- **Ramp/Exit #:** The text “On Ramp” or “Off Ramp” and, if applicable, “Exit <#>”

Note: If there is no exit number for ramps connecting an undivided road and a limited-access road, then “On Ramp” and “Off Ramp” are preferred to a generic “Ramp” designation.

- **FROM Street:** Route/Street Name that the ramp is exiting from
- **TO Street:** Route/Street Name that the ramp is going to
- **Travel direction:** NB, SB, EB, WB

Due to the current 75 character field width limitation of the Street Name field, some abbreviations are necessary for the ramp names. For consistency, abbreviations are allowed ONLY for the travel direction (i.e., NB, SB, EB, WB) and the road jurisdiction for numbered routes in a ramp name. Everything else must be fully spelled out. The allowable abbreviations for the road jurisdiction in a ramp name are:

- I – Interstate
- US – United States Highway, United States Route
- M – State Highway, State Trunk Highway, State Route, State Road
- CO RD – County Highway, County Trunk Highway, County Route, County Road, County

Example ramp names using the recommended ramp naming convention:

- **Street Name:** West I 96/Okemos Road
- **Street Name:** East 10 Mile Road / South US 131
- **Street Name:** West I 496/South Waverly Road
- **Street Name:** Byron Center Avenue/West M 6

5.5 Overlapping Routes and Multiple Street Names

Street names are an important part of an NG9-1-1 system. However, in many cases, roads can be known by several different street names. Local jurisdictions may assign a local name for a road, while the Michigan DOT may assign a state highway number to that same road. As a further complication, the road may also carry a US route number, a second state route number, a county route number, or a memorial or honorarium name for that same road.

These multiple street names are all important, however, the official 9-1-1 name assigned by the Street Naming Authority is the Street Name that must be populated in the Road Centerlines layer for NG9-1-1 Location Validation and Emergency Call Routing purposes. To easily keep track of street name alias you can build a Street Name Alias Table. Documentation required to create a Street Name Alias Table is located in [Appendix B | Street Name Aliases](#).

Organizations with local CAD systems that can currently use related tables should consider developing a Street Name Alias Table now in a format that can be used by their CAD system, if time and resources permit. More advanced CAD systems may allow alias street names to be parsed into the Street Name elements while others may initially only be able to handle a simple concatenated full street name. Any work done now would not be lost but be an important first step for development the future NG9-1-1 Street Name Alias Table.

5.5.1 Street Naming Hierarchy

The most important thing to remember is that for NG9-1-1 purposes, the official 9-1-1 name assigned by the Street Naming Authority is the Street Name that must be populated in the Road Centerlines layer. All other names are considered alias street names and would be populated in the Alias Street Name Table.

Where named and numbered roads overlap, it is usually clear which street name is the official 9-1-1 street name to populate in Road Centerline layer. However, there are some situations where the street name overlap is in a small, limited area (e.g., traffic circles, roundabouts, exit ramps that lead to multiple roads) and determining which official 9-1-1 street name to populate in the Road Centerlines layer may not be straightforward. For these situations where two official 9-1-1 Street Names overlap, follow this hierarchy for populating the Street Name in the Road Centerlines:

- Interstate Name (highest priority)
- Interstate Business Route name
- US Route name
- US Business, Alternate, or Truck Route name
- State Route name
- State Business, Alternate, or Truck Route name
- County Route Name
- Other local or memorial street name (lowest priority)

Using this hierarchy, the highest jurisdiction route name would be put into the Road Centerline Street Name, and the lower jurisdiction route would go into the Street Name Alias Table. When multiple routes with the same jurisdiction overlap, the lowest route number would go into the Road Centerline Street Name and the higher route number(s) would go into the Street Name Alias Table.

For example, sometimes an exit ramp leads to more than one connected road but only one of the connected street names can be used for the “TO Street” in the ramp name. For the road centerline leaving the “FROM Street,” the “TO Street” in the ramp name should follow the naming hierarchy above and be populated with the highest jurisdiction route name. The lower jurisdiction route would go into the Street Name Alias Table. At some point, the ramp will split and the centerline for each ramp after the split should be named with the “TO Street” for the connected road it leads to.

5.6 Roundabouts and Traffic Circles

Naming of roundabouts and traffic circles can be complicated, particularly when routes overlap the official 9-1-1 street name or when street names end or change at the circle. Many of the Street Naming Hierarchy concepts discussed above in Section 5.5, Overlapping Routes and Multiple Street Names, can be applied to roundabouts and traffic circles.

5.6.1 If two roads intersect at a roundabout or traffic circle

Populate the Street Name elements with the official 9-1-1 street name on those segments in the circle that one would traverse to get to the other side of the circle. In situations where a segment in the circle would be traversed by both intersecting roads, populate the Street Name elements with the street name of the road with the higher jurisdiction, following the same Street Naming Hierarchy as established above in Section 5.5, Overlapping Routes and Multiple Street Names. If both roads only have a local street name, populate the Street Name elements with the name of the street that typically has a higher traffic flow. All other overlapping street names and route numbers would go into the Street Name Alias Table.

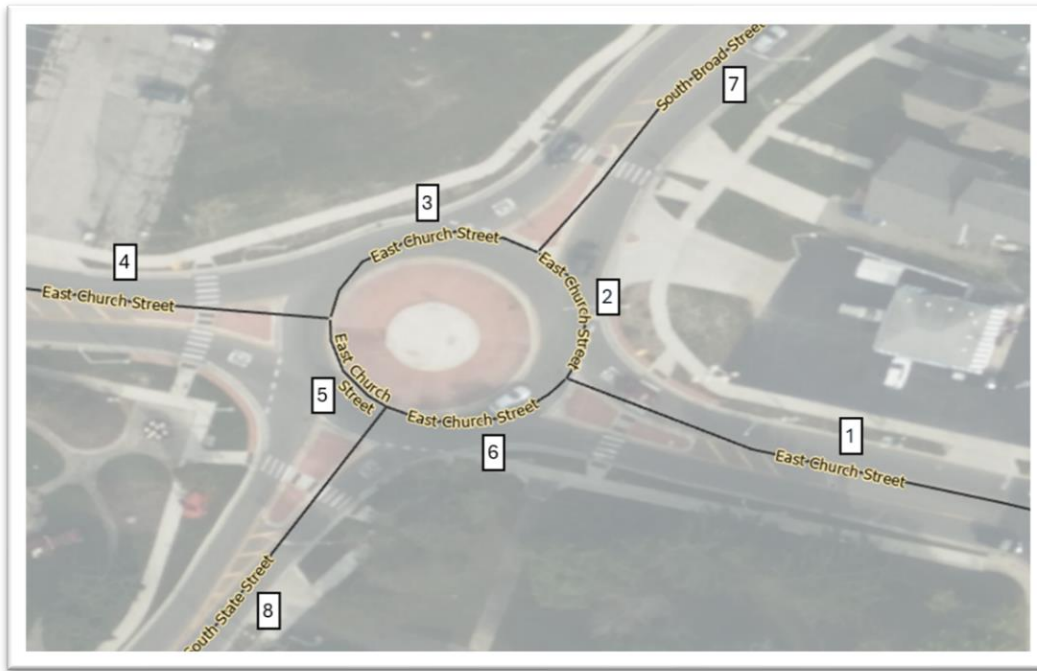


Figure 5-11 Roundabout with Two Intersecting Roads at the Same Hierarchy

For example, in Figure 5-11 above, East Church Street runs east-west through the roundabout and South Broad Street / South State Street runs north-south through the roundabout. All three (3) are the official 9-1-1 name as assigned by the Street Naming Authority and all three (3) are local roads at the same hierarchy. Since East Church Street has a higher traffic flow than South Broad Street / South State Street, the Street Name elements for segments 2, 3, 5, and 6 in the circle are populated with East Church Street.

If a Street Name Alias Table is used, South Broad Street and South State Street would be populated as an Alias Street Name in the Street Name Alias Table for these segments. Table 5-1 below provides the recommended population of the Street Name elements and Table 5-2 provides the Street Name Alias Table for all segments.

Table 5-1 Population of Street Names in Figure 5-11

Segment Number	From Address Left	To Address Left	From Address Right	To Address Right	Parity Left	Parity Right	Street Name Pre Directional	Street Name	Street Name Post Type	Legacy Street Name Pre Directional	Legacy Street Name	Legacy Street Name Type
1	201	205	200	218	O	E	East	Church	Street	E	CHURCH	ST
2	0	0	0	0	Z	Z	East	Church	Street	E	CHURCH	ST
3	0	0	0	0	Z	Z	East	Church	Street	E	CHURCH	ST
4	121	189	120	188	O	E	East	Church	Street	E	CHURCH	ST
5	0	0	0	0	Z	Z	East	Church	Street	E	CHURCH	ST
6	0	0	0	0	Z	Z	East	Church	Street	E	CHURCH	ST
7	101	195	100	194	O	E	South	Broad	Street	S	BROAD	ST
8	201	299	200	298	O	E	South	State	Street	S	STATE	ST

Table 5-2 Population of Street Name Aliases in Figure 5-11

Segment Number	From Address Left	To Address Left	From Address Right	To Address Right	Parity Left	Parity Right	Street Name Pre Directional	Street Name	Street Name Post Type	Legacy Street Name Pre Directional	Legacy Street Name	Legacy Street Name Type
2	0	0	0	0	Z	Z	South	Broad	Street	S	BROAD	ST
2	0	0	0	0	Z	Z	South	State	Street	S	STATE	ST
3	0	0	0	0	Z	Z	South	Broad	Street	S	BROAD	ST
3	0	0	0	0	Z	Z	South	State	Street	S	STATE	ST
5	0	0	0	0	Z	Z	South	Broad	Street	S	BROAD	ST
5	0	0	0	0	Z	Z	South	State	Street	S	STATE	ST
6	0	0	0	0	Z	Z	South	Broad	Street	S	BROAD	ST
6	0	0	0	0	Z	Z	South	State	Street	S	STATE	ST

5.6.2 If a single street name ends at a roundabout or traffic circle

Populate the Street Name elements with the official 9-1-1 street name of the primary road that traverses through the circle on those segments in the circle that one would traverse to get to the other side of the circle. Continue the ending street name into the circle, populating the ending street name on those segments in the circle that one would traverse to get to the other side of the circle and populating the ending street name on those segments in the circle one would have to traverse to get from the primary road to the ending street. For routing purposes, the street name of the primary road that traverses through the circle would be populated as an Alias Street Name in the Street Name Alias Table for those segments in the circle populated with the ending street name.



Figure 5-12 Roundabout with Road Ending at the Roundabout

For example, in Figure 5-12 above, Rose Crest Boulevard ends at the roundabout where it intersects with Central Park Boulevard. The Street Name elements for segment 2 in the circle would be populated with Central Park Boulevard since it runs mainly east-west through the circle, and it is the primary segment one would traverse through the circle. The Street Name elements for segment 5 in the circle would be populated with Rose Crest Boulevard in order to travel from Rose Crest Boulevard to eastbound Central Park Boulevard. The Street Name elements for segment 6 in the circle would also be populated with Rose Crest Boulevard in order to travel from eastbound Central Park Boulevard to Rose Crest Boulevard. For routing purposes, segments 5 and 6 in the circle would be populated with Central Park Boulevard as an Alias Street Name in the Street Name Alias Table. Table 5-3 below provides the recommended population of the Street Name elements and Table 5-4 provides the Street Name Alias Table for all segments.

Table 5-3 Population of Street Names in Figure 5-12

Segment Number	From Address Left	To Address Left	From Address Right	To Address Right	Parity Left	Parity Right	Street Name	Street Name Post Type	Legacy Street Name	Legacy Street Name Type
1	200	298	201	299	E	O	Central Park	Boulevard	CENTRAL PARK	BLVD
2	0	0	0	0	Z	Z	Central Park	Boulevard	CENTRAL PARK	BLVD
3	100	198	101	199	E	O	Central Park	Boulevard	CENTRAL PARK	BLVD
4	200	298	201	299	E	O	Rose Crest	Boulevard	ROSE CREST	BLVD
5	0	0	0	0	Z	Z	Rose Crest	Boulevard	ROSE CREST	BLVD
6	0	0	0	0	Z	Z	Rose Crest	Boulevard	ROSE CREST	BLVD

Table 5-4 Population of Street Name Aliases in Figure 5-12

Segment Number	From Address Left	To Address Left	From Address Right	To Address Right	Parity Left	Parity Right	Street Name	Street Name Post Type	Legacy Street Name	Legacy Street Name Type
5	0	0	0	0	Z	Z	Central Park	Boulevard	CENTRAL PARK	BLVD
6	0	0	0	0	Z	Z	Central Park	Boulevard	CENTRAL PARK	BLVD

5.6.3 If multiple street names end at a roundabout or traffic circle

Populate the Street Name elements on those segments in the circle exactly as described above in Section 5.6.2, **If a single street name ends at a roundabout or traffic circle**, with one exception. Both ending street names would only be populated on those segments in the circle one would have to traverse to get to the road on the other side of the circle. For routing purposes, the ending street names would be populated as an Alias Street Name in the Street Name Alias Table for those segments in the circle one would traverse to get from the primary road to the ending street.

However, if multiple street names end at a roundabout or traffic circle and the primary road that traverses through the circle enters and exists the circle as divided roads, all segments in the circle would be populated with the official 9-1-1 street name of the primary road. For routing purposes, the ending street names would be populated as an Alias Street Name on those segments in the circle that one would traverse to get to the road on the other side of the circle.

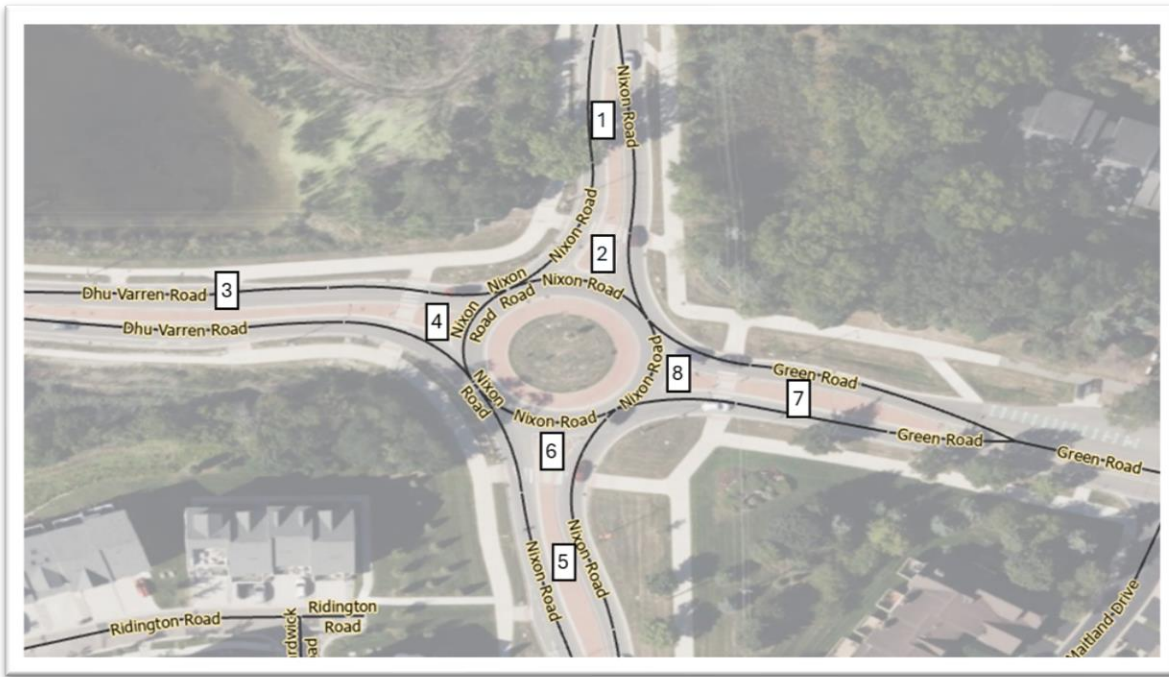


Figure 5-13 Roundabout with Multiple Roads Ending at the Roundabout

For example, Figure 5-13 above, Green Road and Dhu Varren Road both end at the roundabout where they intersect with Nixon Road. Since Nixon Road enters and exists the roundabout as divided roads, the Street Name elements for segments 2, 4, 6, and 8 in the circle are populated with Nixon Road. For routing purposes, segment 2 in the circle would be populated with Green Road as an Alias Street Name in the Street Name Alias Table and segment 6 in the circle would be populated with Dhu Varren Road as an Alias Street Name in the Street Name Alias Table.

Table 5-5 Population of Street Names in Figure 5-13

Segment Number	From Address Left	To Address Left	From Address Right	To Address Right	Parity Left	Parity Right	Street Name	Street Post Type	Legacy Street Name	Legacy Street Name Type
1	0	0	0	0	Z	Z	Nixon	Road	NIXON	RD
2	0	0	0	0	Z	Z	Nixon	Road	NIXON	RD
3	0	0	0	0	Z	Z	Dhu Varren	Road	DHU VARREN	RD
4	0	0	0	0	Z	Z	Nixon	Road	NIXON	RD
5	0	0	0	0	Z	Z	Nixon	Road	NIXON	RD
6	0	0	0	0	Z	Z	Nixon	Road	NIXON	RD
7	0	0	0	0	Z	Z	Green	Road	GREEN	RD
8	0	0	0	0	Z	Z	Nixon	Road	NIXON	RD

Table 5-6 Population of Street Name Aliases in Figure 5-13

Segment Number	From Address Left	To Address Left	From Address Right	To Address Right	Parity Left	Parity Right	Street Name	Street Post Type	Legacy Street Name	Legacy Street Name Type
2	0	0	0	0	Z	Z	Green	Road	GREEN	RD
6	0	0	0	0	Z	Z	Dhu Varren	Road	DHU VARREN	RD

Jurisdictional boundaries that cross through a traffic circle or roundabout such as in Figure 5-14 below, directly impact the Street Name assigned to the Road Centerline segments. It is important for the Street Naming Authorities to agree on the official 9-1-1 name for each of the segments within the circle so that NG9-1-1 Location Validation and Emergency Call Routing Functions operate as expected.

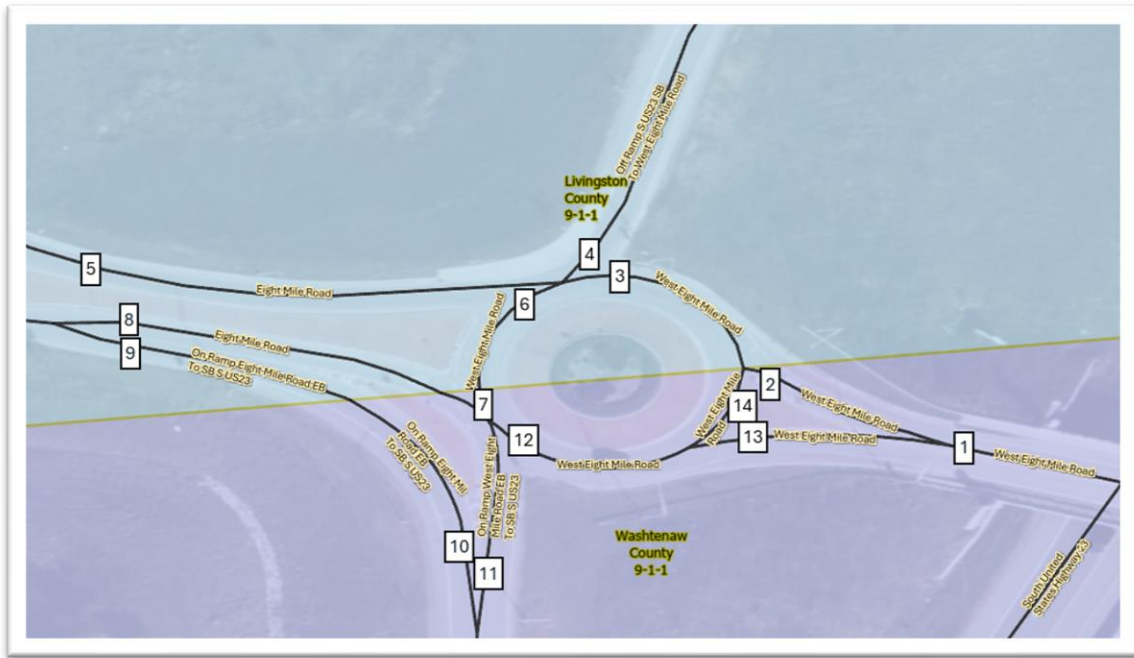


Figure 5-14 Roundabout with Multiple Roads Ending at the Roundabout

Local CAD software requirements must also be considered as they may impact the assigned Street Name, particularly if the local CAD software cannot handle Street Name Alias Tables. Sometimes, assigning the traffic circle or roundabout its own unique 9-1-1 Street Name may resolve the conflicting needs of the different jurisdictions as well as the CAD software.

Table 5-7 Population of Street Names in Figure 5-14

Segment Number	From Address Left	To Address Left	From Address Right	To Address Right	Parity Left	Parity Right	Street Name Pre Directional	Street Name	Street Name Post Type	Legacy Street Pre Directional	Legacy Street Name	Legacy Street Name Type
1	0	0	0	0	Z	Z	West	Eight Mile	Road	W	EIGHT MILE	RD
2	0	0	0	0	Z	Z	West	Eight Mile	Road	W	EIGHT MILE	RD
3	0	0	0	0	Z	Z	West	Eight Mile	Road	W	EIGHT MILE	RD
4	0	0	0	0	Z	Z		Off Ramp S US23 SB to West Eight Mile Road			OFF RAMP S US 23 SM TO W EIGHT MILE RD	
5	0	0	400	466	Z	E		Eight Mile	Road		EIGHT MILE	RD
6	0	0	0	0	Z	Z	West	Eight Mile	Road	W	EIGHT MILE	RD
7	0	0	0	0	O	Z	West	Eight Mile	Road	W	EIGHT MILE	RD
8	401	459	0	0	O	Z		Green	Road		GREEN	RD
8	0	0	0	0	Z	Z		Eight Mile	Road		EIGHT MILE	RD
9	0	0	0	0	Z	Z		On Ramp Eight Mile Road EB to SB S US 23			ON RAMP EIGHT MILE RD EB TO SB S US 23	
10	0	0	0	0	Z	Z		On Ramp Eight Mile Road EB to SB S US 23			ON RAMP EIGHT MILE RD EB TO SB S US 23	
11	0	0	0	0	Z	Z		On Ramp West Eight Mile Road EB to SB S US 23			ON RAMP W EIGHT MILE RD EB TO SB S US 23	
12	0	0	0	0	Z	Z	West	Eight Mile	Road	W	EIGHT MILE	RD
13	0	0	0	0	Z	Z	West	Eight Mile	Road	W	EIGHT MILE	RD
14	0	0	0	0	Z	Z	West	Eight Mile	Road	W	EIGHT MILE	RD

Table 5-8 Population of Street Name Aliases in Figure 5-14

Segment Number	From Address Left	To Address Left	From Address Right	To Address Right	Parity Left	Parity Right	Street Name Pre Directional	Street Name	Street Name Post Type	Legacy Street Pre Directional	Legacy Street Name	Legacy Street Name Type
3	0	0	0	0	Z	Z		Eight Mile	Road		EIGHT MILE	RD
4	0	0	0	0	Z	Z		Off Ramp S US23 SB to Eight Mile Road			OFF RAMP S US 23 SM TO EIGHT MILE RD	
6	0	0	0	0	Z	Z		Eight Mile	Road		EIGHT MILE	RD
7	0	0	0	0	O	Z		Eight Mile	Road		EIGHT MILE	RD
11	0	0	0	0	Z	Z		On Ramp Eight Mile Road EB to SB US 23	Road		ON RAMP EIGHT MILE RD EB TO SB US 23	RD
12	0	0	0	0	Z	Z		Eight Mile	Road		EIGHT MILE	RD
14	0	0	0	0	Z	Z		Eight Mile	Road		EIGHT MILE	RD

5.7 Military Bases and Tribal Nations

Military bases and tribal nations may or may not have their own PSAP and responsibility for emergency services. In most cases, the military facility will share street name information but will not provide address specific information. It is recommended that the local 9-1-1 jurisdiction reach out to the military facility and work directly with them to obtain the most current information the facility is willing to provide.

Local 9-1-1 jurisdictions having difficulties obtaining road information from military bases or tribal nations should reach out to the State of Michigan, DTMB, NG9-1-1 Repository HelpDesk (DTMB-NG911GIS@michigan.gov) for assistance.

6. Site/Structure Address Point Recommendations and Best Practices for GIS Data Development and Maintenance

6.1 General Best Practices

The Quality Control checks described in Section 3, Quality Control of Next Generation 9-1-1 GIS Data, provide valuable information into how the validation software looks at the Site/Structure Address Point layer to identify integrity issues and ensure consistent, valid data throughout the dataset. Ensuring that the data meets the requirements of the Address Point QC checks, Address Point to Road Centerline QC checks, and the synchronization of the ALI to the Site/Structure Address Point layer will eliminate unnecessary rework and ensure that the data meets the required specifications for the NG9-1-1 Location Validation and the Emergency Call Routing Functions. Quality control is a continuous process. The data maintenance plan for the Site/Structure Address Point layer must include these QC checks and at a minimum, resolution of all critical errors.

Address point placement should be based on an authoritative list of addresses, current orthoimagery or a high-quality data collection device, and source data with reliable attribution. The accuracy of the Site/Structure Address Point layer is only as good as the least accurate data source or data collection device that was used to create it.

NG9-1-1 civic address validation incorporates subaddress elements such as Site, SubSite, Structure, Floor, Wing, Unit, Room, and Seat to enable precise call routing and dispatch. Each location with subaddress details must also include a primary address point to support verification against legacy systems and facilitate accurate interpretation by 9-1-1 call takers. See Section 6.3.2 **Multiple Structures and/or Sites that Share the Same Address** for additional information.

Given today's navigation technologies used by consumers and emergency responders, it is strongly recommended that Addressing Authorities assign an address based on the named road used to access the structure. This is especially important when there is no direct access from the road that the front entrance to the addressed structure faces. Emergency responders may waste valuable time backtracking to an address if the assigned address does not provide the most direct route to the structure.

6.2 Address Point Placement and Point Classification

The NENA Information Document for Development of Site/Structure Address Point Data for 9-1-1 NENA-INF-014.1-2025 [14] provides detailed guidelines on address point placement and subaddress data development. Review of the document is strongly recommended as it provides an in-depth discussion of five address point placement methodologies that meet NG9-1-1 Location Validation and Emergency Call Routing requirements. These include:

- **Geocoding:** Placement of an Address Point Based on Geocoding off of Road Centerlines
- **Parcel:** Placement of an Address Point Based on a Parcel
- **Site:** Placement of an Address Point Based on a Site
- **Structure:** Placement of an Address Point Based on a Structure(s)
- **Property Access:** Placement of an Address Point Based on Property Access

The document also includes a section on Address Point Placement for Subaddresses (specific locations within structures, sites, or within a group of structures and/or sites). As such, the NENA Information Document for Development of Site/Structure Address Point Data for 9-1-1 NENA-INF-014.1-2015 [14] should be considered a

companion document to Section 6, **Site/Structure Address Point Recommendations and Best Practices for GIS Data Development and Maintenance**, in this document.

The Michigan NG9-1-1 GIS Data Model includes a Point Classification field to further categorize Site/Structure Address Points. The values in the domain are:

- **Primary:** a site/structure address point for a location that has no subaddress
- **Subaddress:** a site/structure address point for a location that has subaddress data (site, subsite, structure, floor label, floor index, wing, unit, unit pre type, unit value, section, row, room, seat)
- **Primary for Subaddress:** a site/structure address point representing a primary point placed at the main entrance where all other points include subaddress information (e.g., an apartment complex)
- **Access Point for Primary:** a site/structure address that represents the designated access location for a primary point situated far from the road.
- **Marker:** a site/structure address point for a location that is a marker. The point must have either the Distance Marker or Location Marker field populated.
- **Not Classified:** a site/structure address point for a location where the classification has not be set.

Address point placement is especially critical for NG9-1-1 Emergency Call Routing and dispatch. During NG9-1-1 Emergency Call Routing, the location of an identified address point is spatially compared to the PSAP Boundary to determine which PSAP to send the call. The location of the same identified address point is also spatially compared to the Emergency Services Boundaries to provide the call taker with the recommended Law, Fire and EMS providers that should respond to the call. The address point must fall within the correct PSAP Boundary or valuable time will be lost for call transfer to the correct PSAP.

6.2.1 Address Point versus Access Point

Primary address points are typically placed on the addressed feature (e.g., a structure or a site). However, there are some situations where an access point may be preferred. An access point is the point of access to the addressed feature and may represent a driveway, gate, an entrance to a building containing multiple addresses, or other entrance. Access points can also be used for a building with multiple entrances where each entrance serves many specific addresses (e.g., a high-rise building where certain entrances only allow access to units on specific floors.)

The access point can be useful for directing emergency responders to a structure that may be located far from the road it is addressed off of or may share a long driveway with several other addressed structures as shown below in Figure 6-1. In such cases, it may be useful to include an address point and an access point. Access points should be placed as a Property Access address point, offset from the road centerlines and in alignment with the direction of the increasing address ranges. Attributes on a Property Access address point should be populated with the same values as on the Structure address point it represents, with only the Placement Method attribute being populated differently. This is regardless as to whether the access point is physically located in a different jurisdiction or responder area since its location only represents from where off of a named road one would turn to access the addressed structure.



Figure 6-1 Structure Address Points on Structures with Property Access Address Points at the shared driveway

Access points are valuable for guiding emergency responders to the correct structure when properties have multiple entrances. As illustrated in Figure 6-2, a campus with two addressed buildings located far from its primary entrances benefits from clearly defined access points.



Figure 6-2 Property Access Address Points indicating the entrance used to reach the Structure

Road reconstruction projects for safer and efficient traffic flow may result in the access to addressed properties being relocated so that access is from a different road than what the property is addressed off of, as shown below in Figure 6-3. If the properties are unable to be readdressed to the new access road (which is strongly recommended), then including both a Structure address point and a Property Access address point may benefit emergency responders by directing them to the relocated entrance. The example below shows all four (4) potential entrances into the structure.

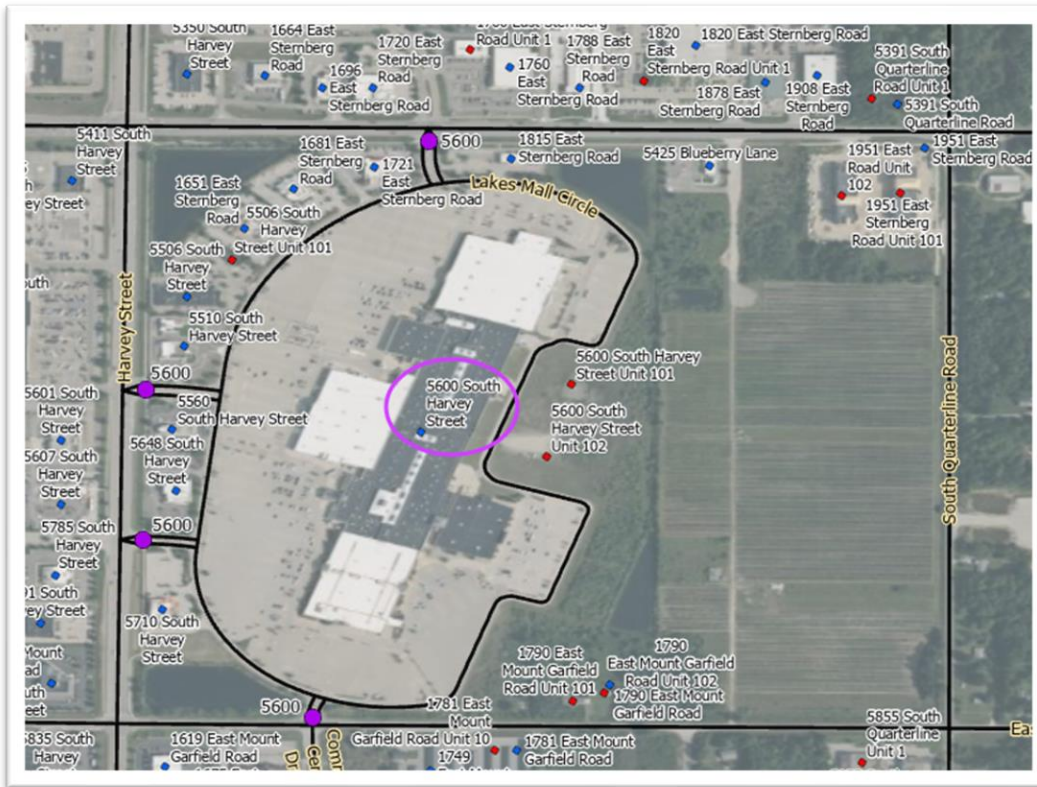


Figure 6-3 Property Access Address Points indicating the entrance to use to reach the Structures

If both an access point and address point are shown, population of the Placement Method attribute (see the MI NG9-1-1 GIS Data Model) is strongly recommended to clearly differentiate the two points. It also provides a means to easily remove one or the other if a 9-1-1 application is unable to differentiate between them. A list of acceptable values can be found here:

<http://technet.nena.org/nrs/registry/SiteStructureAddressPointPlacementMethod.xml>. See NENA Information Document for Development of Site/Structure Address Point Data for 9-1-1 NENA-INF-014.1-2015 [14], Section 3.4.5, Placement of an Address Point Based on Property Access, for more information.

6.3 Address Point Placement for Special Cases

In most cases, address point placement is straightforward with points placed on the center of a structure or site. Large structures or sites, particularly those with multiple entry points, may benefit by having the address point placed at the primary entrance to the structure or site. However, there are some situations that may require a little more research or even field visits to determine the correct placement location.

6.3.1 Multiple Addresses or Units within a Single Structure

Shopping centers, commercial buildings, condominiums, and duplexes contain multiple businesses or residences that are located within the same structure. In some cases, the individual units have been addressed with their own individual address number but in many situations, they share the same address number and are only differentiated by subaddress information (e.g., apartment, unit, suite, etc.). In both situations, Subaddress point placement is usually based on whether the units share an entrance to the building or have their own separate entrance.

Generally, Subaddress points should be placed at or near each addressed unit's building entrance, just within the building footprint and near the building base. This will keep the Subaddress points very close to their true location, even if future imagery shifts slightly, and will help avoid the urge to move the

address points each time new imagery is acquired. This point placement method is shown in Figure 6-4 below, where each unit in a shopping center has its own separate entrance.

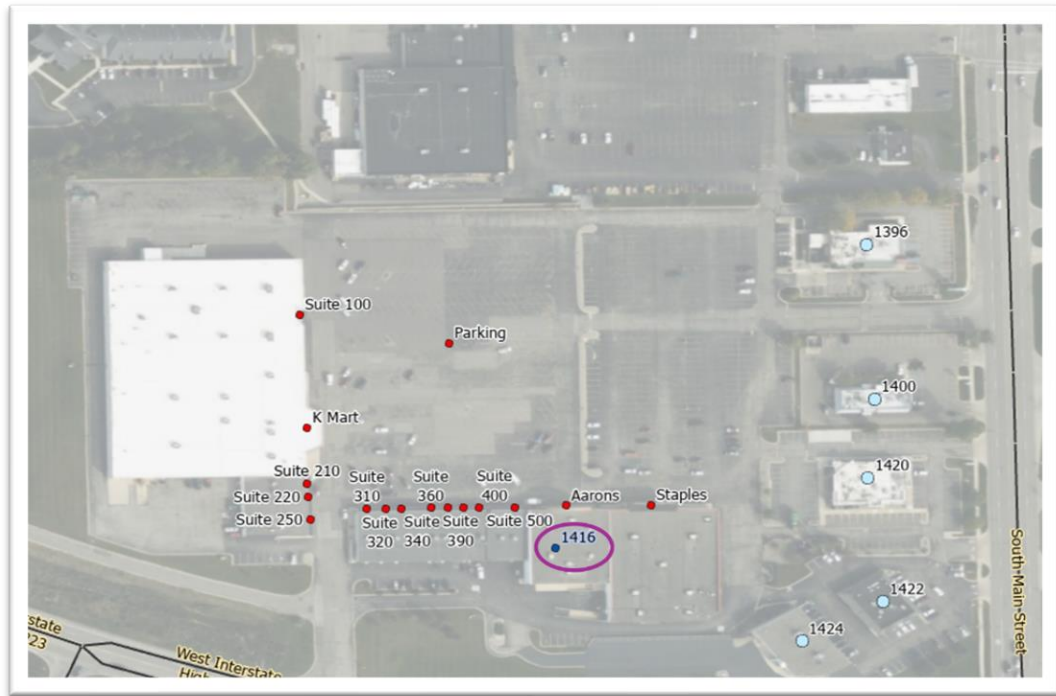


Figure 6-4 Multiple addresses within a single structure, all with separate entrance.

Table 6-1 Population of Street Names in Figure 6-4

Address Number	Street Name Pre Directional	Street Name	Street Name Post Type	Legacy Street Pre Directional	Legacy Street Name	Legacy Street Name Type	Building	Floor	Unit Type	Unit	Complete Landmark Name
1416	South	Main	Street	S	MAIN	ST			Suite	100	K Mart
1416	South	Main	Street	S	MAIN	ST			Suite	210	
1416	South	Main	Street	S	MAIN	ST			Suite	220	Postal Plus
1416	South	Main	Street	S	MAIN	ST			Suite	250	Sherwin Williams
1416	South	Main	Street	S	MAIN	ST	Crossroads Plaza	1	Suite	310	AT&T Store
1416	South	Main	Street	S	MAIN	ST	Crossroads Plaza	1	Suite	320	
1416	South	Main	Street	S	MAIN	ST	Crossroads Plaza	1	Suite	340	
1416	South	Main	Street	S	MAIN	ST	Crossroads Plaza	1	Suite	360	SVS Vision
1416	South	Main	Street	S	MAIN	ST	Crossroads Plaza	1	Suite	380	
1416	South	Main	Street	S	MAIN	ST	Crossroads Plaza	1	Suite	390	Salsarias
1416	South	Main	Street	S	MAIN	ST	Crossroads Plaza	1	Suite	400	Mancino's
1416	South	Main	Street	S	MAIN	ST	Crossroads Plaza	1	Suite	500	Cornerstone Community Church
1416	South	Main	Street	S	MAIN	ST	Crossroads Plaza	1		Aarons	Aarons
1416	South	Main	Street	S	MAIN	ST				K Mart	K Mart
1416	South	Main	Street	S	MAIN	ST				Parking	K Mart - Parking
1416	South	Main	Street	S	MAIN	ST	Crossroads Plaza	1		Staples	Staples
1416	South	Main	Street	S	MAIN	ST	Crossroads Plaza	1			Crossroads Plaza

When addressed units share a common entrance, typical practice is to stack the address points at the shared building entrance as exactly where within the structure an individual unit is located is usually unknown. Subaddress points should be placed just within the building footprint, near the shared entrance for the addressed unit. Consultation with the Core Services Provider and understanding the requirements of the local CAD software is necessary to determine whether stacked points can be used.

In Figure 6-5 below, two buildings share the same address with each building having two primary entrances. Each entrance provides access to four separate apartments. Four Subaddress points are stacked at each building entrance, representing the four apartments that can be accessed through that entrance. Providing this level of detail for complicated addressing situations will help direct responders to the correct entrance, saving valuable time during an emergency.



Figure 6-5 Multiple addresses within a single structure, sharing a common entrance

Table 6-2 Population of Street Names in Figure 6-5

Address Number	Street Name Pre Directional	Street Name	Street Name Post Type	Legacy Street Pre Directional	Legacy Street Name	Legacy Street Name Type	Building	Floor	Unit Type	Unit
835		Arcadian	Boulevard		ARCADIAN	BLVD				
835		Arcadian	Boulevard		ARCADIAN	BLVD			Apartment	61
835		Arcadian	Boulevard		ARCADIAN	BLVD			Apartment	62
835		Arcadian	Boulevard		ARCADIAN	BLVD			Apartment	63
835		Arcadian	Boulevard		ARCADIAN	BLVD			Apartment	64
835		Arcadian	Boulevard		ARCADIAN	BLVD			Apartment	65
835		Arcadian	Boulevard		ARCADIAN	BLVD			Apartment	66
835		Arcadian	Boulevard		ARCADIAN	BLVD			Apartment	67
835		Arcadian	Boulevard		ARCADIAN	BLVD			Apartment	68
835		Arcadian	Boulevard		ARCADIAN	BLVD			Apartment	69
835		Arcadian	Boulevard		ARCADIAN	BLVD			Apartment	70
835		Arcadian	Boulevard		ARCADIAN	BLVD			Apartment	71
835		Arcadian	Boulevard		ARCADIAN	BLVD			Apartment	72
835		Arcadian	Boulevard		ARCADIAN	BLVD			Apartment	73
835		Arcadian	Boulevard		ARCADIAN	BLVD			Apartment	74
835		Arcadian	Boulevard		ARCADIAN	BLVD			Apartment	75
835		Arcadian	Boulevard		ARCADIAN	BLVD			Apartment	76

Some 9-1-1 applications and CAD software have difficulty with subaddresses. To alleviate this issue, a Primary address point that has only the structure address and no subaddress information can be created and placed at the structure’s primary entrance. The address points with subaddress information can then be stacked on it. If subaddresses are not usable in an application, Subaddress points with populated subaddress fields can then be easily extracted from the file while still allowing other applications full use of the address points with subaddress information.

Trying to place Subaddress points exactly where individual units are located can be resource intensive to research, create, and maintain. Placement at this level of detail should be reserved for locations where knowing that level of detail will be valuable to the responders.

Large buildings may sometimes have multiple entrances with elevators located nearby that only serve specific floors. In these situations, it is important to make sure that Subaddress points are stacked at the building entrance associated with the elevator that serves their floor so that responders are directed to the correct entrance.

In rare situations, a structure may be split by a PSAP Boundary or Emergency Service Boundary. In these situations, it is critical that the Primary address and Subaddress points are placed within the corresponding PSAP and Emergency Services Boundaries that services the address. This may not be at the structure entrance.

6.3.2 Multiple Structures and/or Sites that Share the Same Address

Some properties contain multiple structures and/or sites that share the same address and are only differentiated by a number, name, or other unique identifier (e.g., medical campus, mobile home park, correctional facility, campground).

At a minimum, each structure and/or site should have its own Subaddress point with subaddress fields populated so that responders can be sent to the correct location. This is especially critical when the property is split by a PSAP Boundary or Emergency Service Boundary. Primary address points must be placed so that calls can be routed to the correct PSAP, and the appropriate emergency service providers can be identified.

To assist responders, it is often helpful to create a Property Access address point that contains only the property address (no subaddress information) and place the address point at the primary access to the property, particularly if the property is very large or the CAD software does not recognize subaddresses as unique addresses. If subaddress information is known but one is not able to identify the specific structure and/or site it is associated with, Property Access Subaddress points with subaddress information can be stacked on this access point.

In the mobile home park in Figure 6-6 below, there are two separate unnamed driveways where the structures on each driveway share the same address but have different unit numbers. In this example, all Units (Lots) are all addressed as 1700 Robbins Road. Subaddress points with subaddress information are placed on each structure. A separate Property Access address point with no subaddress information is placed at the main driveway entrance.



Figure 6-6 Structures share same address but are differentiated by their unit number

Table 6-3 Population of Street Names in Figure 6-6

Address Number	Street Name Pre Directional	Street Name	Street Name Post Type	Legacy Street Pre Directional	Legacy Street Name	Legacy Street Name Type	Building	Floor	Unit Type	Unit
1700		Robbins	Road		ROBBINS	RD				
1700		Robbins	Road		ROBBINS	RD			Lot	1
1700		Robbins	Road		ROBBINS	RD			Lot	2
1700		Robbins	Road		ROBBINS	RD			Lot	3
1700		Robbins	Road		ROBBINS	RD			Lot	4
1700		Robbins	Road		ROBBINS	RD			Lot	5

On occasion, properties containing multiple structures and/or sites that share the same address and are only differentiated by their subaddress information, may have an administrative building that carries the same address as the other units, but the administrative building does not have subaddress information.

The administrative building serves as the Primary address point. Figure 6-7 below shows an example of this situation where all structures are addressed as 200 North Beechtree Street but are differentiated by their Lot number, with the exception of the administrative building. It is addressed without any subaddress information.

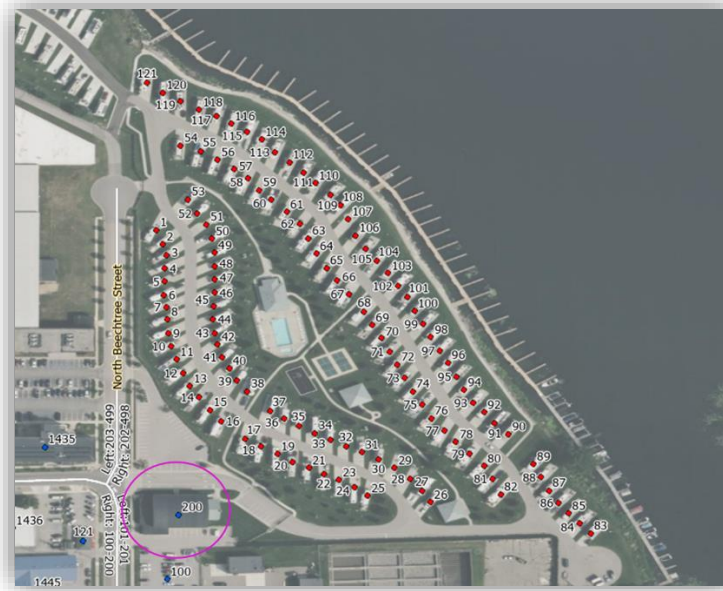


Figure 6-7 Administrative building has same address but no unit number as other subaddressed structures

Table 6-4 Population of Street Names in Figure 6-7

Address Number	Street Name Pre Directional	Street Name	Street Name Post Type	Legacy Street Pre Directional	Legacy Street Name	Legacy Street Name Type	Building	Floor	Unit Type	Unit
200	North	Beechtree	Street	N	BEECHTREE	ST			Lot	1
200	North	Beechtree	Street	N	BEECHTREE	ST			Lot	2
200	North	Beechtree	Street	N	BEECHTREE	ST			Lot	3
200	North	Beechtree	Street	N	BEECHTREE	ST			Lot	4
200	North	Beechtree	Street	N	BEECHTREE	ST			Lot	5

If the CAD system does not recognize subaddresses as unique addresses, only the Primary address point placed on the administration building will be recognized. For such a situation, consideration should be given to create an additional Property Access address point that contains only the property address (no subaddress information) to represent the access for all units at that location and place the Property Access address point at the primary access to the property.

6.3.3 Multiple Properties Sharing One Address

Large properties assigned a single address may consist of multiple parcels and even span across a road. A Primary address point for the property should be placed on the addressed structure regardless of if the address conflicts with the address range odd/even parity on that side of the road. In such a case, the Primary address point would need to be flagged as an exception for Parity Checks during the QC process. If no structure exists on the addressed property, a Primary address point should be placed on the side of the road that does not conflict with the address range odd/even parity based on the Parcel. If there is a driveway or other main access to the property that goes to a specific feature on the property such as a swimming hole or fishing pond, a Property Access address point could be used instead of a Parcel based address point.

6.3.4 Boat Wells and Slips

Boat wells and slips should be addressed similarly to other multi-unit locations such as apartment complexes or mobile home parks. Each site must include a Primary address point with the civic address and no subaddress information. Individual wells or slips should be represented as Subaddress points located at the center of each slip, with the Unit field populated using the slip identifier. In Figure 6-8, the primary address point is shown in blue, while each well/slip is depicted in red.

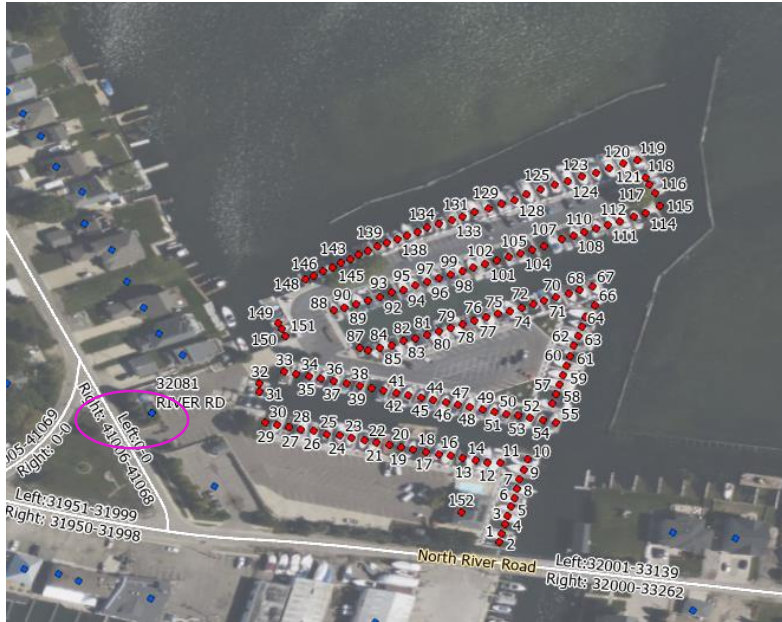


Figure 6-8 Boat Wells and Slips

Table 6-5 Population of Addressing in Figure 6-8

Address Number	Street Name Pre Directional	Street Name	Street Name Post Type	Legacy Street Pre Directional	Legacy Street Name	Legacy Street Name Type	Building	Floor	Unit Type	Unit
32081		River	Road		RIVER	RD				
32081		River	Road		RIVER	RD			Unit	1
32081		River	Road		RIVER	RD			Unit	2
32081		River	Road		RIVER	RD			Unit	3
32081		River	Road		RIVER	RD			Unit	4

6.3.5 Transient Structures

Mobile home parks, seasonal camps, and other addressed locations often have temporary structures that can be moved to a different location on the addressed property or be removed entirely from the property. For large properties where the temporary structure is moved frequently, a Property Access address point should be placed at the access to the property or, if there is no primary access to the property, a Primary address point based on the Parcel should be used.

For small areas or areas where the temporary structure is usually located when it is on the property (e.g. RV park, campsite), the Primary address point can be placed where the transient structure would normally be located. To minimize maintenance of the Placement Method attribute for such situations, populate Placement Method as "Site" if the address contains subaddress information (e.g., Lot #, Unit #, etc.) and "Parcel" if there is only one address for the property. This avoids having to constantly update the record when the temporary structure is removed from the property.

6.4 Distance Markers and Location Markers

Mile posts, trail head markers, trail intersection markers, and other location markers provide a valuable reference for 9-1-1 callers when a civic address location is unavailable. If these locations will be used for call routing purposes, they can be represented as an address point in the Site/Structure Address Points dataset by populating either the Distance Marker, formally Milepost, or the Location Marker fields instead of, or in addition to, the Address Number fields. Alternatively, distance markers can be placed in a Mile Marker layer that can be referenced by the telecommunicator. This is a recommended layer in the NENA Standard for NG9-1-1 GIS Data Model [1], but it is not used for the Emergency Call Routing or Location Validation Functions. Development and maintenance of these features and their associated layers is an important consideration when deciding how to represent them in the NG9-1-1 GIS data. For more information on the content of these two fields, reference the MI NG911 GIS Data Standard.

6.5 Military Bases and Tribal Nations

Military bases and tribal nations may or may not have their own PSAP and responsibility for emergency services. In most cases, they will share street name information with the local 9-1-1 jurisdiction but may not provide address specific information. It is recommended that the local 9-1-1 jurisdiction reach out to the military facility and tribal nations and work directly with them to obtain the most current information they are willing to provide. Some may share their address information but restrict usage for 9-1-1 operations only, not allowing the data to be publicly shared.

Local 9-1-1 jurisdictions having difficulties obtaining address information from military bases or tribal nations should reach out to the State of Michigan, DTMB, NG9-1-1 Repository HelpDesk (DTMB-NG911GIS@michigan.gov) for assistance.

7. Items Pending Future Work

The following items require additional research and/or development work:

- Development and maintenance of domains used within Michigan
- Develop consistent naming/addressing convention for:
 - Crossover/connector roads on controlled-access highways
 - Rest areas, service plazas and their buildings on controlled-access highways
 - On and off ramps to rest areas and service plazas
- Minimum metadata elements required with local data submission and whether metadata should be on the data or in a separate file
- Monitor changes to the NENA Site/Structure Address Point Placement Method Registry
- Monitor changes to NENA Civic Location Data Exchange Format (CLDXF) Standard
- Monitor changes to NENA Standard for NG9-1-1 GIS Data Model
- In version 3 of the NENA standard for NG9-1-1 GIS Data model, SSAP will now include SSAPolygons to support locations with floor awareness.
- NENA is currently engaging in the creation of an informational document on an Indoor GIS Data Model that will include both 2D and 3D aspects of GIS features including points, lines and polygons to model indoor spaces down to the room/unit level. Monitoring this work to include and/or update State standards should be done.
- NENA will be developing stewardship guidelines for data development and maintenance of Indoor GIS data. Monitoring the development of this document should be done.

8. Terminology

Unless otherwise noted, the following terms are a subset of terms defined in the NENA Master Glossary of 9-1-1 Terminology [15] or the NENA Standard for NG9-1-1 GIS Data Model [1].

Term or Abbreviation	Definition / Description
<i>Addressing Authority</i>	In Michigan, an Addressing Authority is a local, tribal, military, or county department responsible for issuing addresses and reconciling addressing discrepancies, through administrative procedures, to locations within its jurisdiction. The local and county authority is provided by state statute for the specific purpose of aiding in fire protection, emergency services, and civil defense.
<i>ALI (Automatic Location Identification)</i>	The automatic display at the PSAP of the caller's telephone number, the address/location of the telephone and supplementary emergency services information of the location from which a call originates.
<i>CAD (Computer Aided Dispatch)</i>	A computer-based system, which aids PSAP Telecommunicators by automating selected dispatching and record keeping activities.
<i>CLDXF (Civic Location Data Exchange Format)</i>	A United States emergency services profile of PIDF-LO that defines a set of data elements that describe detailed street address information.
<i>Domain (Data Domain)</i>	An enumerated listing or range of valid values that may be used as an attribute. If no Data Domain is provided, then any value that meets the format criteria may be used.
<i>DNS (Domain Name System)</i>	A globally distributed database for the resolution of host names to numeric IP addresses.
<i>ECRF (Emergency Call Routing Function)</i>	A functional element in an NGCS (Next Generation 9-1-1 Core Services) which is a LoST protocol server where location information (either civic address or geo-coordinates) and a Service URN serve as input to a mapping function that returns a URI used to route an emergency call toward the appropriate PSAP for the caller's location or towards a responder agency.
<i>ESInet (Emergency Services IP Network)</i>	A managed IP network that is used for emergency services communications, and which can be shared by all public safety agencies. It provides the IP transport infrastructure upon which independent application platforms and core services can be deployed, including, but not restricted to, those necessary for providing NG9-1-1 services. ESInets may be constructed from a mix of dedicated and shared facilities. ESInets may be interconnected at local, regional, state, federal, national and international levels to form an IP-based inter-network (network of networks). The term ESInet designates the network, not the services that ride on the network.
<i>GCS (Geocode Service)</i>	A web-based service that provides two functions: Geocoding and reverse-geocoding. Geocoding takes a PIDF-LO, which contains a civic address and returns a PIDF-LO containing a geodetic representation for the same location; reverse-geocoding takes a PIDF-LO, which contains a geodetic representation and returns a PIDF-LO that contains a civic address for the same location.

Term or Abbreviation	Definition / Description
<i>i3</i>	A shorthand term for a version of a NENA technical architecture that introduces the concept of an Emergency Services IP network (ESInet), which is designed as an IP-based inter-network (network of networks) shared by all agencies which may be involved in any emergency. An interim version of the NENA E9-1-1 architecture evolving to an IP infrastructure is referred to as 'i2'.
<i>LoST (Location-to-Service Translation) Protocol</i>	A protocol that takes location information and a Service URN and returns a URI. Used generally for location-based call routing. In NG9-1-1, used as the protocol for the ECRF and LVF.
<i>LVF (Location Validation Function)</i>	A functional element in an NGCS that is a LoST protocol server where civic location information is validated against the authoritative GIS database information. A civic address is considered valid if it can be located within the database uniquely, is suitable to provide an accurate route for an emergency call and adequate and specific enough to direct responders to the right location.
<i>MCS (MSAG Conversion Service)</i>	A web service providing conversion between Presence Information Data Format-Location Object (PIDF-LO) and Master Street Address Guide (MSAG) data.
<i>MDS (Mapping Data Service)</i>	A service that returns images or features stored in a GIS that can be used to create a display for a telecommunicator or facilitate spatial analyses. Often used to provide maps for handling out of area calls, the Mapping Data Service can also be used locally to provide a single, uniform map display for all functional elements in a PSAP that require maps.
<i>MSAG (Master Street Address Guide)</i>	A database of street names and house number ranges within their associated communities defining Emergency Service Zones (ESZs) and their associated Emergency Service Numbers (ESNs) to enable proper routing of 9-1-1 calls.
<i>NENA (National Emergency Number Association)</i>	NENA, also referred to as The 9-1-1 Association, is fully dedicated to the continued improvement and modernization of the 9-1-1 emergency communication system. NENA's approach includes research, standards development, training, education, certification, outreach, and advocacy through communication with stakeholders. As an ANSI-accredited Standards Developer, NENA works with 9-1-1 professionals, public policy leaders, emergency services and telecommunications industry partners, like-minded public safety associations, and more. Current NENA activities center on awareness, documentation, and implementation for Next Generation 9-1-1 (NG9-1-1) and international three-digit emergency communication systems. See www.nena.org .
<i>NGCS (Next Generation 9-1-1 (NG9-1-1) Core Services)</i>	The base set of services needed to process a 9-1-1 call on an ESInet. Includes the ESRP, ECRF, LVF, BCF, Bridge, Policy Store, Logging Services and typical IP services such as DNS and DHCP. The term NG9-1-1 Core Services includes the services and not the network on which they operate.
<i>PIDF-LO (Presence Information Data Format – Location Object)</i>	Provides a flexible and versatile means to represent location information in a SIP header using an XML schema.

Term or Abbreviation	Definition / Description
<i>Primary Address Point</i>	A site/structure address point that represent an address assigned by the local addressing authority, which may not reflect the addresses used in commercial or United States Postal Service (USPS) databases. A Primary Address Point contains no values in the subaddress components as outline in the NENA NG9-1-1 GIS Data Standard and the Civic Location Data Exchange Format Standard.
<i>Registry</i>	A single place for keeping valid data values associated with a specific data element.
<i>SI (Spatial Interface)</i>	A standardized NG9-1-1 interface between the GIS data and the functional elements that consume GIS data, such as the ECRF/LVF, Map Database Services, etc.
<i>Street Naming Authority</i>	In Michigan, a Street Naming Authority is the local, tribal, military, or county department responsible for approving or issuing street names and reconciling street name discrepancies, through resolution or ordinance, to public streets and private driveways within its jurisdiction. The local and county authority is provided by state statute for the specific purpose of aiding in fire protection, emergency services, and civil defense.
<i>Subaddress Point</i>	A site/structure address point that provides differentiation between features having a common street name and address number. The eight (8) subaddress elements (Site, Subsite, Structure, Floor, Unit, Room, Seat, and Additional Location Information) are described in the Civic Location Data Exchange Format standard (NENA-STA-004).
<i>URI (Uniform Resource Identifier)</i>	An identifier consisting of a sequence of characters matching the syntax rule that is named <URI> in RFC 3986 [3]. It enables uniform identification of resources via a set of naming schemes. A URI can be further classified as a locator (URL), a name (URN), or both. A Uniform Resource Locator (URL) is a type of URI that provides a means of locating the resource by describing its primary access mechanism (e.g., its network "location"). An example of a URI that is neither a URL nor a URN is sip:psap@example.com.
<i>URN (Uniform Resource Name)</i>	A type of URI (Uniform Resource Identifier). URNs are intended to serve as persistent, location-independent, resource identifiers and are designed to make it easy to map other namespaces (which share the properties of URNs) into URN-space. An example of a URN is urn:service.sos.
<i>WGS 84 (World Geodetic System 1984)</i>	The reference coordinate system used by the Global Positioning Systems and in cartography and navigation.

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