

SURVEY REPORT

NG911 GIS Data and CAD Integration in Pennsylvania PSAPs

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Pennsylvania
Emergency Management Agency

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Introduction

The transition to Next Generation 911 (NG911) technology introduces opportunities for enhanced interoperability, standardization, and efficiency in emergency response operations. A critical component of this transition is the adoption of the NENA NG911 GIS Data Model Standard, which provides a consistent framework for GIS data management across Public Safety Answering Points (PSAPs) and in applications used for 911. However, challenges such as vendor-specific GIS schemas, data conversion complexities, and regional inconsistencies have created obstacles to seamless implementation. PEMA conducted this survey to assess the current state of Computer Aided Dispatch (CAD) systems and GIS data utilization among PSAPs in accordance with **Goal 2.6 of the NG911 GIS Strategic Plan** adopted in December 2023: ***Encourage adoption of the NG911 GIS Data Model Standard across PSAP mapping platforms***. This report details the findings of our survey.

Purpose

The purpose of this survey was to:

- Identify CAD systems, data structures, workflows, and mapping technologies in use
- Assess the adoption of NG911 GIS Data Model standards across PSAP mapping platforms
- Identify challenges and gaps in CAD and GIS data management
- Provide actionable recommendations that promote statewide standardization and alignment with NG911 goals

Acknowledgements

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Survey/Respondent Overview

- **Survey Timeline:** October 29, 2024 – November 8, 2024
- **Total Responses:** 86 (43 from PSAPs, 43 from Counties)
- **Participating PSAPs:** Various counties across Pennsylvania
- **Target Audience:** Individuals from PSAPs with knowledge of CAD technologies, and individuals responsible for maintaining GIS data at the county level
- **Respondent Roles:** 911 Coordinators, GIS Data Stewards

Key Findings

1. Many counties are interconnected: More than half (53%) of the respondents said their PSAP is part of a regional CAD system. While we did not ask them to provide specifics about how their CADs are connected, we think this information reinforces the need for recognizing the importance of PSAP interoperability as Pennsylvania's NG911 environment continues to develop.

2. One dataset, multiple uses: Many respondents (56%) reported maintaining a single GIS dataset to meet the needs of both the NENA NG911 schema and their CAD's vendor-specific schema. In most cases, the PSAP uses the NENA standard as the primary schema and simply extends or formats it as needed for CAD rather than creating a fully separate dataset to achieve greater efficiency.

3. Some still pull double duty: Meanwhile, almost half of respondents (44%) said they currently maintain two independent GIS databases. The main reason given is because of boundary and schema differences, but some indicated having to maintain one dataset for their county or for multiple counties.

4. Working in the fields: A majority (72%) of PSAPs said they populate and maintain GIS attribute fields that are not part of the NENA NG911 standard to support CAD or other operational requirements. Examples include unique ID codes for legacy systems, custom response zone identifiers, and fields to store combined address elements or abbreviations used by dispatchers.

5. Still some inconsistency: Roughly two-thirds of the PSAPs are using the NENA NG911 GIS Data Model Standard, with the remaining respondents instead using a vendor-specific or custom GIS schema for their CAD mapping. There does not appear to be a clear pattern as to which vendors have adopted the NENA standard, and schemas and workflows seem to be unique at each PSAP.

Conclusions

This report highlights the importance of adopting the NG911 GIS Data Model to enhance Pennsylvania's emergency response capabilities. The survey findings reveal progress in many areas but also identify challenges, such as reliance on vendor-specific GIS schemas, data conversion complexities, and duplicative datasets.

By incentivizing compliance, streamlining workflows, collaborating with vendors, and supporting training, Pennsylvania can overcome these challenges and advance toward the goals outlined in the NG911 GIS Strategic Plan. These efforts will improve data interoperability, efficiency, and the overall effectiveness of emergency response operations.

With collaboration from PSAP administrators, GIS data stewards, 911 Advisory Board, and other stakeholders, Pennsylvania is well-positioned to set a standard of excellence in NG911 GIS implementation, ensuring a stronger, more reliable public safety framework for all residents.

Areas of Concern

Based on the survey responses and supporting comments, five key areas of concern emerged in the adoption of the NG911 GIS Data Model among Pennsylvania PSAPs:

1. Vendor-Specific GIS Schema Limitations

- **67% of PSAP Coordinators** reported that their CAD systems **use a vendor-specific GIS data schema** rather than relying solely on the NG911 standard. These proprietary schemas create inconsistencies, increase the complexity of GIS maintenance, and potentially limit interoperability across jurisdictions.

2. Dual Maintenance of GIS Datasets

- **44% of GIS Data Stewards** reported maintaining **two independent GIS datasets** – one for NG911 and one for CAD. This is primarily due to differences in schema requirements, boundary alignment, legacy CAD configurations, and multi-jurisdictional data responsibilities. While some counties are working toward consolidation, these factors continue to drive duplication – which increases staff workload and the risk of data inconsistencies.

3. Time-Consuming Data Conversion Processes

- **40% of PSAPs** reported **converting GIS data** from the NG911 schema to a CAD-specific schema. These processes are often partially manual and introduce inefficiencies and increased risk of error during updates. Among those PSAPs reporting:
 - **29%** said it takes **less than 1 hour**
 - **53%** said it takes **1–4 hours**
 - **12%** said it takes **4–8 hours**
 - **6%** said it takes **more than 8 hours**

4. Use of Non-NG911 GIS Data Model Fields

- **72% of GIS Data Stewards** reported maintaining **additional attribute fields** outside the NG911 GIS Data Model to meet CAD vendor or local operational needs. While necessary in some cases, these non-standard fields increase schema variability and add complexity to data validation, sharing, and cross-system integration. Among those reporting:
 - **68%** maintain **1–4 fields**
 - **16%** maintain **5–9 fields**
 - **16%** maintain **10 or more fields**

5. Inconsistent Adoption of the NG911 GIS Data Model Across CAD Vendors

While a majority of PSAP Coordinators report using the NG911 GIS Data Model, **vendor adoption remains inconsistent** – even within the same CAD vendor. This indicates that implementation is often driven by local decisions, CAD system configuration, or support limitations rather than vendor capability.

For example:

- **Tyler Technologies:** 18 PSAPs use NG911; 7 do not
- **Motorola:** 3 use NG911; 2 do not
- **Hexagon:** 3 use NG911; 2 do not
- **LogiSYS:** 2 use NG911; 1 does not
- **GeoConex/Zetron:** 1 uses NG911; 1 does not
- **Peraton:** 1 uses NG911; 2 do not
- **CIS:** 1 uses NG911
- **Central Square, Infor, and Versaterm:** All had at least one PSAP using vendor-specific schemas only

This variability in implementation across the same platforms creates barriers to standardization and interoperability between PSAPs.

Recommended Action Items

Based on the survey responses, PEMA – working in collaboration with the 911 Advisory Board and its subcommittees – offers the following recommendations to support **Goal 2.6 of the NG911 GIS Strategic Plan**: Encourage the adoption of the NG911 GIS Data Model Standard across PSAP mapping platforms.

1. Incentivize Compliance

- a) PEMA provides financial incentives by prioritizing grant funding for PSAPs that implement shared CAD systems capable of supporting the adopted NG911 GIS Data Model Standard.

2. Engage with Vendors

- a) PEMA encourages counties to collaborate with their CAD vendors and vendor user groups to better understand and resolve schema challenges.
- b) PEMA promotes adoption and implementation of the NG911 GIS data model during CAD upgrades.
- c) PEMA, in collaboration with counties, works with chapters of PA APCO and PA NENA to encourage national organizations and vendors to update CAD and NG911 mapping applications to require compatibility with the NG911 GIS Data Model Standard.

3. Streamline GIS Data Workflows

- a) PEMA collaborates with PA GIS stakeholders to identify areas where duplicate GIS datasets may be maintained and evaluate existing workflows contributing to that duplication.
- b) PEMA encourages PA GIS stakeholders to engage with counties maintaining duplicate GIS datasets and assist in developing standardized workflows to eliminate duplication.

Appendix A: Survey Questions and Responses – CAD Systems

Which CAD system does your PSAP use?

- (58%) Tyler Technologies
- (12%) Hexagon
- (12%) Motorola
- (7%) Other
- (2%) Central Square
- (2%) Computer Information Systems (CIS)
- (2%) Infor
- (2%) Peraton
- (2%) Versaterm

What is the model of your PSAP's CAD system?

- Various responses

What is the version of your PSAP's CAD system?

- Various responses

Is your PSAP's CAD system part of a regional CAD system?

- (53%) Yes
- (47%) No

When does your PSAP's current CAD system maintenance contract expire?

- Various responses. Many reported that their contracts renew annually, but most all respondents indicated an expiration of their current contract before the end of 2025.

Does your PSAP's CAD system map use locally provisioned GIS data?

- (100%) Yes
- (0%) No

Does your PSAP's CAD system use a vendor-specific GIS data schema?

- (67%) Yes
- (33%) No

Does your PSAP's CAD system use the NENA NG911 GIS Data Model Standard?

- (67%) Yes
- (33%) No

What other mapping technologies, if any, are being used at your PSAP:

- County GIS Maps
- EagleView Pictometry
- Google Maps
- IamResponding
- Local maps in Carbyne CHE
- Motorola Aware GPS Technology
- Paper Maps
- PDF Maps
- Prepared Live
- PulsePoint
- RapidDeploy
- RapidSOS (integrated into CHE, interfaced to CAD, or standalone)
- Smart 911
- What3words

How satisfied is your PSAP with your CAD system?

- (36%) Very Satisfied
- (52%) Somewhat Satisfied
- (10%) Neither Satisfied nor Dissatisfied
- (0%) Somewhat Dissatisfied
- (2%) Very Dissatisfied

Are there any additional comments, considerations, or insights regarding the survey that you believe PEMA should take into account? (Summary of responses):

1. GIS Data/Schema Concerns

- Issues with data schema compatibility (e.g., NENA vs. vendor-specific schema)
- Concerns about how NG911 GIS data will be utilized in CAD systems
- Adjustments needed for data field types (e.g., LONG integers vs. DOUBLE)
- Comments that they are using a schema that meets vendor requirements but could be modified to use the NG911 GIS Data Schema

2. CAD Upgrades/Projects

- Planned CAD system upgrades or refreshes (examples include Philadelphia's Versaterm V-CAD project and Hexagon upgrades)

3. Vendor-Specific Issues

- Desire for a more-direct ESRI connection instead of the current Hexagon system
- Discussions about launching a regional CAD/mapping solution

4. Aging Technology

- Acknowledgment of aging CAD systems needing future replacements

5. Cloud Migration Considerations

- Consideration of moving from on-premises servers to cloud-based solutions

6. Miscellaneous

- General feedback that didn't fit into specific themes; Examples include descriptions of current CAD systems or operations

Appendix B: Survey Questions and Responses – GIS Data

Does your PSAP currently maintain two independent GIS datasets? (One dataset in the CAD vendor-specific data schema, and one dataset in the NENA NG911 GIS Data Model Standard)

- (56%) No
- (44%) Yes

If “yes” to maintaining both datasets, why?

Various responses, but main themes include:

- CAD vendor needs or requires different layers, fields, response boundaries, or attributes than the NENA NG911 Data Model requires
- County manages datasets for more than one county or jurisdiction
- Unable to make changes on current CAD schema but awaiting CAD upgrade
- Concern that different datasets and schemas differ greatly from what telecommunicators are used to working with, and want to avoid interference with CAD operations and configurations

Does your PSAP populate and maintain additional GIS attribute fields that are CAD vendor-specific and not included in the NENA NG911 GIS Data Model Standard?

- (72%) Yes
- (28%) No

If “yes”, approximately how many additional CAD vendor-specific attribute fields are populated and maintained?

- (68%) 1-4
- (16%) 5-9
- (16%) 10 or more

For the PSAP’s CAD system, is the GIS data converted from the NENA NG911 GIS Data Model Standard to a CAD vendor-specific GIS data schema?

- (60%) No
- (40%) Yes

Please select the option that best describes the GIS data conversion process from the NENA NG911 GIS Data Model Standard to a CAD vendor-specific GIS data schema:

- (71%) The process is both automated and manual
- (18%) The process is automated
- (12%) The process is manual

Approximately how long does the GIS data conversion process take?

- (29%) Less than 1 hour
- (53%) 1-4 hours
- (12%) 4-8 hours
- (6%) Longer than 8 hours

How often is your PSAP's CAD system updated with GIS data?

- Daily (9%)
- Weekly (12%)
- Biweekly (33%)
- Monthly (30%)
- Quarterly (14%)
- Yearly (2%)

Are there any additional comments, considerations, or insights regarding the survey that you believe PEMA should take into account? (Summary of responses):

1. Schema Usage and Data Transformation

- **CAD as the Primary Source:** In several counties, data is maintained primarily for CAD systems and then transformed into the NENA NG911 Data Model for PEMA submission. There is no double editing. All edits occur in the native CAD dataset.
- **Conversion Tools and Reprojection:** ETL (Extract, transform, load) scripts and tools like ArcGIS Model Builder are commonly used to convert data to the NG911 schema. In some cases, the native data (e.g., NAD83 State Plane) also requires reprojection during conversion.
- **Enterprise Schemas:** Some counties maintain an enterprise schema that supports all county needs and is extracted, transformed, and loaded to both CAD and NG911 formats as required.
- **Data Aggregation from Multiple Sources:** For example, Tioga County PSAP receives data from multiple contributing provisioning agencies, making its data aggregation setup unique but not unprecedented.

2. Differences Between NG911 and CAD Requirements

- **Functional Difference:** The NG911 schema is built for call routing, but CAD systems require more for dispatching, visualization, and operational workflows.
- **Labeling and Display Preferences:** Some users find NG911's full-format field requirements (e.g., pre/post directionals, street type) visually cluttered on maps. Abbreviated fields are often preferred for labeling purposes in CAD.
- **Geometric Constraints in CAD:** CAD systems often cannot support multiple geometry types with the same name or description. As a result, counties submit different Fire, Police, and EMS boundaries to NG911 and CAD.

3. Supplemental Fields and Departmental Uses

- **Non-NG911 Fields:** Many counties maintain additional fields outside the NG911 schema to support internal operations such as:
 - Hazard mitigation planning
 - Voter registration and elections
 - Tax assessment
 - Planning departments
 - General record keeping
- **Field Consistency Across Departments:** Some counties maintain a single SSAP and RCL dataset in the NG911 schema, but with added fields to serve various departments beyond CAD.

4. Update Frequency and Process

- **Sporadic Update Schedules:** Update frequency ranges from every two weeks to every three months, depending on available staff or consultants. In some cases, data management is shared among multiple regionalized PSAPs.
- **Consultant Support:** Some counties rely on consultants to perform schema conversions and updates, which may contribute to the irregular update schedule.

Appendix C: Survey Respondents by County and Role

County	PSAP	GIS		County	PSAP	GIS		County	PSAP	GIS
Adams		X		Delaware	X	X		Monroe	X	X
Allegheny				Elk				Montgomery	X	X
Armstrong				Erie	X	X		Montour	X	
Beaver	X	X		Fayette	X	X		Northampton	X	X
Bedford		X		Forest	X	X		Northumberland		X
Berks	X	X		Franklin	X	X		Perry	X	
Blair	X			Fulton	X			Philadelphia	X	X
Bradford	X	X		Greene	X	X		Pike		X
Bucks	X	X		Huntingdon				Potter		X
Butler	X	X		Indiana	X	X		Schuylkill		
Cambria	X	X		Jefferson	X			Snyder	X	X
Cameron	X			Juniata	X			Somerset	X	X
Carbon	X			Lackawanna				Sullivan		
Centre	X	X		Lancaster		X		Susquehanna		
Chester		X		Lawrence	X	X		Tioga	X	X
Clarion		X		Lebanon				Union	X	
Clearfield		X		Lehigh	X			Venango	X	X
Clinton	X	X		Luzerne	X	X		Warren	X	
Columbia	X	X		Lycoming	X	X		Washington		X
Crawford	X	X		McKean	X			Wayne		X
Cumberland	X	X		Mercer	X	X		Westmoreland	X	X
Dauphin				Mifflin				Wyoming		
								York		