Provisioning Geospatial (GIS) Data from Local and County Sources for Translation and Usage into the Planned Statewide NextGen9-1-1 System in Minnesota

A report to the

State Emergency Communications Board

NextGen9-1-1 Committee

Prepared by the
State Emergency Communications Board's

NextGen9-1-1 GIS Work Group

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SECB
Statewide Emergency Communications Board

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Summary. This report is offered by the SECB's NextGen9-1-1 GIS Work Group to the SECB NextGen9-1-1 Committee to inform their decisions for system planning and the selection of standards for data collection, transfer and deployment related to GIS data provisioning for NextGen9-1-1.

A NextGen9-1-1 system is composed of many technologies providing various types of functionality. This report focuses ***exclusively on the topic of electronic geospatial data (GIS data) as it is needed by the forthcoming NextGen9-1-1 system***. More specifically, this document will provide a description of the ***challenges faced in standardizing this data across jurisdictions*** and insights how data of this kind has been to date successfully created, maintained, transferred, translated, standardized and ultimately delivered for deployment and usage in Minnesota.

Purpose of the report. The purpose of this report is to:

- Serve as a general reference and resource to the members of the SECB's NextGen9-1-1 Committee on the prior, current and needed actions for provisioning of authoritative GIS data for the NextGen9-1-1 effort;

- Serve as a general reference and resource to the members of the geospatial profession in Minnesota and to provide clarity on the data, standards, process and the legal standing and authority of the various involved partners;

- Provide context on the origin and status of GIS data needed for the deployment of the forthcoming NextGen9-1-1 system in Minnesota;

- Describe the origin of and viability of the available standards for assembling the GIS data needed for NextGen9-1-1 and outline how and why they were developed;

- Explore and describe potential roles and responsibilities of the various participating agencies and interests related to data provisioning for NextGen9-1-1;

- Identify and correct lingering misinformation about the work to date on the provisioning of GIS data for the NextGen9-1-1 effort;

- Present a body of recommendations for to the SECB NextGen9-1-1 Committee for its planning and standard selection activities;

Introduction and definitions.

Introduction. The creation, maintenance, standardization and delivery of electronic geospatial data (GIS data) for consumption by—and deployment into—a statewide NextGeneration 9-1-1 system poses a unique set of technical, fiscal and policy challenges. At the same time, the activities leading to the provisioning of this authoritative, locally-produced electronic geospatial data offers a unique and unparalleled opportunity for delivering sets of inter-jurisdictionally standardized data to satisfy on-going needs at all levels of government in a way that perhaps no other statewide effort has in the past had the opportunity to achieve. This development of a provisioning mechanism for standardized data available to all interest serves the overall aim of improving both the quality of the data and its frequency of update for a range of needs, inclusive of both NextGen9-1-1 and various public safety applications.

Definitions. For the benefit of the users of this document, the following basic contextual definitions are provided as they will appear frequently in the body of this report.

NextGeneration9-1-1 (also referred to as ***'NextGen9-1-1'*** or ***'NG9-1-1'***) is the next advancement in 9-1-1 system technology which facilitates the handling of all types of emergency calls, including voice, text, data, and multimedia. One factor that distinguishes Next Generation 9-1-1 from established legacy 9-1-1 technology is that it makes extensive use of GIS data in the core processes for validating 9-1-1 call locations, delivering emergency calls to the designated dispatch center, and identifying appropriate response agencies.

A condensed summary of its features and functions of a NextGen9-1-1 system are as follows:

- Requests for emergency service are sent to an emergency dispatch center (known as a Public Safety Answering Point or PSAP), based on call location, entirely over an Internet Protocol (IP) enabled infrastructure using standardized interfaces;

- The location of the request is determined and transmitted with the call using Presence Information Data Format – Location Object (PIDF-LO), a standard used to represent an address/location in an XML format;

- The use of Internet Protocol enables the transmission of photos, videos, real-time text messaging and other forms of multimedia communication and the integration of supplemental emergency call data that may be useful to call handling;

A requirement of the success of the NextGen9-1-1 system is use and effective deployment of electronic geospatial data (GIS data). This data is essential in not only ascertaining the location of the call and event for response, but also in determining the appropriate agency to receive the emergency call, for verification and confirmation of the location and for responding to requests for emergency assistance.

Electronic geospatial data are digital data using geographic or projected map coordinate values, identification codes, and associated descriptive data to locate and describe boundaries or features on, above, or below the surface of the earth or characteristics of the earth's inhabitants or its natural or human-constructed features.[1] In the body of this report it will simply be referred to conterminously and consistently as 'GIS data' (GIS being an abbreviation for 'geographic information systems'). GIS data uses digital geometry in the form of points, lines and polygons to represent real world features such as streets, building footprints, parcels, addresses and service areas. These geometric features have data essentially embedded in them (called 'attributes') and are referenced to a specific location on the surface of the earth with coordinates. This locational information provides enormous value in determining the appropriate agency to receive an emergency call and locating, verifying and responding to requests for emergency assistance. The primary geospatial datasets needed for NextGen9-1-1 deployment are defined below as follows:

Street centerlines are linear data features representing roadways of all kinds. In addition to containing the location of the roadway and representing it with a line segment, the linear geometry is embedded with these linear features are embedded with data such as the name of the road or street, any alternate names of the street (for example: if it is both a city street and a county highway), the ZIP Code, address range along the road segment, if it is a one-way or two-way street, the speed limit and other relevant information. These are shown as yellow lines in the detail at right.

Address points are point data features which contain address attributes unique to their location; each point contains a specific set of address information. This data generally represents a unique building, a house or a place of business; however, they can also represent the center of a parcel, the entrance to a building, a fixture such as a water tower, or an ingress point such as a driveway entrance. These are shown as green dots at right.

Emergency service boundaries are polygon data features which show the boundaries and extent of service areas for law enforcement departments, fire department response areas and emergency medical service agencies;

PSAP boundaries are polygon data features which show the extent of service areas of the various ***public service answering points*** (PSAPs);

Provisioning boundaries—The provisioning boundary is a polygon layer that defines the area of GIS data provisioning responsibility. The geographic extent of the provisioning boundary

[1] *Minnesota Statute §16E.30, Subd. 11.*

must be agreed to by neighboring data providers and should be a seamless coverage with no intentional gaps or overlaps. The purpose of the provisioning boundary is to delineate the spatial extent within which a single data provider will provision the civic address and emergency service boundary data. [2]

Authoritative source is an agency or department designated by statute, administrative rule, court opinion or established and recognized common practice as ***the official reliable source*** of a given set of data. [3] For example, in Minnesota, county governments are tasked by the Legislature to conduct the work of real property taxation for which they create and maintain digital parcel data to facilitate this activity. Counties are therefore the ***authoritative source*** for this data and parcel data produced independently by another level of government or a private vendor would not be considered authoritative.

Trusted aggregator is an agency that collects, assembles and publishes data from authoritative sources. Trusted aggregators generally work in collaboration simultaneously with numerous authoritative sources and will often perform additional work such as validation or other quality control checks of the data prior to publication. For example, the Metropolitan Council acts in the role of trusted aggregator for address point and road centerline line for the counties of the metropolitan region. Staff at the Council ingest the authoritative data from the various counties, and then run a validation (quality) check on it to ensure it conforms to the agreed upon schema. If a deviation is found, the Council will contact the county and note the discrepancy, however, the Council has no standing or power to enforce the county to make any changes; these governments work collaboratively in a peer-to-peer fashion to produce and maintain these inter-jurisdictional datasets.

Data standards are documented sets of information, instructions and/or agreements on the representation, format, definition and structure of data. Data standards facilitate the usability, extensibility, maintenance, reliability of data and enhance its capacity for aggregation with other datasets. Data standards enable the sharing and efficiency of use of data by ensuring there is a clear understanding of what data is present and how the data are represented. [4]

Data models are formats, schemas or abstractions which organize data and standardizes how data elements relate to one another and explicitly determines the structure of the data.[5] Data models tend to be less rigid in terms of their content than data standards. Both data standards and data models are more fully described in their context to NextGen9-1-1 needs later in this document.

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[2] P. 23, NG9-1-1 GIS Data Provisioning and Maintenance, Virginia Information Technologies Agency
[3] P. 177, Epstein, Earl and Niemann, Bernard; Modernizing American Land Records: Order Upon Chaos
[4] U. S. Geological Survey, Data Management-Data Standards
https://www.usgs.gov/products/data-and-tools/data-management/data-standards
[5] Princeton University, Center for Data Analytics & Reporting; 'What is a Data Model?"
https://cedar.princeton.edu/understanding-data/what-data-model

Data validation is the process by which data that has been submitted by a local/county provider to a regional or state agency is then run through a series of automated checks, or validations, to determine if all the necessary fields are populated, if the data itself is in the correct format and that there are no errors in the geometry (points, lines, polygons) of the data that would cause errors when it is imported in the NextGen9-1-1 system. Validations can be run on the format of the data (usually known a *schema validation*), on the content and completeness of the data, on the geometry of the data, or other criteria.

Data aggregation is the assembly of data that has been validated and then aggregated (or 'federated') together into a final dataset. By way of example, the Metropolitan Council has an on-going need for road centerline and address point data across its entire seven-county service territory for its various legislatively mandated planning, sanitary sewer service and transit operations. On a quarterly basis it acquires the data from the counties of the metropolitan region and runs a validation (*quality check*) on the data and will then aggregate (federate) the data into a single dataset covering all counties of the metro region.

Standardized data. In the context of this effort, a ***standardized dataset*** is that body of data which has been collected from various jurisdictions and local sources, and after validation and aggregation is formed into ***a single dataset where all data is in the same standard format***. If all data is in the same standard format it can be much more effectively used for inter-jurisdictional purposes of all kinds, this being a key requirement for successful NextGen9-1-1 uses. Creating and maintaining a ***standardized dataset*** across built from the data of multiple jurisdictions is best served and most effective with the partnership with the local data producers working in alignment with the regional and state interests. This specific challenge is explored more fully in the next section of this report.

The challenge of standardizing GIS data across jurisdictions

The most significant challenge for the creation and maintenance of a statewide NextGen9-1-1 system will be the consistent provisioning of GIS data from local/county sources for the statewide system and assembling this data in a standardized format. As will be described in more detail later in the body of this report: GIS data created at the local/county level is not commonly created or maintained in a specific standard, instead, this data is created and maintained in locally-generated formats in order to meet the internal mapping, application and analysis needs of that jurisdiction.

The data produced by local/county governments is for their internal use and is not and cannot be expected to meet all the various external public sector or private sector needs. In line with this understanding, statute language protects county GIS data producers from liability from the external usage of the data they publish, provided they offer a suitable disclaimer at the point of access to the data.[6]

[6] *Minnesota Statute §466.03, Subd. 21*

State interests, in their initial project scoping effort in 2015, acknowledged this need; specifically referencing it in the MN.IT Services original Scope Statement document for the NextGen9-1-1 project as one of the foundational understandings to *'define a common data model and successfully transition collected data to the defined schema'*. [7]

Further the state interests recognized and acknowledged this data standard and resulting aggregated datasets would have the potential to meet not only NextGen9-1-1 needs but also a range of other standardized data needs.[8] This would be enormously beneficial to a wide range of public and private sector GIS data consumers with wider availability of data and serve to reducing effort of both local/county governments and state interests in the preparation, validation, aggregation and publishing of these data sets.

To summarize, the issue takes shape as follows:

- The state-level interests have the ***specific business need*** for locally produced, authoritative, standardized GIS data for a NextGen9-1-1 system, and concurrently, other state agencies and interests have a range of similarly-aligned generalized needs for standardized data arising from the same local, authoritative sources;

- The state may currently access, request and acquire the GIS data produced by the county at no charge and without licensure[9], however, the local/county data provider is not required to provide this data in an alternate format specified by the state or any other requestor; [10]

- State-level interests have no authority to require or mandate that local/county governments translate their data into any specified or desired format; [11]

- Many of the geospatial data attributes needed by the state for its NextGen9-1-1 effort are largely outside of the administrative control of the state's 9-1-1 office; [12]

- The work of translating data from local/county formats to a standardized format that is usable for NextGen9-1-1 and other myriad purposes has the potential to be a fiscal, personnel and resource capacity issue for local/county data providers who will create and maintain that data;

- There is a clear and apparent benefit to both the state interests and the counties—

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[7] *p. 7, MN.IT Services, Scope Statement Minnesota Geospatial Development for Next Generation 9-1-1 Project, #19VM03R, 3/11/2015*
[8] *p. 9, Ibid.*
[9] *Minnesota Statute §16E.30, Subd. 11*
[10] *Ibid.*
[11] *Ibid.*
[12] *p. 10, Guidelines for Developing A State NG911 Plan, National Highway Traffic Safety Administration, 2018*

as well as to many other jurisdictions and interests—to have GIS data in an inter-jurisdictionally standardized format facilitating use for multiple purposes, among which NextGen9-1-1 is of primary importance. Numerous interests need data that is consistent across jurisdictions, while counties also benefit by having access to the data of their neighboring counties in a standardized format for a variety of emergency services, mapping, planning, analysis, hazard mitigation and other purposes.

- Significant public purpose—including interests in businesses, academia, non-profits and others—are satisfied by assembling and publishing GIS data that is standardized across jurisdictions—the NextGen9-1-1 effort is an excellent catalyst for examining and satisfying this need; data that is fully attributed to meet the needs of NextGen9-1-1 is also able to meet many other government and non-governmental data needs.

- In their initial project planning for NextGen9-1-1, the state interests have already acknowledged the benefit of collaboratively creating, maintain and updating statewide layers and to share these with local, regional and state entities; [13]

- By way of example, the Commonwealth of Virginia has articulated the benefits and importance of developing and maintaining multi-purpose GIS datasets that emphasize public safety uses including deeper integration of GIS for 9-1-1 operations and analytics and supporting regional and peer-to-peer exchange of best practices, NextGen9-1-1 support and integration of their information technology (IT) systems.[14] Minnesota would be well served to work fully examine and emulate these efforts and comparable efforts taking place in other states;

- There is an opportunity for capacity building (data improvement, scripting for automation of tasks, establishment of services for automatic harvest of data, etc.) afforded by the NextGen9-1-1 effort that would have far reaching effects to provide much needed statewide, standardized datasets;

The above listed set of stated conditions lead to the following questions:

- What is the present data status and resource level at each local/county data provider to meet the needs of GIS data provisioning for NextGen9-1-1?

- Which GIS standards, models, methods, validations and quality control checks should be applied for the translation, aggregation and provisioning of data to meet the needs of the state's NextGen9-1-1 system development as a primary aim, and to concurrently satisfy other known aggregated data needs?

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[13] p. 9, MN.IT Services, Scope Statement Minnesota Geospatial Development for Next Generation 9-1-1 Project, #19VM03R, 3/11/2015
[14] GIS Strategic Plan, 2020-2022: Commonwealth of Virginia, VITA, VGIN Geospatial Services; https://www.vita.virginia.gov/integrated-services/vgin-geospatial-services/

- Who has authority to decide which GIS data standard (or standards) should be selected and used to satisfy the emerging need of the state's NextGen9-1-1 deployment and myriad other uses? While technical requirements often determine the schemas, models and standards applied, final authority may be vested in certain bodies or authorities to make a definitive and final decision which drives policy, strategy and action.

- If data translation from local/county formats to a standardized format is needed, who is responsible for performing this translation activity, how often will it occur, by what method will it occur and how will that work be appropriately funded and maintained?

- After the data translation activity has been performed, who will assume responsibility to then perform the needed data validation activity (*validation of the data schema, validation of the data completeness, error reporting, validation of topological integration, etc.)* and to ensure the data is of sufficient quality to meet the needs of NextGen9-1-1?

- How often would local/county data be translated and federated into an integrated statewide dataset to serve NextGen9-1-1 needs?

- How would this potential final statewide aggregated dataset be managed, published and maintained for both the on-going needs of NextGen9-1-1 and the other range of needs?

- What kinds of automated processes can be leveraged to maximize efficiency and ensure consistency of delivery?

These questions will be explored throughout the body of this document with examples of existing activities as well as recommendations to inform a realistic and workable path forward.

Legal authority summary

State authority for 9-1-1 actions. The authority to conduct the specific actions—of project planning, selection of standards for project usage, project oversight and maintenance—needed to create the state's anticipated NextGen9-1-1 system are not vested within a single entity, rather: ***authority for these specific actions are spread out among the several participating interests.***

Some of these actions and activities—specifically ***coordination*** activities—overlap among the various interests, while other actions and activities are housed within specific organizational bodies and boards.

The ***coordination of the plan for implementation***, the ***implementation of the plan***, the ***selection of standards for use*** and the ***establishment and enforcement of rules establishing***

performance, operational and system standards for the statewide system reside specifically with the State Emergency Communications Board (SECB).[15]

This is an important consideration as:

- The actions resulting from these decisions in the development of a statewide NextGen9-1-1 system have the potential for ***direct fiscal and/or resource allocation impacts on local/county jurisdictions*** who will perform the work of preparing the data;

- The membership of the SECB is composed of a range of representatives from cities, counties, regional organizations, state agencies, fire departments, law enforcement agencies at all levels, dispatch centers, PSAPs and tribal government. This mix of agencies and interests at the SECB is intended to inhibit the ability of one interest in dictating the terms of the work, or in dominating the direction of the decisions to be made and, ideally, provides the opportunity for thoughtful and thorough review of decisions and their resulting actions among the various interests;

- The SECB having these specific decision-making authority powers also works to ensure that a full review, discussion and consideration by a range of perspective viewpoints can occur to appropriately shape and direct the work;

These above considerations therefore have direct impact on the:

- The planning of how the needed GIS data will be provisioned for NextGen9-1-1;

- The selection of which standards are to be used for the transfer, storage, use and publication of the GIS data provisioning activity;

The responsibility for ***coordination*** of the statewide system resides appropriately among the several interests, these being the Commissioner of the Department of Public Safety[16] and the SECB[17] and the Emergency Communication Networks (to the extent it has been empowered to do so by the Commission for Public Safety) for system interoperability[18].

Additionally, responsibility related to both the ***oversight and maintenance*** of the statewide system is vested among the Commissioner of Public Safety[19] and the SECB. [20]

To summarize, the SECB carries the responsibility for ***system planning*** and ***selection of standards*** for use in the system; a responsibility which will directly impact the decisions to be made regarding the provisioning of local/county sourced GIS data to the state for the system. As

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[15] Minnesota Statute §403.382, Subd. 1 through 8;
[16] Minnesota Statute §403.06
[17] Minnesota Statute §403.382, Subd. 1 through 8;
[18] Emergency Communications Networks – About; Interoperability: https://dps.mn.gov/divisions/ecn/about/Pages/default.aspx
[19] Minnesota Statute §403.06
[20] Minnesota Statute §403.382, Subd. 5 through 8;

these decisions may entail fiscal or personnel resource costs to the counties, it is vital that a body such as the SECB—which has representation from all level of governments potentially impacted—be directly involved in the decision making.

It is understood and acknowledged that a successful NextGen9-1-1 deployment effort will entail a significant level of research, information gathering, planning and outreach activity [21] and consistent and focused oversight of these actions will be needed. The following section will outline which GIS data are specifically needed; followed by a narrative related to the standards which are available and viable for translation, deployment and publication of the GIS data needed.

The role of County governments in 9-1-1 systems and services. County governments also have a substantial role and statutory obligation to perform, conduct and maintain 9-1-1 systems in Minnesota. County roles include the operation and maintenance of emergency telecommunications systems and to operate and maintain its 9-1-1 systems to permit future expansion and enhancement.[22] Further, County-level 9-1-1 roles articulated in state statute language stipulate that each county and responsible governmental agency shall maintain and update its 9-1-1 system as required by the state's administrative rules.[23] Within this body of administrative rules are a large set of requirements, regulations, guidelines for planning and language inclusive of coordination, funding, maintenance, operational detail beyond the scope of this report to outline.

What is evident is that counties maintain a large existing set of on-going 9-1-1 responsibilities for which the state has both a vested interest—and legal obligation—to assist in. [24]

This is organized in both law and practice with the goal for government at all levels working together effectively to protect, serve, assist and support the citizens of the state.

The GIS data needed for NextGen9-1-1

According to the National Emergency Number Association (NENA)[25], the primary geospatial datasets required for a successful NextGen9-1-1 deployment include the following:

- Road Centerlines
- Site/Structure Address Point
- PSAP Boundaries
- Emergency Service Boundaries for Law, Fire and Emergency Medical Services
- Provisioning Boundaries

[21] *p. 9, Guidelines for Developing A State NG9-1-1 Plan, National Highway Traffic Safety Administration, 2018*
[22] *Minnesota Statute §403.025, Subd. 1*
[23] *Minnesota Administrative Rules, 7580.0100 through 7580.1100*
[24] *Minnesota Statute §403.06, Subd. 1*
[25] *p. 17, NENA Standard for NG9-1-1 GIS Data Model NENA-STA-006.1.1-2020, February 18, 2020*

In Minnesota, these data are developed and maintained at the county level, with county GIS staff often working in partnership (both formally and informally) with their constituent municipalities to keep them updated for their various internal needs.

Of note, several counties in Minnesota rely on external private vendors to create and maintain some, or all, of these datasets for their use. Data produced in these kinds of arrangements can be considered authoritative as it is being produced with the sanction, funding and oversight of the county, is intended specifically and primarily for county purposes in consideration of the county's role and legal standing as a 9-1-1 authority.[26] However, the direct purchase of commercially available GIS data from a private vendor would likely not be considered *authoritative*, in that, it is not produced by, or under the direction of a county government in its role as the 9-1-1 authority.

NENA also strongly recommends the following data layers be available or included to aid in the functionality of the NextGen9-1-1 system:[27]

- Street name alias table
- Landmark name part table
- Complete landmark name alias table
- States or equivalents
- Counties or equivalents
- Incorporated Municipality Boundary
- Unincorporated Municipality Boundary
- Neighborhood Community Boundary
- Other Emergency Service Boundary (e.g. poison control, forest service, coast guard, animal control, etc.)

Except for Neighborhood Community Boundary and the Other Emergency Service Boundary layers, these recommended data can generally be accommodated within, or extrapolated from, the required datasets mentioned prior. Finally, NENA recommends the following data layers to complete the minimum recommended GIS data for NextGen9-1-1:[28]

- Railroad centerlines
- Hydrology lines
- Hydrology polygons
- Cell tower site locations
- Mile marker locations

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[26] Minnesota Statute §403.03, Subd. 1 through 4; and p. 17-22, NENA Standard for NG9-1-1 GIS Data Model NENA-STA-006.1.1-2020, February 18, 2020
[27] p. 17, NENA Standard for NG9-1-1 GIS Data Model NENA-STA-006.1.1-2020, February 18, 2020
[28] Ibid, p. 18.

These final five datasets may or may not be managed by local (municipal and/or county) jurisdictions; and are more likely in the hands of either private interests (such as railroad centerlines, cell tower site locations) or state agencies (mile markers, hydrology features). While these data would certainly provide helpful context for 9-1-1 work, for the purposes of this report, these five recommended GIS datasets will be considered out-of-scope.

Differences between a data standard and data model.

For reference and to further support the recommendation of this report that the GAC-approved standards be put into use for the NextGen9-1-1 effort in preference to the state's currently active derivative data model, a short review highlighting the differences between data standard and data model is offered in the following paragraphs:

The goal of a ***data standard*** is to enable the sharing and exchange of information between multiple parties in a way that guarantees the interacting parties share the same understanding of what is represented within that information. [29] Additionally, a data standard serves to define a frame of reference that encourages confidence between interacting parties—in both essence and function—it acts as an agreement between interacting parties as to the context of that interaction. [30]

When information is exchanged that is comprised of structured data, a ***data standard*** provides the description of that structure and will define key specific fixtures within that structure including entity names, data element names, descriptions, definition and formatting rules, in addition to any other contextual or functional components necessary for the use of the data effectively and fully. [31]

While similar and related in some respects to a data standard, a ***data model*** is concerned primarily with the structure and representation of the information, and not all of the associated details with the content in the structure.[32] For context, within a ***data standard***, a date would be prescribed to follow a specific format (such as 02/06/2021) creating uniformity, clarity and lessening the interpretive and processing work of all who would need or consume that data, where in a data model, a date may exist in in a variety of readable and translatable formats (e.g. February 6, 2021, Feb 6 2021, 2021-02-06, etc.) so long as there is date data available; the solution, to the extent possible, is to make use of the data standard for information exchange.[33]

As the Minnesota NG9-1-1 Data Model is a downstream need for a specific use and is formed of the component features of both the existing GAC-approved standards and aspects of the NENA

[29] *Data Standards and Data Models; Knowledge Integrity: Business Intelligence Solutions Archive, DM Review, January 2004*
[30] *Ibid.*
[31] *Ibid.*
[32] *Ibid.*
[33] *Ibid.*

data models into which it readily translates, preference for the use of the GAC-approved data standards is recommended.

Legal considerations for GIS data creation

The GIS data to be used for NextGen9-1-1 arise from the specific responsibilities, work and actions of both cities and counties. The following summarizes the origin of this authority which in turn inform the content of the resulting GIS data.

Address points. GIS data representing address points arise and originates from the power to both name and apply numbering to streets; in Minnesota, this authority rests explicitly with incorporated municipalities, specifically, the actions of their City Councils.[34]

County governments are empowered by the legislature to perform and conduct a variety of location-based activities including 9-1-1 emergency services, emergency preparedness, animal control, law enforcement, planning and public health programs.

To support those activities county government plays an important role in assigning addresses within the unincorporated townships and unorganized areas of the state to effectively conduct these location-based activities.[35] Additionally, county governments in Minnesota adopt and implement their own ordinances which guide and facilitate, establish and maintain orderly road naming and numbering criteria.[36]

Counties have also emerged through consistent and common practice as the trusted aggregator for the address point data created by municipalities within their jurisdiction. Cities and counties are therefore acknowledged as the authoritative sources and trusted aggregators of locally sourced address point data in Minnesota.[37] The Geospatial Advisory Council Data Address Points Data Standard for Minnesota operates as a reliable base-line resource for geospatial practitioners, but this standard does not enforce rules, nor does it intend to replace locally applied practices or internal standards for developing and maintaining the data.

Road centerlines. Many levels of government are authorized to construct and maintain physical roadways and to install related roadway fixtures within the State of Minnesota.[38] However, there are no specific legal rules in place to precisely govern or direct the relevant details for the creation and maintenance of the GIS data which represent these assets digitally in GIS systems.

The Geospatial Advisory Council Road Centerline Standard for Minnesota operates as a reliable base-line resource for geospatial practitioners, but it does not enforce rules, nor replace locally

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[34] Minnesota Statute §412.221, Subd. 18;
[35] Minnesota Statutes Chapter §394.21-394.37 and §429.021, Subd. 1, sub-part 18;
[36] Minnesota Statute §375.51
[37] p. 1, The Address Point Data Standard for Minnesota: Overview and FAQ; https://www.mngeo.state.mn.us/committee/standards/address/FAQ_MN_Address_Point_Data_Standard.pdf
[38] Minnesota Statute §160.02; §160.08, Subd. 1-7, §160.085, Subd. 1-3, §160.13;

applied practices or internal standards for developing and maintaining the data representing roadway features.

In the absence of formal rules for GIS data creation, informal activities and actions have emerged out of necessity which are now common practice and are strongly relied upon as operational norms by both the creators and consumers in GIS for consistent roadway data. These can be outlined and best understood in the following two situations:

First, county governments—in addition to serving as the ***authoritative source*** in creating and maintaining GIS data for the roadways they construct and maintain—have also emerged in the simultaneous role as the ***trusted aggregators*** for the non-county (federal, state, municipal, township, private and special district roads) road assets occurring within their boundaries. This work is performed by county staff to satisfy and fully inform their on-going internal needs for road data. These range from providing emergency services, public safety, snow removal activities, integration with municipal government activities and so forth. This effort by county GIS personnel to assemble and work with road centerline data within their jurisdiction is of tremendous value to the other members of the GIS data consumer community.

Second, is that road centerline data representing physical roadways are intended primarily to align with the center of existing paved surface of the roadway; these data are not intended to represent the center of right of way or other possible legal descriptions of the roadway. [39]

While the GIS data representation of the roadway is generally understood to be the center of the pavement, some segments may be modified slightly from their actual pavement alignment to better facilitate the routing functions of the digital model; this may require them deviate slightly from the actual paved centerline to better facilitate routing and other functions in the digital environment. [40]

Public Service Answering Point (PSAP) boundaries. A PSAP boundary layer defines the geographic area of extend of the service area of a PSAP, and similarly to Emergency Service Boundaries in Minnesota these data arise from county's responsibilities to provide police, firefighting, emergency medical and ambulance services and county governments can therefore be considered the authoritative source to create and maintain these GIS data. [41] These boundaries define the extent of the PSAP with the primary responsibility for an emergency request. [42]

Emergency Services Boundaries. An emergency service boundary layer defines the primary geographic area of law enforcement, emergency medical services and fire response. In Minnesota these data arise from county government's responsibility to provide police,

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[39] *p. 8, Metro Regional Centerlines Collaborative Guidebook & Best Practices Document, 5/31/2018*
[40] *p. 7, Ibid.*
[41] *Minnesota Statute §403.03*
[42] *p. 24, NENA Standard for NG9-1-1 GIS Data Model NENA-STA-006.1.1-2020, February 18, 2020*

firefighting, emergency medical and ambulance services. [43] County governments can therefore be considered the authoritative source to create and maintain these GIS data. Emergency service boundaries are used by the Public Service Answering Point (PSAP) to identify the appropriate entities and first responders to be dispatched. [44] In the Twin Cities metropolitan region, ten (10) counties have—through a joint powers agreement which also includes the City of Minneapolis—created the Metropolitan Emergency Services Board (MESB). Acting as an extension of county government, the MESB creates and maintains the Emergency Services boundary and PSAP data layer across the region on behalf of, and for the benefit of their constituent counties.[45]

Jurisdictional boundaries (Provisioning Boundaries in the NextGen9-1-1 context).
The provisioning boundary is a polygon layer that defines the area of GIS data provisioning responsibility. The geographic extent of the provisioning boundary must be agreed to by neighboring data providers and should be a seamless coverage with no intentional gaps or overlaps. The purpose of the provisioning boundary is to delineate the spatial extent within which a single data provider will provision the civic address and emergency service boundary data. The data provider must ensure that they are including seamless GIS data for the entire geographic area within their provisioning boundary extent.

Though these data may meet the requirements of those individual agencies and there are procedures and processes where authoritative boundary adjustments are recognized through the state's Office of Administrative Hearings, there is at this time no regularly maintained universal dataset of statewide municipal boundaries available for use by the NextGen9-1-1 effort directly nor for the GIS community at large.

The layer of GIS data representing jurisdictional boundaries must be agreed upon by all adjoining GIS data provisioning providers and by the local 9-1-1 authority (or 9-1-1 authority designee) who are to include and provide GIS data for their geographic area of responsibility.[46]

How and where do these GIS datasets originate?

Perhaps the single most common assumption and misconception about provisioning GIS data for NextGen9-1-1 usage is that the needed road, address point and various needed boundary data are already created, available and viable for import and use for NextGen9-1-1.

Since the mid-2010s significant advances in standards applicable for provisioning data in standardized formats have taken place in Minnesota; this is discussed in more detail in the next section of this report titled: **The emergence and development of standards for GIS data in Minnesota** beginning on page 19.

[43] *Minnesota Statute §403.03*
[44] *p. 25, Ibid.*
[45] *Metropolitan Emergency Services Board, https://mn-mesb.org/about-us/*
[46] *p. 26, NENA Standard for NG9-1-1 GIS Data Model NENA-STA-006.1.1-2020, February 18, 2020*

However, the challenge of assembling and maintaining standardized data from numerous local/county GIS data providers remains a persistent issue and needs to be defined, resourced and solved. This challenge is not unique to Minnesota, our neighbor to the east—the State of Wisconsin—is also facing the issue. They have cited their challenging experiences of many different local governments assigning addresses and the general lack of the much-needed standardization of GIS data at the municipal, county and state level and the work conducted currently to develop and promote a road centerline and address point standard.[47] Additionally, Wisconsin cites the various administrative issues and the lack of centralized authority to supervise the assembly, standardization, storage and maintenance of the needed GIS data for NextGen9-1-1. [48] Similar issues and challenges have also been evident in the Minnesota experience to date.

Some context and background on the origin of GIS data is offered in the following narrative to hopefully explain and reveal how we arrived at our present situation.

As GIS technology has expanded and matured from the time of its original introduction into government in the late 1980s and early 1990s, county governments have been creating the GIS data that they needed for representing address points, road centerlines, municipal boundaries and other features in schemas and formats to meet their own internal mapping, analysis and application needs. At that time, the lack of available GIS data standards directly applicable to local needs contributed to the trend of each jurisdiction working independently. Some initial standards began to emerge from the Federal Geographic Data Committee which was established in 1990,[49] however, these were primarily intended for interoperability between federal agencies using GIS data, and the federally-created data standards were rarely useful or applicable for local, municipal, county or state-level needs.[50]

This independent development of GIS data within each county made standardization and inter-jurisdictional operability initially difficult, the legacy of which remained until somewhat recently in Minnesota. This early trend even resulted in the necessity of state agencies such as the Department of Transportation[51] and the Department of Natural Resources[52] creating their own road centerline data and jurisdictional boundary GIS datasets with different attributes to meet their specific agency needs; further heightening the challenge of inter-operability of data from different jurisdictions.

The potential confusion, conflict and lack of efficiency of having both local/county and state-level actors creating and maintaining their own disparate 'authoritative' GIS datasets for road networks and other features could be remediated by a shared understanding of needs, an

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[47] p. 21, Wisconsin Statewide NextGen9-1-1 Plan, June 2020
[48] Ibid.
[49] Federal Geographic Data Committee, A-16 Revised, https://www.fgdc.gov/who-we-are/history#7
[50] Federal Geographic Data Committee, Geospatial Standards, https://www.fgdc.gov/resources/download-geospatial-standards
[51] MnDOT Route Centerlines, https://gisdata.mn.gov/dataset/trans-roads-centerlines
[52] MNDNR Administered State Forest Roads, https://gisdata.mn.gov/dataset/trans-state-forest-roads-wheels

agreed-upon data schema and resulting dataset and a trusted and on-going process and method for inter-jurisdictional and inter-agency data assembly and publication.

The emergence and development of standards for GIS data in Minnesota

Background. In the late 1990s, the counties, regional agencies and other interests working with GIS data in the Twin Cities metropolitan region established a voluntary collaborative effort (MetroGIS) to determine their shared needs for GIS data, avenues of cost sharing for aerial imagery and to explore and discuss how inter-jurisdictional datasets could potentially be developed.[53] The first GIS data standard to arise from this collaborative effort was for tax parcel data. This emerged as the Metro Parcel Data Standard, begun in 1999,[54] with the first metro standardized dataset appearing by 2002.[55]

This regional Metro Parcel Data Standard formed the basis for the statewide Geospatial Advisory Council-approved Parcel Data Standard for Minnesota, which was eventually adopted in March 2018.[56] Along with the parcel data, the metro partners also developed a method of working and a *de facto* data standard emerged for maintaining and updating city and township boundaries across the Twin Cities Metropolitan Area.[57] This early work on regional dataset development provides useful insight into the kinds of inter-jurisdictional collaboration and cooperative action needed for NextGen9-1-1 data provisioning. These initial successes at the metro level set the stage for future work in creating standards for address points and road centerlines and led to the appearance of multi-county datasets in these standards in the latter half of the decade of the 2010s. [58]

Address point standard and data development. In 2004, the metro partners began developing a standard for address points to meet their shared needs; aligning their effort to parallel work conducted by the Federal Geographic Data Committee (FGDC) and the Urban and Regional Information Systems Association (URISA) during 2005-2006.[59] By 2010, both the FGDC and MetroGIS Address Working Group had released their standards, with the FGDC approving their standard in 2011.[60]

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[53] *Origins of MetroGIS, History and Development: https://metrogis.org/about-metrogis/history-development.aspx*
[54] *p. 2, Minnesota Geospatial Advisory Council Parcel Data Standard – Frequently Asked Questions; Available at: https://www.mngeo.state.mn.us/committee/standards/parcel_attrib/parcel_attrib.html*
[55] *MetroGIS Regional Parcel Dataset (Year End 2002); https://gisdata.mn.gov/dataset/us-mn-state-metrogis-plan-regonal-parcels-2002*
[56] *GAC Minutes, March 28, 2018, Available at: https://www.mngeo.state.mn.us/councils/statewide/past_meetings.html*
[57] *https://gisdata.mn.gov/dataset/us-mn-state-metc-bdry-metro-counties-and-ctus*
[58] *https://gisdata.mn.gov/organization/us-mn-state-metrogis*
[59] *p. 3, The Address Point Standard for Minnesota, Overview and Frequently Asked Questions; https://www.mngeo.state.mn.us/committee/standards/address/FAQ_MN_Address_Point_Data_Standard.pdf*
[60] *p. 3, Ibid.*

In late 2014-early 2015, the state's NextGen9-1-1 effort began, to develop data standards to help satisfy the needs of the emergency services sector using the NENA (National Emergency Number Association) data standards as their starting point.

In August 2016, the Metro partners and the state's NextGen9-1-1 interests convened in St. Paul to compare and discuss their two address point standards. The Metro partners decided to further modify their existing standard to better align with the needs of the NextGen9-1-1 stakeholders. Subsequent discussions led to the creation of ***a single, statewide multi-purpose address point standard*** to meet the range of uses and needs.[61] As of June 2017, the Metro Address Point Standard and NextGen9-1-1 Address Point Standards were finally, fully and effectively merged into a single standard for address point data.

The Geospatial Advisory Council's Standards Committee reviewed the draft standard at its meeting on June 21, 2017 and approved its release to the stakeholder community for a formal 60-day review period beginning on Monday, July 24, 2017 and ending on Friday, September 22, 2017.[62] The draft standard and its supplemental material was circulated broadly to all known municipal and county GIS practitioners in Minnesota as well as to the various regional governments, state agencies as well as tribal governments and federal agencies in Minnesota. These interests were encouraged to review and provide comment on the draft standard. The resulting input, comments, suggestions for revision and improvement were documented by the Standards Committee and used to improve and refine the standard prior to being advanced for final approval.

The current **Address Point Data Standard for Minnesota** was adopted by the Geospatial Advisory Council on December 6, 2017[63] and has gone through several minor corrections and revisions since that time to ensure it meets the specific needs of NextGen9-1-1 and the other uses and functions as expressed by the geospatial profession.

Road centerline standard and data development. The creation, development and maintenance of a detailed, multi-purpose, road centerline GIS data standard and the publication of a dataset in that standard has posed a significant challenge to the geospatial community in Minnesota, however, consistent and focused recent work beginning in the early 2010s has yielded significant progress and success.

In the late 1990s, the metro partners identified road data as one of their top data need priorities and in May 1997 executed an agreement with a private vendor to be able to access and share a regional dataset among government and academic partners.[64] At the same time, both city and county governments also were developing their own road centerline data for internal usage. As eventually the vendor-provided data was no longer fully meeting the emerging needs for road

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[61] MetroGIS: Address Point Aggregation, https://metrogis.org/projects/address-point-aggregation.aspx
[62] p. 3-4, The Address Point Standard for Minnesota, Overview and Frequently Asked Questions; https://www.mngeo.state.mn.us/committee/standards/address/FAQ_MN_Address_Point_Data_Standard.pdf
[63] GAC Minutes, December 6, 2017, Available at: https://www.mngeo.state.mn.us/councils/statewide/past_meetings.html
[64] Origins of MetroGIS, History and Development: https://metrogis.org/about-metrogis/history-development.aspx

centerline data in terms of its completeness, content or frequency of updates, by 2011, the metro partners began to focus on the creation of an authoritatively-sourced dataset (e.g. data sourced directly from the counties) and a multi-use standard in which this dataset would appear.

In September 2011, a metro-level workshop event was held in Saint Paul with over twenty metro-region representatives from state agencies, regional organizations, county and city governments as well as representation from private companies.[65] In early 2012, the metro regional partners joined with the Minnesota Geospatial Information Office and the Minnesota Department of Transportation in an effort called the State Centerline Initiative, with the goals to develop, test, refine, publish and perpetuate a state-wide roadway dataset that meets the needs of a diverse road data user community.[66]

Despite two years of focused effort, by late 2013, the original State Centerline Initiative broke down and ceased to operate. This was primarily due to the state-level interests being focused on a linear referencing system (LRS)[67] based solution to meet their needs, while county and regional partners maintained a strong primary business need for a node and link data solution.[68] Adherence to the node and link solution by the metro partners has proven to be of enormous value in creating data suitable for use in both local 9-1-1 applications and for the forthcoming NextGen9-1-1 system as well as meeting myriad other documented road data needs.

In May 2014, the metro partners reformed their effort, establishing the Metro Regional Centerlines Collaborative (MRCC) and spent the next three years focused on developing and refining a metro-regional data standard for road centerline data. In the documentation of business needs to be met by the work of the MRCC effort, it heavily emphasized its need to accommodate NextGen9-1-1 uses of the data. The desired shared uses of the road centerline data schema and resulting dataset were specifically articulated to include NextGen9-1-1 call routing and location validation, vehicular routing, address geocoding and emergency services dispatch.[69] By April 2017, the first seven county regional road centerline dataset was completed and published to the Minnesota Geospatial Commons and by mid-2019, three additional counties of Chisago, Isanti and Sherburne were also included.[70]

Upon its completion in early 2017, the MRCC standard was advanced as a candidate for a statewide standard. Between 2017 and its eventual adoption by the GAC in May 2019[71] it was

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[65] Statewide Centerline Initiative, Project Brief, May 17, 2013, available here: http://metrogis.org/MetroGIS/media/gis-documents/projects/05_02_CenterlineProjectBrief.pdf

[66] p. 1, Ibid.

[67] Linear referencing is a method of storing geographic locations by utilizing known positions along a measured linear feature, the linear feature may or may not be broken up at intersections or nodes, this differs from the node and link model of linear systems;

[68] 'Node and link data' are composed of a network of lines (links, line geometry) which meet at points of intersection (nodes);

[69] Metro Road Centerline Collaborative: https://metrogis.org/projects/centerlines-initiative.aspx

[70] p. 9, MetroGIS Coordinating Committee: Meeting Minutes, 2/28/2019 & p. 10, MetroGIS Coordinating Committee: Meeting Minutes, 8/8/2019

[71] GAC Minutes, 5/29/2019, Available at: https://www.mngeo.state.mn.us/councils/statewide/past_meetings.html

reviewed by the stakeholder community and modified repeatedly to better align with the specific needs and requirements of NextGen9-1-1.[72]

During fall 2020, address point and road centerline datasets in the GAC-approved formats were made available to several private Core Service Provider vendors to review for their general fitness for use in a NexteGen9-1-1 system.

All of these vendors, after reviewing the GAC Standard formatted data reported that the format was suitable for ingest directly into NextGen9-1-1 systems. The following quote is from an email communication with staff from Digital Data Technologies Incorporated (DDTI) of Columbus, Ohio after they provided a review of the metro's aggregated data:

"DDTI reviewed the Road Centerline and Address Point datasets available on the Minnesota Geospatial Commons website. Upon review, we believe that the schema is acceptable for ingestion by a NG9-1-1 system. The content contains the PIDF-LO elements, MSAG Community, Address Ranges, and other attributes that are required by most NG9-1-1 systems. [73]

How are standards for GIS data created, modified and governed in Minnesota?

There is no centralized or supervising authority which mandates the creation, content, structure or usage of standards for GIS data in Minnesota. To date, the creation of standards that are useful, desired and effective for meeting multiple uses have been developed by the collaborative effort of the members of the GIS profession through various volunteer organizations and mechanisms. GIS staff from all levels of government have been working in a continual peer-to-peer approach behalf of their agency's need and interest and for the greater good of the profession through the Geospatial Advisory Council (GAC) and other regional mechanisms such as the MetroGIS collaborative and other regional groups.

Success to date in the development of standards for GIS data in Minnesota has emerged from the following conditions and activities:

- The consistent work, presence and advocacy of the Geospatial Advisory Council and its Standard Committee for the creation, maintenance and adoption of standards;

- A clear identification of the ***purpose and need*** for the standard and the appropriate identification of the ***range of mapping, application and analysis needs*** to be met by the adoption and use of the standard. To date, the needs of NextGen9-1-1 have been a primary driver in creating both the Road Centerline and Address Point Standards as

[72] *Road Centerline Data Standard for Minnesota, Public Review Comment Archive, http://www.mngeo.state.mn.us/committee/standards/roadcenterline/#*
[73] *Email correspondence dated 10/29/2020 between Dan Casey of Digital Data Technologies, Inc. (DDTI) and Geoff Maas, Ramsey County Information Services Department, Ramsey County, Minnesota*

adopted by the GAC and in increasing use by the community. By meeting the needs of NextGen9-1-1, a whole range of other needs for the same data are effectively met;

- A ***transparent and inclusive process*** by which standards can be proposed, discussed, refined, developed, communicated, adopted and revised for the benefit of the professional community; [74]

- ***Inclusion and engagement of stakeholders*** from all of levels of government and other interests to ensure the resulting standard can satisfactorily meet the range of uses including open meetings, opportunities for input and participation and suitable periods for stakeholder comment on standards as they are developed; [75]

- Clear communication and full availability of the materials during all phases of the standard development process;

- The opportunity for stakeholders to provide comment, have their comments recorded and responded to by the Standards Committee;

- Full opportunity for all interested individuals to participate in the standards creation process, to participate on the Standards Committee and to participate in the Geospatial Advisory Council;

The role of the Geospatial Advisory Council

The Geospatial Advisory Council (GAC) acts as a coordinating body for the Minnesota geospatial professional community. It represents a cross-section of organizations that include counties, cities, universities, business, nonprofit organizations, federal and state agencies, tribal government, and other stakeholder groups that benefit from geospatial technology. [76]

The GAC was created to provide recommendations for improving the operations and management of geospatial technology within state government and also on issues of importance to users of geospatial technology throughout the state, regarding the improvement of services statewide through the coordinated, affordable, reliable, and effective use of geospatial technology, and to represent a cross-section of organizations including counties, cities, universities, business, nonprofit organizations, federal agencies, tribal governments, and state agencies. [77]

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[74] *Geospatial Advisory Council Standards Committee Charter, Minnesota Geospatial Advisory Council, Approved on 3/28/2018*
[75] *Operational Procedures for Proposing, Approving and Revising Standards, Minnesota Geospatial Advisory Council, v. 1.0, Approved on 6/3/2019*
[76] *Minnesota Geospatial Advisory Committee, https://www.mngeo.state.mn.us/councils/statewide/index.html*
[77] *Minnesota Statute §16E.30, Subd. 8*

The GAC is supported by various committees and workgroups, including a Standards Committee which is chartered to perform the following: to coordinate strategies for integrating geospatial data and business processes across all levels of government; to advise and inform the statewide geospatial community about relevant standards issues; to facilitate a clear, transparent and inclusive process for the creation, development and adoption of data standards within Minnesota with an emphasis on stakeholder engagement and interaction and; to maintain a geospatial data standard development process that is transparent and inclusive of all level of professional practice in the state, based upon meeting articulated business needs of stakeholders, provides ample opportunity for input, critique, comment and feedback. [78]

Additionally, the Standards Committee is established to communicate and advise the statewide geospatial community on opportunities for shared and standardized geospatial data, opportunities for defining data workflows and data architecture within Minnesota and to work as effectively and efficiently as possible with other governing bodies, agencies, committees, review panels and boards whose activities are related or germane to the work of the Standards Committee.[79]

Further, in its role to facilitate its role in service to the GAC, the Standards Committee is to receive, document and report on the input, suggestions, recommendations, inquiries and proposals regarding geospatial data standardization from the professional geospatial community in the state. [80]

Given this level of specific prior action, the statutory role of the Geospatial Advisory Council, the role of the GAC's Standards Committee in supporting that role and the successes achieved to date in creating both standards for GIS data and the emerging datasets from this process, the state's NextGen9-1-1 program would be well served to leverage and capitalize on this ready-made body of expertise, action and demonstrated achievement for meeting their stated aims of assembling and using geospatial data inter-jurisdictionally.

The need for a GIS data gap analysis study for NextGen9-1-1

As of this writing in January 2021, there is no uniform availability of the full set of the needed address point and road centerline GIS data across Minnesota from authoritative local/county sources to provision data fully for a NextGen9-1-1 Core Services Vendor system nor is there the mechanism for assembling updates of the data.

A baseline or gap analysis study is greatly needed in Minnesota; the findings from which will assist in understanding:

- The current status and level of completeness of address point and road centerline data at each local/county data provider;

[78] *p. 2, Minnesota Geospatial Advisory Council Standards Committee Charter*
[79] *Ibid.*
[80] *Ibid.*

- The current and/or anticipated level of staff resources available at each local/county government that are committed to creating and maintaining the needed datasets;

- If a local/county government is reliant on external vendors for the creation and maintenance of their data instead of in-house staff performing that work;

- The frequency of changes and updates to the needed GIS data occurring at the local/county provider level, as some data providers will make daily updates, while others will see new roads and address points less frequently.

Minnesota would be wise to emulate the efforts the State of Wisconsin which has a gap analysis study presently underway and is anticipated to be completed by June 2021.[81]

Budget and funding considerations for on-going GIS data provisioning

Securing and maintaining sustainable funding is crucial to support and ensure quality data from local/county sources can continue to feed the system. Decision-makers and leadership at all levels of government must have confidence that costs related to GIS data provisioning for NextGen9-1-1 have been evaluated carefully and accurately represent specific associated actions and tasks to be undertaken for creation, validation, revision, improvements and maintenance. [82]

If a capacity or gap analysis study is conducted, additional attention to the budget and funding aspects and consideration of the project are recommended to be a part of that work.

The case for using the Geospatial Advisory Council (GAC) Standards and the importance of provisioning standardized GIS data for meeting many needs beyond just NextGen9-1-1

GIS data that produced and maintained by government is a valuable, flexible and unique asset. Unlike a fixed asset such as a vehicle, a building, a server or other physical equipment, GIS data is an easily copiable and transferable digital asset with many uses and such can be defined as a ***non-rivalrous good***,[83] meaning that the data does not diminish in supply, quality or effectiveness as it is utilized and consumed.

Further, GIS data is an ***extensible good***,[84] meaning the same dataset can be used in a variety of similar, parallel or even disparate ways to meet many uses and be expanded upon from its

[81] *p. 17, Wisconsin Statewide NextGen9-1-1 Plan, June 2020*
[82] *p. 22, Guidelines for Developing A State NG911 Plan, National Highway Traffic Safety Administration, 2018*
[83] *Corporate Finance Institute, Non-Rivalrous Goods, https://corporatefinanceinstitute.com/resources/knowledge/economics/non-rivalrous-goods/*
[84] *Tech Terms, 'extensible' - https://techterms.com/definition/extensible*

original format to additional needs. For example, while GIS data representing road centerlines are well known to be a vital and required asset for a NextGen9-1-1 system. These data can also be utilized by a city public works department to link their pavement condition data for viewing, mapping and analysis where to concentrate their next round of repairs. At the same time, a planning department could consume the same standardized road centerline GIS data to assess speed limits and traffic volume to explore traffic calming measures where a new school is planned to be built.

GIS data as a strategic resource. By creating and assembling the data in a way that facilitates multiple potential uses, a 'multiplier effect' can be achieved with the benefits of efficiency to downstream users of the GIS data resource. The investment of time, energy and expertise by those who have similar, parallel, and overlapping needs to collaborate on a standard for these data magnifies its usefulness to the wider use community. This shared attention to the data only enhances the quality of the data for NextGen9-1-1 uses. The GIS data that arises from municipal and county level effort, is aggregated at the region and state level becomes a valuable strategic asset for use in NextGen9-1-1, for a wide variety of other public safety applications and for numerous uses in many other disciplines. The benefits of counties and the state working together to produce, share and maintain statewide standardized GIS data sets has a much larger multiplier effect as the use of these standards enables data creators to save time, money and effort and to eliminate duplicative data creation activities.

Further, a single, multi-use data standard for road centerlines and address points that meet both NextGen9-1-1 needs and other needs promotes reliability, quality, trust in the data, adds to its authority for use, facilitates sharing, increases interoperability and facilitates automation in data aggregation, validation processes, storage, publishing and usability.

In its various NextGen9-1-1 publications and documents, NENA itself acknowledges that local jurisdictions ***need not*** maintain the data internally in just the NENA format, in recognition that multiple uses are met by multi-use datasets:

"It is important to note that ***an entity need only be capable of exporting their GIS data in a GIS data file format that meets the field naming convention, mandatory/conditional/optional use requirements, and type and width requirements.*** *This could be handled through the use of scripts, field mapping processes, or other geoprocessing tasks that, once built, need not be changed and may be reused again and again so long as the entity's internal GIS data model does not change.* ***It is not expected that every entity will use the GIS data model described within this standard for its day-to-day internal use and maintenance*** *but* ***it is expected that each entity will be capable of exporting their internal GIS data model into a given GIS file format that complies with this standard as frequently as may be necessary.*** *Alternatively, some entities may opt to use the guidance provided within this standard for the development of their internal GIS data model and use it for day-to-day use*

and maintenance. This is, of course, acceptable and has an added benefit in that it eliminates the need for the previously mentioned export process." [85] [emphasis added]

What weight and meaning does the term 'mandatory' carry in the documentation about GIS data and standards related to the development of NextGen9-1-1?

The use and frequent misuse and misinterpretation of the term 'mandatory' has caused a great deal of concern and confusion as it has been encountered in Minnesota applied to provisioning GIS data for NextGen9-1-1. There is a great deal of language found in the NENA documentation and with geospatial data standards in general about 'mandatory' data fields and significant focus on the 'required' aspects of data provisioning.

In the context of GIS data standards as they are used and applied in Minnesota, the term 'mandatory' simply means that a given field must be populated for each record to be fully compliant with the standard and that null values are not allowed, nothing more.[86]

For example, an agency that creates and maintains their GIS data could potentially provide their data with some mandatory values missing and, while the data would still be useful, it would simply not be compliant with standard. Providing the 'mandatory' fields enables the data to be used for its intended core functions.

Compliance with the standard is not something that can be legally mandated or enforced. The term mandatory has unfortunately been wrongly promulgated as 'providing your data is mandatory' in the context of the NextGen9-1-1's project, to the detriment of the understanding, trust, engagement, participation of the local/county partners.

A potent example of the use of this type of language can be taken directly from the NENA Standard for its NG9-1-1 GIS Data Model:

"Locally maintained GIS data layers are REQUIRED to include all Mandatory data fields within this GIS Data Model but are NOT REQUIRED to include Conditional or Optional data fields if no data exists to be populated within the Conditional or Optional data fields. If there are no records in the entire database for a specific Conditional or Optional data field, then the data field itself is NOT REQUIRED. Local policy may dictate that all data fields be included in the structure regardless if data exists." [87]

Additionally, within the standards adopted by the Minnesota Geospatial Advisory Council, the terms 'mandatory', 'conditional' and 'optional' are used to describe the disposition of individual

[85] *p. 18, NENA Standard for NG9-1-1 GIS Data Model, NENA-STA-006.1.1-2020, publication date: February 18, 2020*
[86] *Ibid.*
[87] *Ibid.*

fields of data for compliance with the standard, and not the ability of the state to enforce compliance or data delivery.[88]

This has led to many questions and concerns about what constitutes ***mandatory*** activity. Clarity on the precise use and application of these terms is crucial for fostering understanding among the participants and to dispel misinterpretation. This will aid in strengthening engagement of local/county partners and bolster their participatory role as a peer and contributor to the success of the effort.

What would a successful result or 'end state' look like in provisioning GIS data for the statewide NextGen9-1-1 system?

While significant work in planning, documentation, outreach, agreement language and technical configuration still needs to be defined and accomplished; a broad outline of what a successful and desired and successful operational 'end state' can be reasonably described.

The following section attempts to outline the salient features and functions of a successful GIS data provisioning effort; one which can meet the NextGen9-1-1 system needs as its highest priority and can also simultaneously satisfy the other myriad inter-jurisdictional GIS data needs.

Elements of a successful GIS data provisioning 'end-state' would include the following:

- The SECB must lead the development and publication of ***a clear, detailed, and workable project plan document*** that contains what specifically is to be achieved, the roles each participating agency plays and responsibilities they are to assume, the legal authority under which each operates, clear scopes of work and service level agreement language, identification of the gaps between existing conditions and the desired conditions and an articulation of the full set of resource costs (fiscal, personnel, software, hardware, etc.) required to meet the needs described. State law is unambiguous in assigning this role to the SECB [89], and it is to the will and discretion of the SECB to determine if this will be carried out by its Steering Committee, NextGen9-1-1 Committee or other body authorized to perform the work.

- All interests involved would be encouraged to embrace and ***make use of the GAC-approved standards*** for transfer, validation and aggregation of GIS data as well as the Geospatial Advisory Council and its Standards Committee's established, stakeholder driven methods for standards development, revision of standards, data governance and outreach. The use of the GAC-established process works to ensure consistency, clarity and communication between partners and delivery of data and serves to heighten its resulting quality;

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[88] p. 4, Minnesota Geospatial Advisory Council, Address Point Data Standard, Compliance Notes and p. 4 Minnesota Geospatial Advisory Council - Road Centerline Data Standard

[89] Minnesota Statute §403.382, Subd. 1 through 8

- The recognition and acknowledgement that the resources for producing and maintaining GIS data are unevenly distributed across the jurisdictions of Minnesota and that eventual uniform creation, maintenance and delivery of this data will be an on-going and iterative process. This recognition needs to include planning language and provisions made for jurisdictions to maintain their existing E9-1-1 systems to appropriately serve their residents, and—as needed—a detailed plan for the state to provide on-going support for the creation and maintenance of GIS data in areas of the state where fiscal, personnel and technical resources are unable at present levels.

- Local/county/tribal governments who are responsible for providing the authoritative GIS data to be used by the statewide NextGen9-1-1 system have a ***clear and unambiguous understanding of what specifically is needed, when it is needed, the extent of their responsibilities*** for the creation and maintenance of their part of the system;

- Local/county/tribal governments who are responsible for providing the authoritative GIS data ***have access to the range of fiscal, personnel, instructional, technical and operational resources they need*** to successful perform and conduct the work of creating and maintaining the data needed;

- ***Support and encouragement from local/county, tribal and state level executive leadership*** which demonstrates that they fully understand the resource allocation, costs, roles and responsibilities, benefits and liabilities which their agencies assume in participating in the NextGen9-1-1 effort; these agreements, resolutions, or statements of support should be in place, reviewed and approved by all parties prior to a regions participation in any statewide NextGen9-1-1 system which utilizing GIS based 9-1-1 call routing technology;

Recommendations to the SECB NextGen9-1-1 Committee on the provisioning of GIS data as created and maintained by municipal and county governments to the state for the effective development and sustainable maintenance of the NextGen9-1-1 system

1. Project Oversight/Governance

a. Work with the SECB steering committee to further develop an **overall plan for integrating 9-1-1 into the SECB governance process**, especially considering the shared statutory responsibilities for 9-1-1 planning, oversight, and operations. Clarity will benefit downstream efforts, such as the NG9-1-1 GIS project;

b. Create a **steering group for the NG9-1-1 GIS project**, led by ECN and including an appropriate mix of stakeholders, to:

   i. Create and maintain **multi-level project collaboration and oversight;**

   ii. Be utilized for **stakeholder input, feedback, and testing** during the build out of any future GIS-related tools and processes;

   iii. Review **project materials/documents** prior to wider distribution;

   iv. Review and approve **service level agreements (SLAs)** for any vendor procured NG9-1-1 GIS related solutions, including any solutions procured internally through state agencies;

   v. Draft standards that **define roles and responsibilities** for NG9-1-1 GIS project stakeholders, including any pertinent statutory basis for those roles;

   vi. Recommend content for **inter-local governmental agreements** related to NG9-1-1 data, including provisions for Counties/PSAPs using a vendor for GIS support;

   vii. Prepare and communicate a proposed **sequencing of remaining NG9-1-1 data transition steps** from current state to end-state so that data producers clearly understand data priorities, benchmarks, and timing for phased-in implementation of NG9-1-1 Core Services;

   viii. Coordinate a plan to achieve **spatial alignment/edge-matching** of road centerlines and polygons between data producers and address topological relationship and attribution consistency issues across datasets;

c. Incorporate the NG9-1-1 GIS workgroup's recommendations when refining the existing GIS/data goals and tactics in the next iteration of the **SECB's strategic plan;**

d. Document any **NG9-1-1 data policy issues** and refer them to be addressed through the SECB governance process.

2. Project Coordination Resources.

a. Request ECN acquire resources to assist in the **document development work** of the NG9-1-1 Committee and its workgroups to prepare the detailed plans and documentation needed for a successful NG9-1-1 implementation (e.g. a consultant, contractor, or otherwise incorporating the support needs into other solicitations);

3. Project Planning

a. Create a **joint NG9-1-1 planning workgroup**, led by ECN and including members of the NG9-1-1 network technical group and the NG9-1-1 GIS project steering group, charged with collaboratively preparing a well-documented **statewide NG9-1-1 implementation plan** that:

   i. Defines NG9-1-1 **business needs, dependencies, transition sequencing, and dates;**

   ii. Identifies the **linkages of key sub-plans** with the overall plan, especially ties between the NG9-1-1 GIS project and the overall implementation;

   iii. Includes **phased-in implementation strategies** that recognize the need to move forward in a prudent but swift pace given the varied states of readiness in Minnesota;

   iv. Addresses the requirements for maintaining **interoperability with legacy 9-1-1 systems** during the transitionary period between the start of a NG9-1-1 core services implementation and full i3 end state;

   v. Links the statewide implementation plan with **local and regional planning**;

   vi. Reflects the **input/feedback from the SECB regions and key stakeholders;**

b. Seek **approval of each SECB region** on the NG9-1-1 implementation plan prior to adopting it as a living document.

4. Project Outreach and Communication

a. Request ECN develop improved methods for **clear, consistent messaging** and communication among project partners, including:

   i. Implement a **repository web/hub site** for all NG9-1-1 GIS project documentation and communication;

   ii. Provide, on the project site, monthly **project management reports** detailing the statewide GIS project status, progress toward data readiness, as well as any gaps/risks;

   iii. Prepare a clear, concise statement articulating the **business needs** for NG9-1-1 geospatial data and **Minnesota's GIS data readiness criteria** to be circulated to project partners statewide to increase understanding of the geospatial data expectations (e.g. accuracy levels, frequency of updates, etc.);

   iv. Prepare a **gap summary for each region** that clarifies where each region currently stands relative to the GIS data readiness criteria (above);

   v. Coordinate periodic **training on NG9-1-1 GIS** for the county/PSAP data producers;

   vi. Prepare an informational document on the **changing roles of the PSAP Data/MSAG coordinators and GIS support organizations** to be shared with the regional boards;

b. Coordinate outreach with the regional boards to solicit input on **NG9-1-1 core services needs/requirements** prior to issuing an RFP;

5. Data Sharing

a. Request ECN prioritize implementation of **geospatial data sharing methods, tools and resources** that allow PSAPs/counties/regions to easily share, utilize, and collaborate on NG9-1-1 data, including;

   i. A **data sharing portal** for dataset download;

   ii. A **statewide data viewer** of the authoritative datasets collected for the project;

   iii. **Secure, cloud-hosted, high availability ESRI map, feature, and geocoding services** to facilitate the use of the authoritative NG9-1-1 datasets for PSAP, dispatch, and response coordination applications;

b. Request ECN prepare, for SECB approval, an appropriate statement of support for the Geospatial Advisory Council's effort to promote **open data;**

6. Data Submission

a. Direct ECN to ensure the process of NG9-1-1 data submission and ingestion will:

   i. Allow data to be submitted as **county, multi-county, or regional datasets;**

   ii. Allow data to be submitted in any **schema** that can be transformed to minimum NENA requirements using documented business rules. Direct ECN to provide data producers the necessary tools and support for implementing the necessary **data transformations;**

   iii. Be coordinated with the MN Geospatial Advisory Council to ensure that data producers can submit their data once to the state and it will strategically support the **state's NG9-1-1 and statewide road centerline and address point initiatives;**

   iv. Is designed to facilitate as much as possible **data export options** in NENA, GAC, and local schemas that promote the ongoing use and maintenance of high-quality authoritative data;

7. Data Quality

a. Direct ECN to provide **data QA/QC tools and services** (or the funding to obtain them) that empower data producers and their trusted aggregators to self-initiate GIS data validations prior to submission, allow data producers the flexibility to run validations in a user-defined order and timing, and provide data producers errors back with geospatial context whenever possible;

b. Prioritize state level resources on reaching **basic functional requirements** for the statewide datasets (e.g. normalized, aggregated, meet minimum schema and validation requirements, capable of being distributed back to data producers and NG9-1-1 Core Services vendor), rather than continuing internal development of NG9-1-1 specific validations that can be obtained from NG9-1-1 vendors;

8. Data Workflows

a. Request ECN prioritize creation of a draft document on the envisioned **data maintenance workflows** to promptly begin open and collaborative discussions with the NG9-1-1 GIS project steering group;

b. Require any data/workflows and contracts with NGCS vendor to:
    i. Allow **flexibility of interaction with the NGCS vendor** due to the varied level of expertise, staffing, desire to work directly with the vendor;

    ii. Inherently provide **flexible metrics and error reporting** so results can be aggregated and/or drilled down on a variety of levels (e.g. PSAP, county, region, state);
    iii. Provide **automated** processes as much as possible, without compromising data quality;

    iv. Provide data producers **full visibility to their data** deployed in NG9-1-1 platforms;

    v. Provide adequate **ongoing data and technical support** for PSAPs/Counties;

    vi. Be **sustainable** and rely on systems/tools that are committed to be maintained over time;

    vii. Allow for efficient transition of local and state **exception handling/flagging** into the NGCS vendor's methodology;

9. Project Funding

c. Request from the Commissioner of Public Safety information about the **statewide investment** in geospatial data to support NG9-1-1, including:

    i. Funding disbursements made and approved to be made to date by the 9-1-1 Program for the NG9-1-1 GIS project (including sources and uses of the funds);

    ii. Current cost projections to complete the remaining NG9-1-1 geospatial data preparation and for ongoing NG9-1-1 geospatial data provisioning;

d. Request the Commissioner of Public Safety hire a consultant to perform a **study to better understand the level of effort and ongoing costs** at all levels of government for maintaining the geospatial data necessary to support NG9-1-1.

    As part of that study:

    i. Gather **industry and national benchmark data**, as well as appropriate Minnesota information;

    ii. Establish reasonable **statewide estimates for ongoing costs;**

iii. Propose **funding options** that do not negatively impact PSAP funding for other 9-1-1 needs and do not penalize the use of internal/existing GIS support staff for ongoing support;

e. Request the Commissioner of Public Safety prepare materials for informing and educating stakeholders on the **financial impacts of NG9-1-1 implementation and maintenance** on state and local government, including the impacts of NG9-1-1 geospatial data;

f. Under the **SECB Grant program**:

i. Include GIS-related training and projects promoting public safety geospatial data sharing within and among regions as **priorities**;

ii. Establish **grant flexibility** that allows PSAPs to use and reimburse internal/existing GIS support staff time and resources for GIS data improvements for 9-1-1 needs;

g. Recommend the SECB Legislative Committee revise 9-1-1 statutes to clarify that ongoing geospatial data support, using internal/existing GIS support staff, is an **acceptable use of 9-1-1 fees** in line with FCC rules;

10. Geospatial Data as Strategic Asset

h. Request ECN hire a consultant to put the NG9-1-1 GIS project in the appropriate context of meeting all the **geospatial data needs to support a PSAP's functions** of operations, dispatch, and public safety response coordination, including:

i. Document PSAP data requirements for use in all their public safety systems;

ii. Develop a template that can be used by SECB regions and PSAPs for the development of a **strategic public safety data plans;**

iii. Document why it is fully appropriate that the NG9-1-1 GIS project be pursued within a framework that supports the **full context of PSAP and public safety geospatial data needs;**

iv. Explain how the geospatial data needed for NG9-1-1 represents a **core strategic asset of government** that is multi-purpose by nature and necessitates collaboration at all levels;

b. Direct ECN, on behalf of SECB, to **partner with the MN Geospatial Advisory Council** (GAC) to jointly document and communicate a statewide plan that lays out how the NG9-1-1 effort and the goals of statewide road centerline and address point initiatives are both compatible and synergistic. Include reference to the use of GAC standards process.

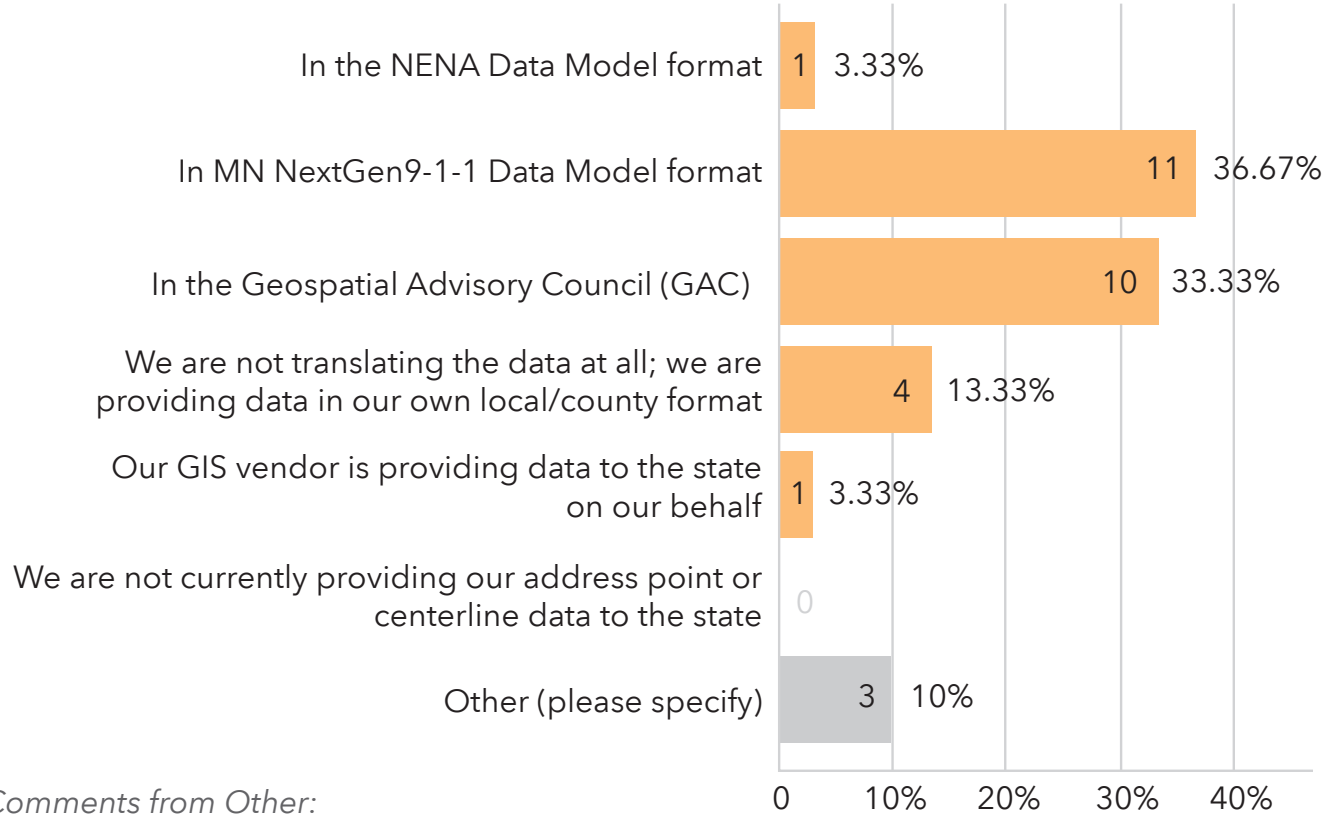
SECB NextGen9-1-1 GIS Work Group
Survey to County Data Providers - October-November 2020

The SECB NextGen9-1-1 GIS Work Group published a short survey to the County data providers (launched on October 28, closed on November 18) regarding key questions about the on-going NextGen9-1-1 effort.

This document contains a summary of the responses and the comments received.

QUESTION 1: DATA FORMAT

For the state's on-going NextGen9-1-1 effort, our County is providing our address point and road centerline data to the state in the following way:



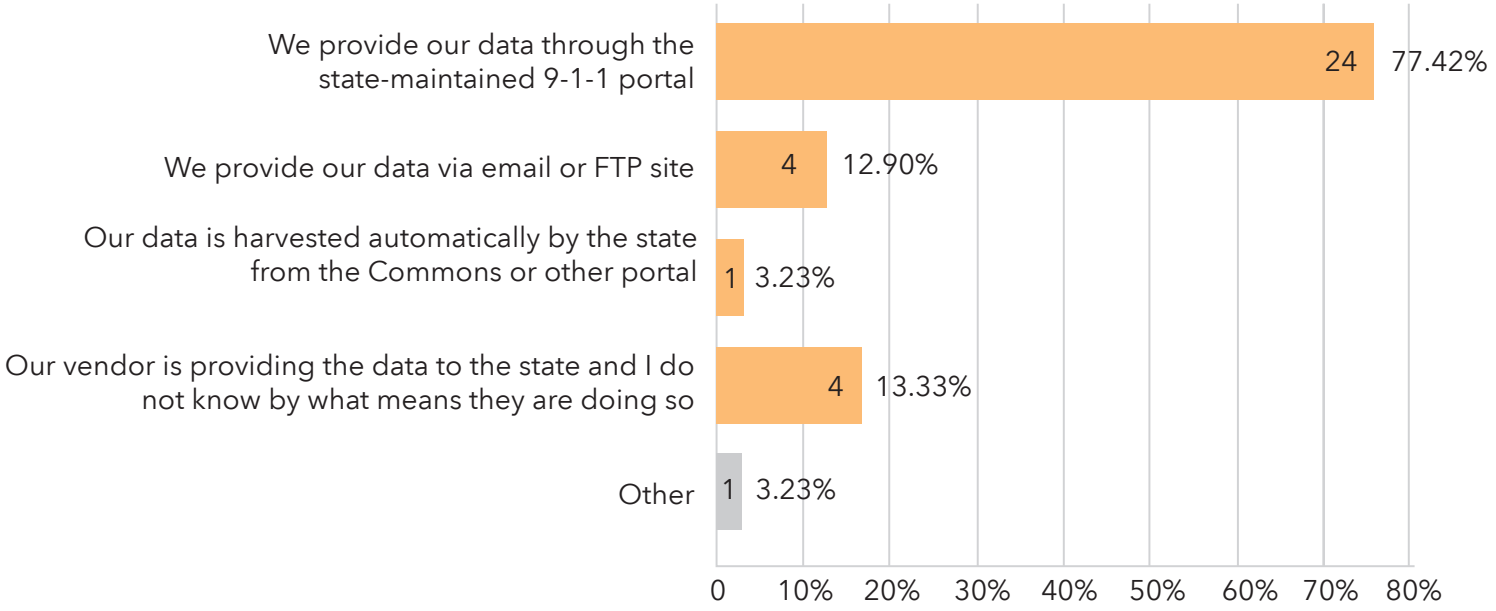
Comments from Other:

We follow the GAC format and follow the metro county consortium process GAC/MN NG9-1-1 hybrid model.

We are providing the data in our own local/county format. However, we are currently working on updating our local format to better meet local needs as well as the GAC & NENA formats

QUESTION 2: DATA TRANSMITTAL

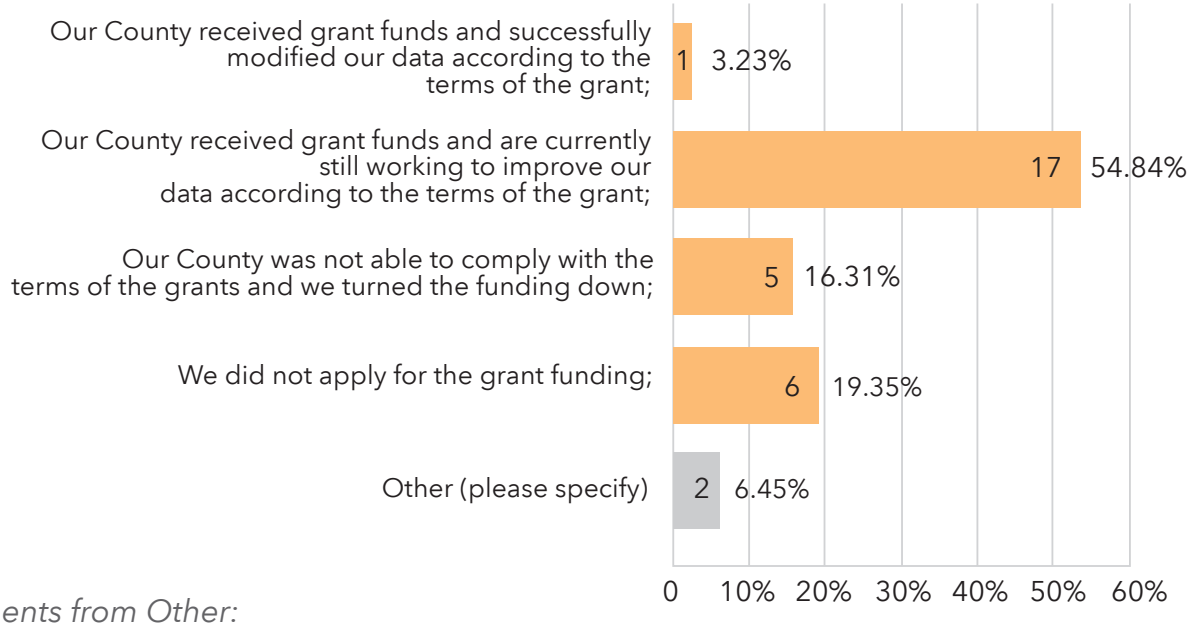
Please indicate the method of how you are sending your data to the state



Comments from Other:
We provide data along with the metro county process

QUESTION 3: GRANT FUNDING

Please indicate which answer most closely represents your experience regarding the recent federal grants for GIS data provisioning for NextGen9-1-1

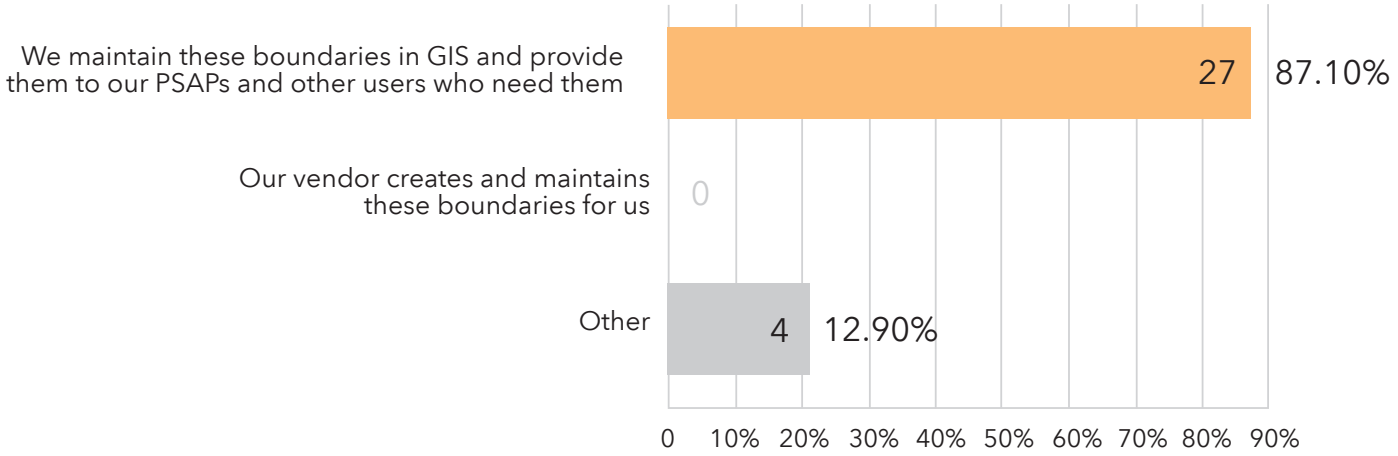


Comments from Other:

We did not apply for funding but did agree with the MESB request for funding.
To the best of my knowledge, we have not received any grant funds yet.

QUESTION 4: PSAP & EMERGENCY SERVICE BOUNDARIES

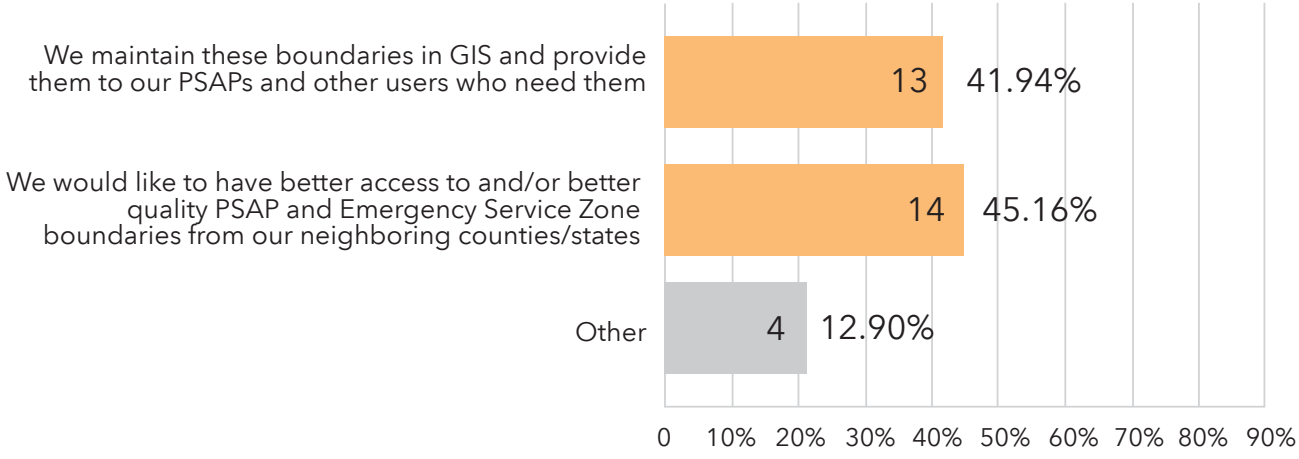
Regarding your internal use of PSAP and Emergency Service Zone boundaries



Comments from Other:
We work with MESB to maintain
We maintain the boundaries in GIS, but we haven't had users request them
The MESB builds and maintains this data for our County.
We are part of a joint dispatch center. Our 911 Center maintains these boundaries.

QUESTION 5: DATA FROM NEIGHBORING JURISDICTIONS

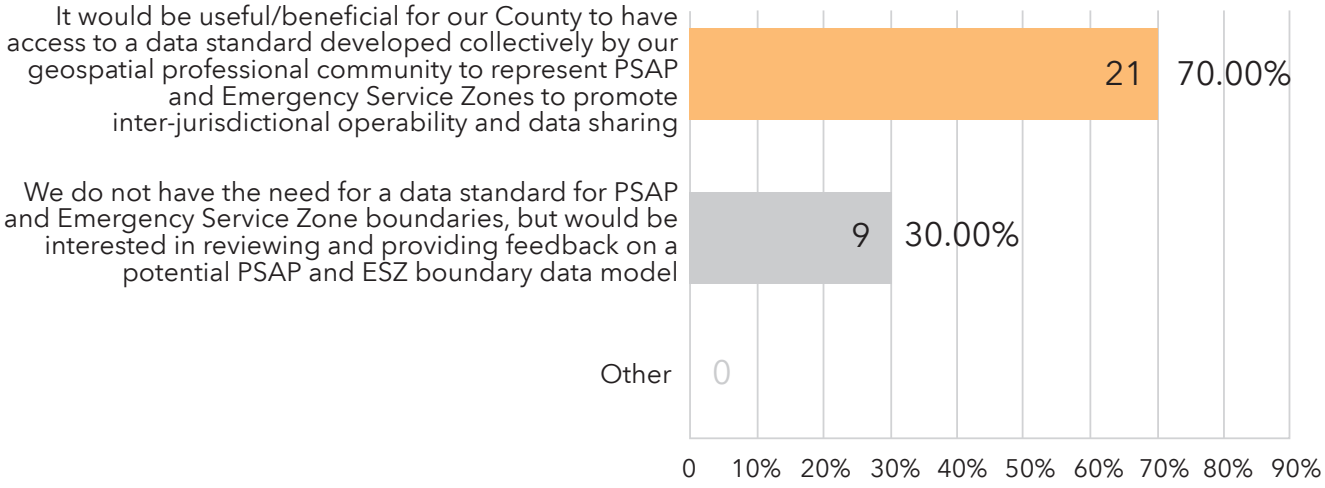
Regarding PSAP and Emergency Service Zone boundaries of neighboring jurisdictions;



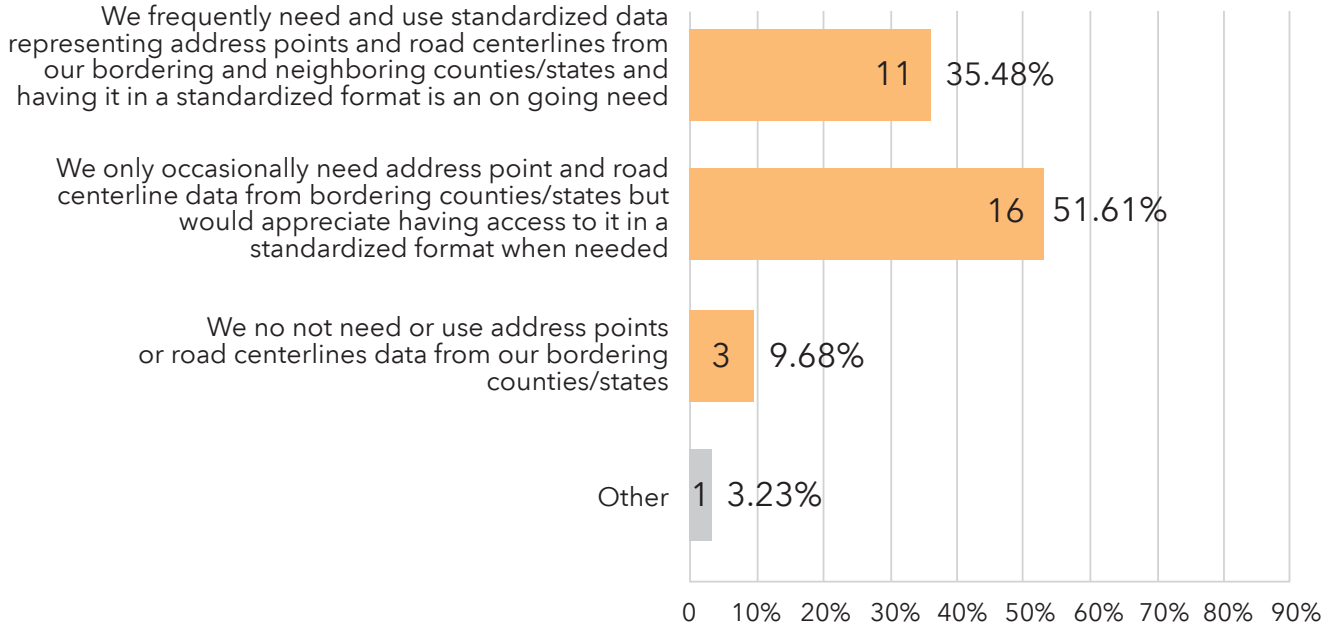
Comments from Other:
We have access to data for neighboring counties, but don't use or need the data
Have not requested access to PSAP and ESZ's from surrounding counties yet.
I don't know that we have a huge need for these boundaries, except for reference purposes.
Not sure if our 911 Center has access to neighboring jurisdictions.

QUESTION 6: DATA STANDARD FOR PSAP & ESZ BOUNDARIES

Regarding a possible data standard for emergency boundaries



QUESTION 7: ADDRESS POINT AND ROAD CENTERLINE DATA FROM NEIGHBORING JURISDICTIONS: Regarding your neighboring jurisdictions...

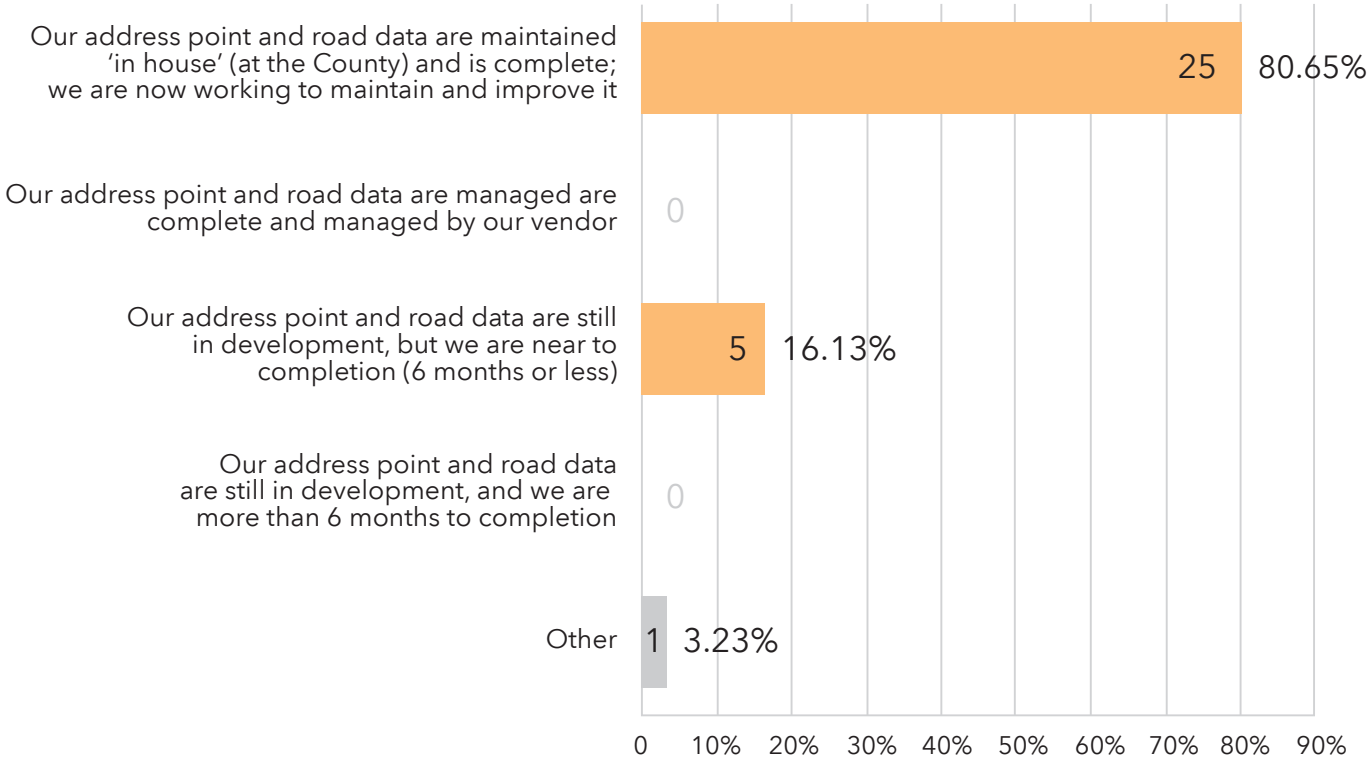


Comments from Other:

We occasionally request road centerline data from bordering counties and receive it in same format as we use

QUESTION 8: CURRENT STATUS OF YOUR DATA

Please indicate your current status and priorities regarding address point and road centerline data.



Comments from Other:

We maintain our GIS data, but we have an outside vendor to much of the quality control

QUESTION 9: GENERAL COMMENTS Please enter any general comments on your current work or concerns with the state's NextGen9-1-1 process.

We have had address point and road centerline data for more than 20 years. Our data has not yet been translated into the state standard, and that process is several months away.

In process of translating our data to this model.

We will switch the schema of our data to match NG-911 standards starting 2021

Work is still ongoing. It's been continually difficult to prioritize NG9-1-1 prep above other ongoing needs and responsibilities at our county. The state's timeframe and expectations have changed numerous times throughout this process, but overall I can't say I'm too concerned with the process. This is understandably a challenging task.

Currently working to be 100% compliant with NENA data standards.

We have found that maintaining the data has been the most labor intensive part of the process, and trying to keep up-to-date data can become overwhelming given that our county doesn't have a sole GIS person.

Bit of a moving target to date with lots of starts and stops has lead to some confusion.
Regional contact an MnGeo is very helpful resource. NG9-1-1 has contributed to the need to revisit county addressing ordinance (underway). I wonder if other counties are finding a similar need?

It is sometimes unclear exactly what format to use for our data, especially for grant reimbursement

They need to stop changing things up

More clarity on what the state actually needs. We need standardized data available back to our county for our neighboring counties, preferrably in GAC format.

Some of my concerns include …
- Standards changing again
- The need for re-work to be done again in the future
- How the boundary layers will be maintained
- What the maintenance workflows will be and how much work they will take on my end.

We are providing data in the GAC approved standards . That process is working for us and we are fine with how we can upload data. The process we are not aware of (at least not our entire group) is if that data will meet the requirements of NENA and NextGen9-1-1. Outside of the big kickoff meeting in St. Paul over a year ago, there hasn't been a lot of communication on that front. We are under the impression that our data will meet NENA requirements in it's current form. Reworking our data into yet another standard with all new requirements would be disastrous for our support. We adopt these standards as our production standards because they are carefully developed by a large pool of smart individuals. As such, we are very susceptible to any kind of schema changes. It causes us to have to realign numerous workflows and the applications that support them. It would be nice to know if everything we are doing will meet the NENA requirements. We understand this is a major effort pulling together all of MN, but some assurances clearly communicated would be helpful.

One man GIS operation here and I am the IT Director also, not much support from our County Board, most of the work I do on my own time, confident I will get it done though. Great staff at MNIT Geo staff that have help me through this and been so patient.

To facilitate data sharing I hope that the state request that organizations use the GAC standard.
One thing that also needs to be discussed is if we should use a combined ESB layer or individual ESB layers. Choosing one or the other may help facilitate data sharing.

We would like not not participate in the state program. Our region would prefer autonomy, and the ability to work with 9-1-1 vendors directly.

I just hope that the data standards stay consistent. Once I have this done I have no intentions of dealing with this ever again. I also wish there were funding opportunities three and a half years ago when I feel that I was forced to start this project. Now the counties that did nothing initially with the project are getting way more money for funding to complete the project. Our county was awarded next to nothing and would've actually cost us more money to take the award and hire a company to finish it. If I would've known to just do nothing and wait for funding to hire someone else to do this, that would've saved me a ton of time.