

# Report on Survey Results: Incident Symbolology – Phase 3

National Alliance for Public Safety GIS Foundation  
in partnership with  
Ardent Management Consulting

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## I. Executive Summary

This report provides a summary of the results from the national *Survey on Incident Symbolology and Mapping Capabilities* conducted by the National Alliance for Public Safety GIS Foundation (NAPSG). The purpose of the survey was to determine a baseline understanding of the level and usage of location-enabled decision support tools and standardized incident symbolology. This study serves as a primary input in determining priority gaps and areas for improvement that are critical to establishing a common symbol dictionary for communicating preparedness and incident information across the entire public safety and homeland security community.

The survey was conducted between March and April 2015 and was strategically released to the community by NAPSG, Federal agency partners, and national association partners. The survey was tailored to address two specific target audiences: 1) Geographic Information Systems (GIS) Technical Professionals who produce maps for public safety; and 2) Public Safety Leaders and Operators who use maps for decision making. The survey sample was of high quality and met the requirements to serve as a primary source for requirements gathering. The survey focused on four key areas that are foundational to determining incident symbol requirements and gaps, they are:

- Level and usage of location-enabled decision support tools.
- How location-enabled decision support tools are currently being used by the community.
- Adequacy and ease of understanding existing incident symbols used in the tools.
- Extent that existing standardized symbols are used and gaps in standardized incident symbols.

The analysis in this report extracts and shares the actionable results from the national survey. The analysis concluded that existing incident symbols are not entirely adequate or effective in supporting decision making by public safety, and there remains numerous areas for improvement in filling unmet gaps and enhancing the elements and features of existing symbols. The results illustrate that much work is still needed to harmonize and standardize incident symbolology due to the diversity of standards and guidelines being used -- as well as the known inconsistencies between them. Inconsistencies such as these have the potential to lead to significant operational coordination issues when multiple agencies share maps and use them in the planning and response to emergencies.

The survey analysis results also revealed several next steps for NAPSG, Federal agency partners, and our national association partners to take, including the following:

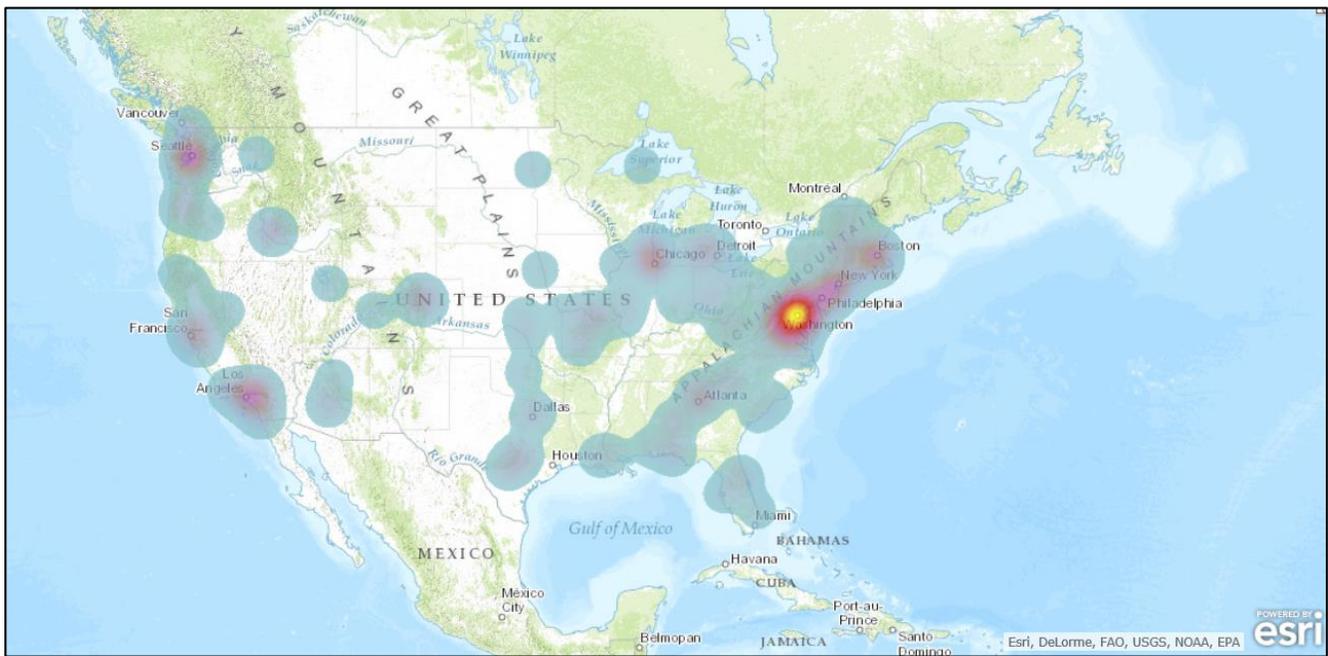
- Entities such as the Federal Geospatial Data Committee's Homeland Security Working Group should take a fresh look at their standard symbols and consider updates based on NAPSG's current efforts to address key gaps and enhance the adequacy of standardized incident symbols.
- NAPSG and our national association partners should develop and conduct a major push to educate both target communities about the latest standardized incident symbols and the operational benefits of using a common symbol dictionary.
- A similar survey needs to be conducted on an annual basis, or a minimum of every 2 years, in order to inform the expansion and refinement of the standardized incident symbolology guideline and symbol set, and to monitor change in adoption and implementation by the community over time.

Finally, this survey report also includes several findings regarding the broader perspective regarding the effectiveness and maturity at which location-enabled decision support tools are being used by the community. These findings serve as the foundational perspective to understanding the successes, issues, and constraints associated with the use of symbols on maps and related tools used by public safety.

## II. Analysis of Survey Participation

A total of 406 individuals participated in the national *Survey on Incident Symbolology and Mapping Capabilities*, 222 GIS Technical Professionals and 184 Public Safety Leaders and Operators. Given that the survey was only open for a 30-day period, this represents a solid response rate and sample size to fulfill the survey's purpose. There are several other participation indicators that confirmed the quality of the sample size and diversity.

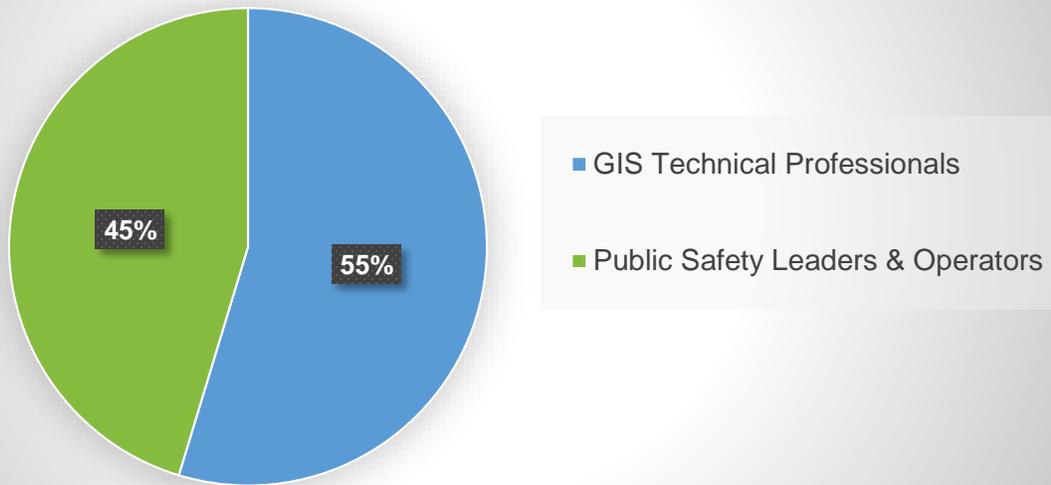
Provided below is a heat map that illustrates the geographic distribution of survey respondents. The pink and yellow areas indicate locations or regions that had a higher number of respondents and blue areas indicate a moderate number of respondents. The larger pink and yellow areas are located in centers of high population density, and in many cases where jurisdictional boundaries are geographically closer together.



**Figure 1 – Heat Map for Survey Participation Nationwide** – The map above serves to illustrate the geographic distribution of survey respondents throughout the United States.

Another important aspect to consider when analyzing the composition and quality of the sample is the breakdown of participation by the two target audiences. The pie chart below illustrates the division in respondent numbers between the two targeted audiences: 1) GIS Technical Professionals who support public safety; and 2) Public Safety Leaders and Operators. The division by target audience represents a fairly even split between the two target audiences and confirms the high quality of the sample.

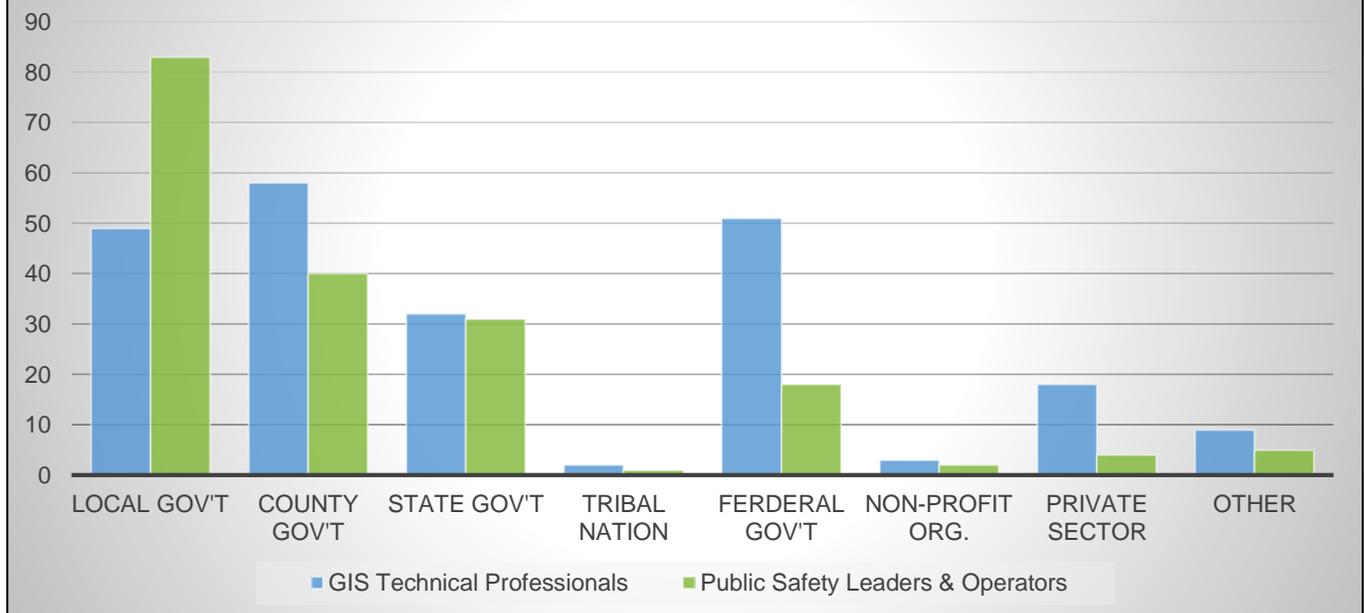
## Survey Participation by Target Audience



**Figure 2 – Pie Chart for Survey Participation by Target Audience** – The pie chart above illustrates the nearly even split in participation by the two target audiences.

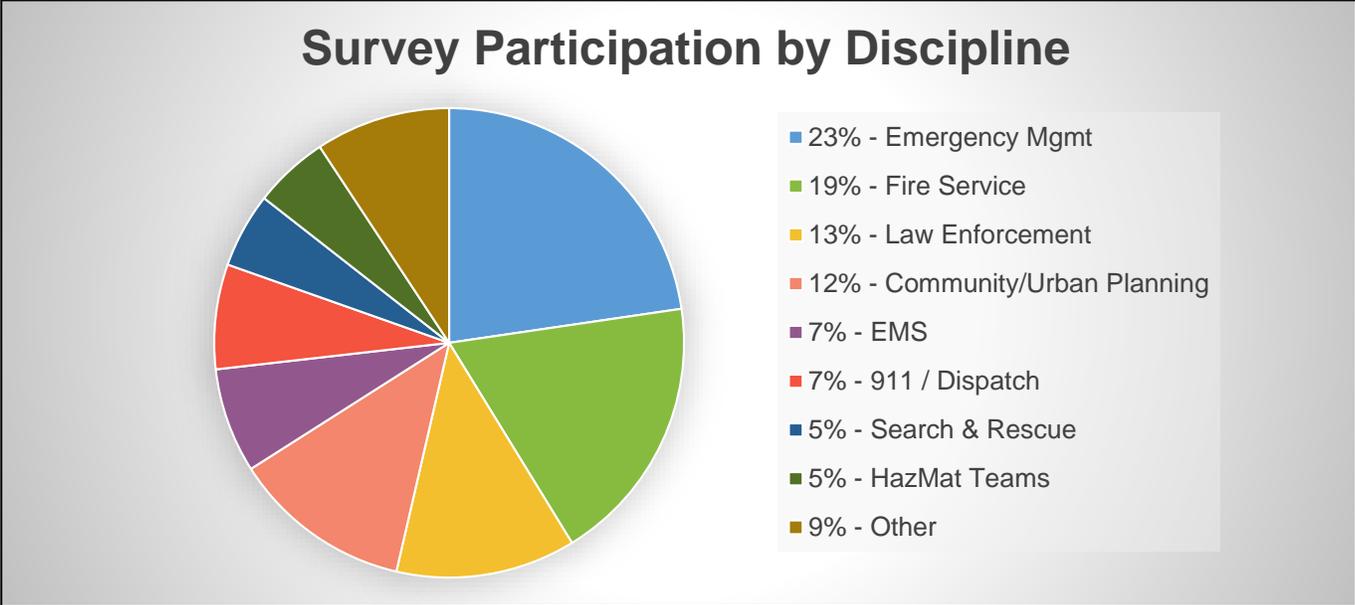
When determining if the sample for this survey accurately represented the intended community, it is imperative that we also look at participation by organization type, and most important by level of government. Since the majority of all incidents occur at the local level, the fact that the majority of respondents represented either local or county units of government confirms that the survey was successful in reaching the intended organization type. Additionally, the survey was also effective in reaching a diversity of other types of organizations that are critical to the homeland security enterprise.

## Survey Participation by Organization Type



**Figure 3 – Bar Chart on Survey Participation by Organization Type** – This bar chart depicts the composition of the sample by organization type represented.

The other critical aspect to consider when assessing the quality of the sample for this survey is participation by discipline. The pie chart below indicates that the sample represented a diverse pool of respondents across all disciplines. The majority of respondents fell into what is often referred to as the core public safety disciplines (emergency management, law enforcement, fire service, and EMS), representing 62% of all survey respondents.

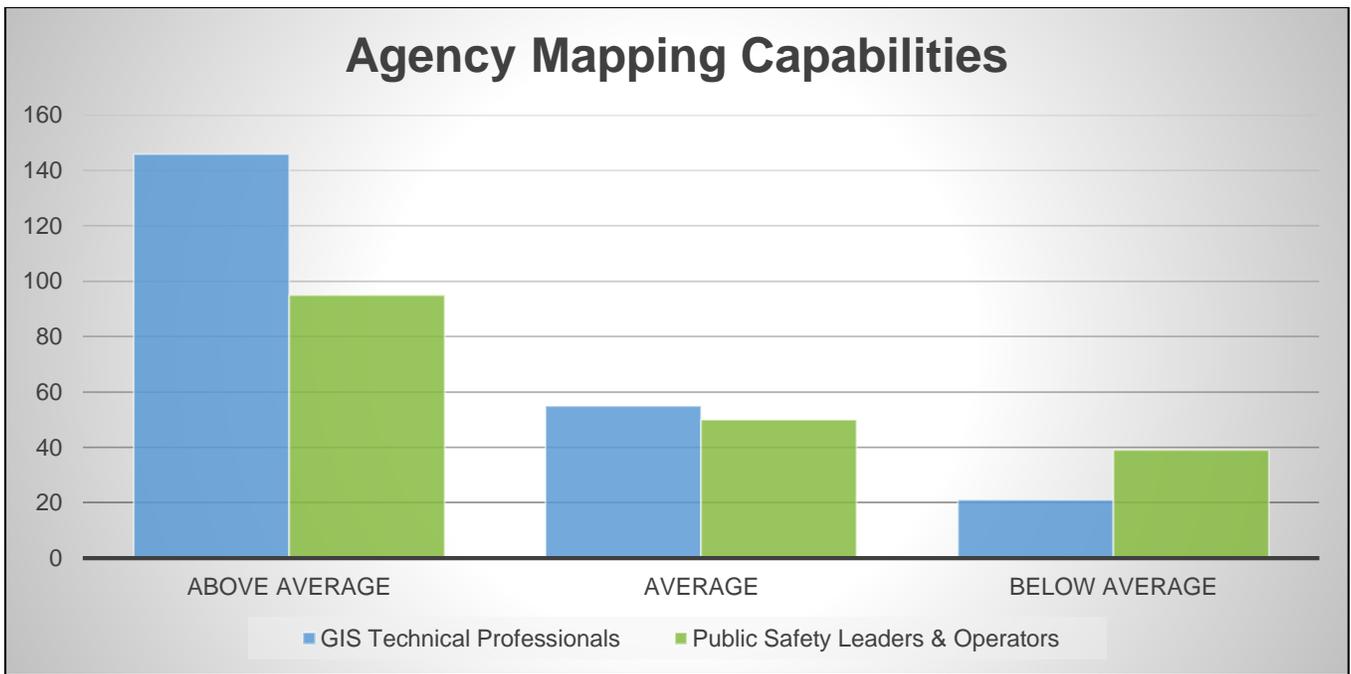


**Figure 4 – Pie Chart on Survey Participation by Discipline** – This pie chart illustrates the diversity of survey respondents based on their self-identified discipline.

### III. Analysis of Agency Mapping Capabilities

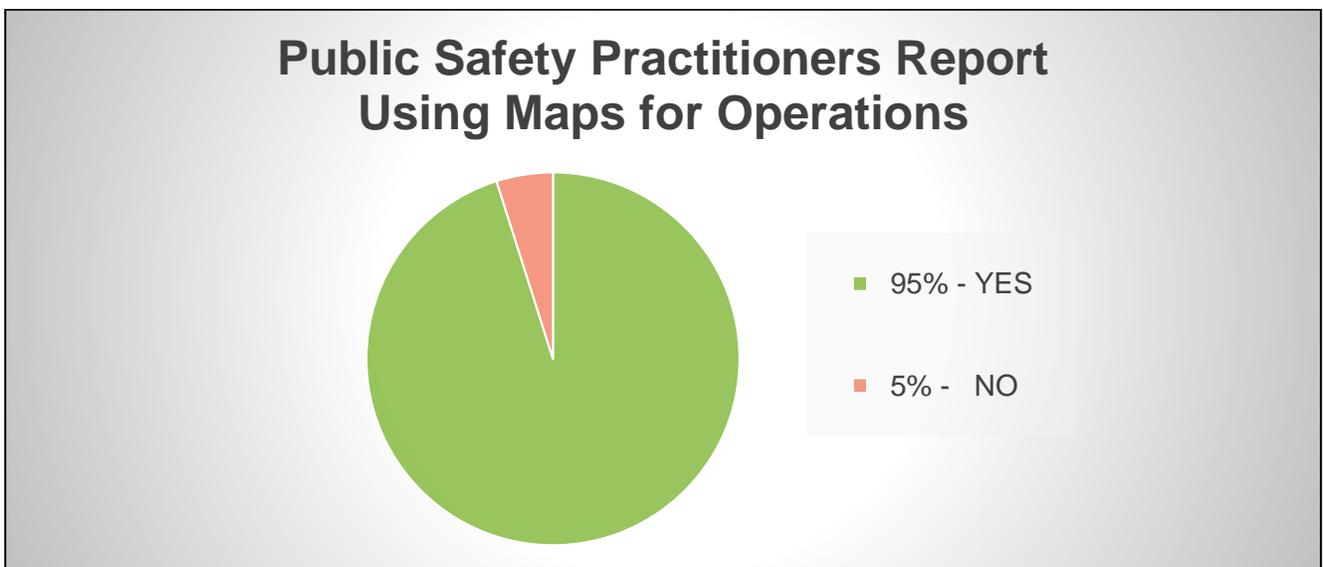
The first several questions in the survey focused on establishing a baseline understanding of the maturity of mapping capabilities by the respondents. This information is important to the overall purpose of the survey in informing current needs and requirements, but also in forecasting needs for future phases based on the direction the community is headed in applying location-enabled decision support tools for public safety operations.

Respondents were asked to self-assess their agency’s mapping capabilities as an indicator to inform maturity and the extent of ‘customer’ satisfaction by the part of the Public Safety Leaders and Operators. The comparative bar chart below illustrates the results from this self-assessment and the results are delineated separately for the two target audiences. The results indicate that the GIS Technical Professionals have a higher level of confidence and satisfaction in their agency’s mapping capabilities than do the Public Safety Leaders and Operators. This is illustrated in both the ‘Above Average’ and ‘Below Average’ rating categories; 65% of GIS Technical Professionals rated their capabilities as ‘Above Average’, whereas only 50% of Public Safety Leaders and Operators rated at ‘Above Average’. Furthermore, 21% of Public Safety Leaders and Operators rated their capabilities at ‘Below Average’, while only 9% of GIS Technical Professionals rated at ‘Below Average’. This finding suggests that there is still substantial need for improvement in the GIS Technical Professionals ability to understand operational needs, to anticipate information requirements, and to produce the decision making products that Public Safety Leaders and Operators need to do their jobs.



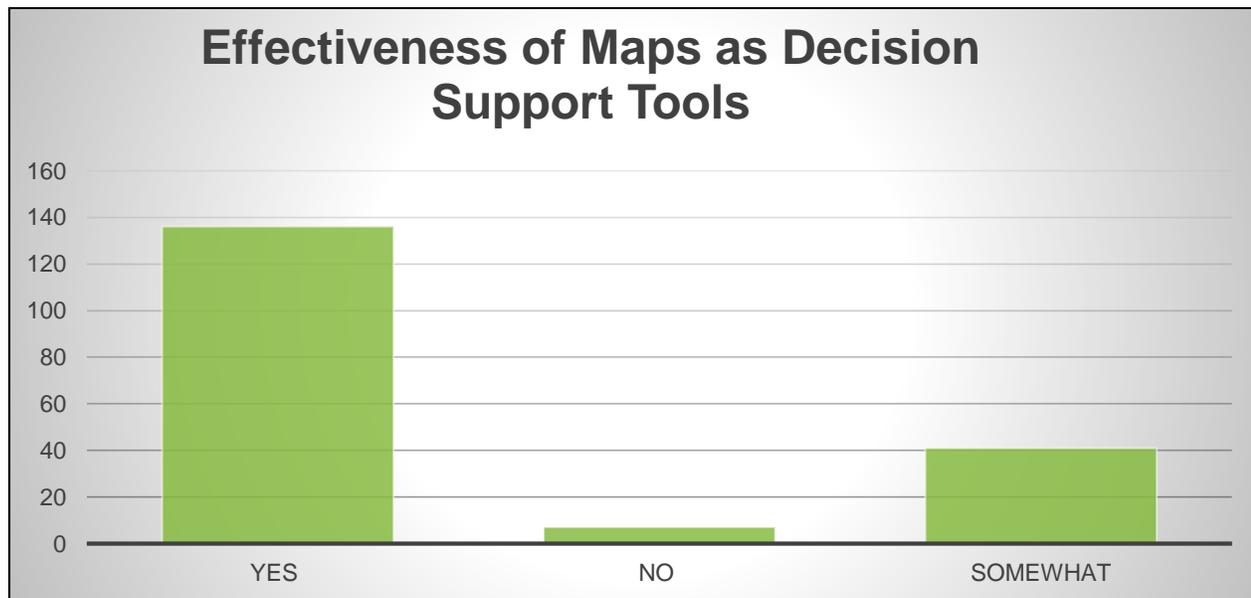
**Figure 5 – Bar Chart on Agency Mapping Capabilities** – This bar chart illustrates the results of the self-assessment of agency-level mapping capabilities by the two target audiences.

Building from the basic self-assessment question on the adequacy of agency mapping capabilities was the question posed specifically to Public Safety Leaders and Operators regarding whether or not they are using maps in public safety operations. An overwhelming number of respondents (95%) indicated that they are using maps in their operations. This represents general progress in the application of maps as decision support tools by public safety. It further strengthens the finding identified in Figure 5, since the Public Safety Leaders and Operators that responded have a basis by which to assess the adequacy of their agency’s mapping capabilities.



**Figure 6 – Pie Chart on Use of Maps in Public Safety Operations** – The pie chart above illustrates that the vast majority of Public Safety Leaders and Operators are using maps to support operations.

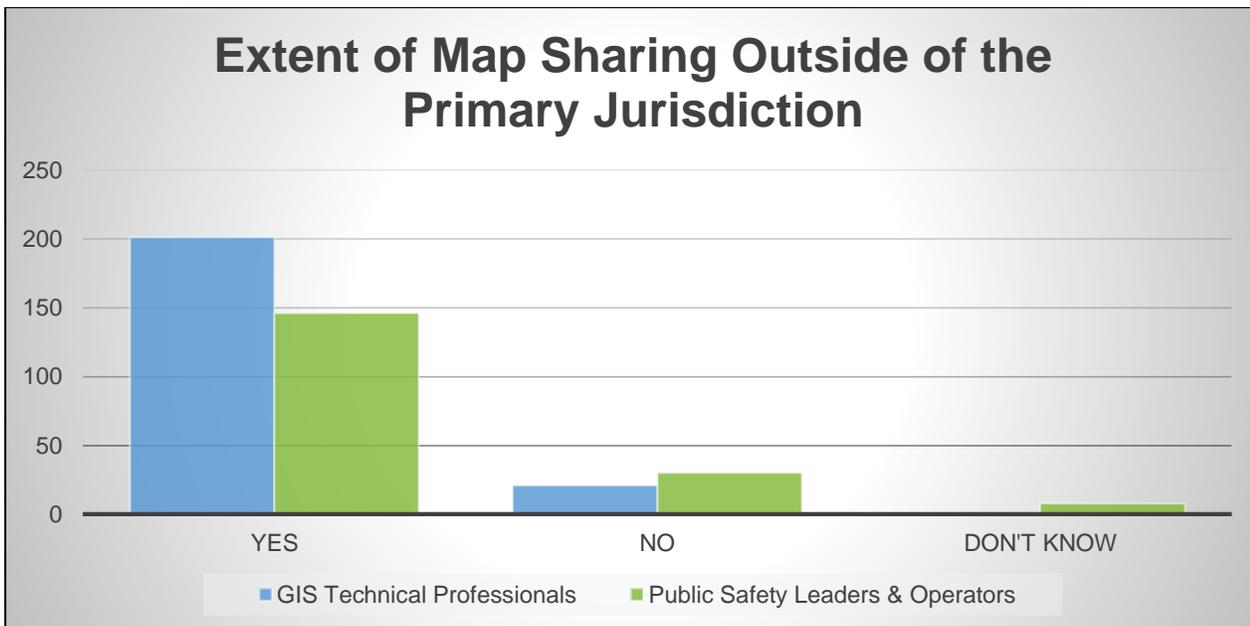
The single most important indicator of the maturity of existing mapping capabilities by and for public safety is how the ‘customer’ assesses their effectiveness as decision support tools. The survey results revealed that while a large portion of Public Safety Leaders and Operators confirmed that their maps serve as effective decision support tools, there is still a moderate portion of the community where maps have not matured into effective decision support tools. This is a critical finding, since it informs potential areas of focus under current and future phases, in particular helping to guide the development of standardized map templates and implementation guidance.



**Figure 7 – Bar Chart Rating the Effectiveness of Maps as Decision Support Tools by Public Safety** – The bar chart above depicts the trends in how Public Safety Leaders and Operators assess the effectiveness of their mapping products as decision support tools.

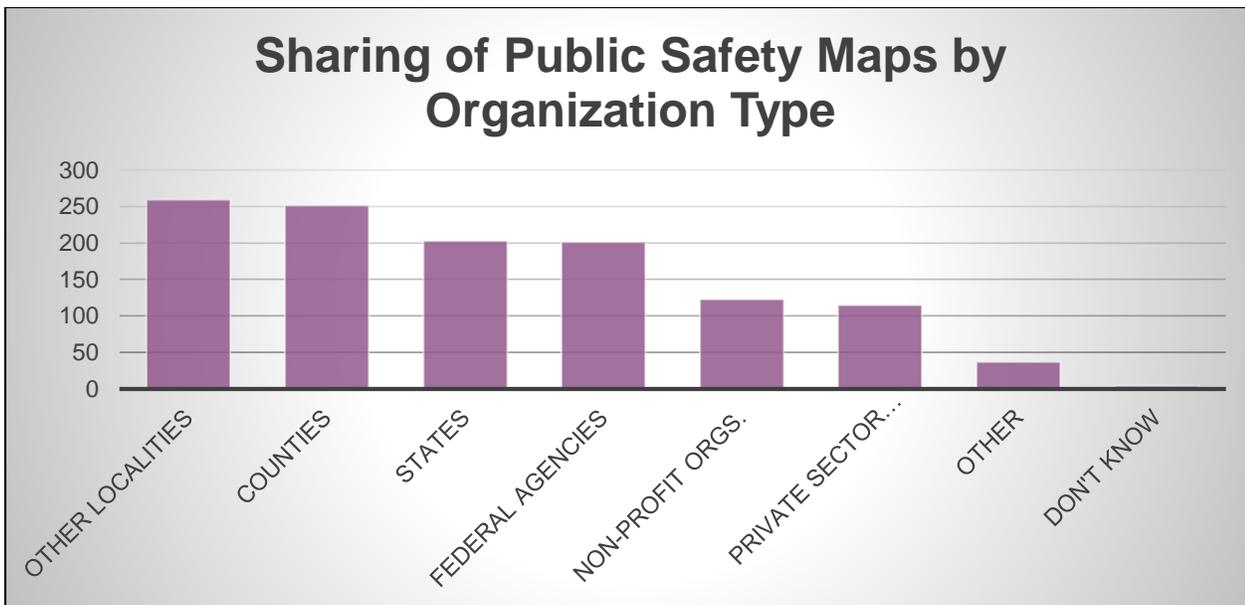
#### IV. Trend Analysis in Sharing of Public Safety Maps

One of the primary drivers for establishing and promulgating the use of standardized symbology is to support effective public safety operations across jurisdictional boundaries. NAPSG posed a series of questions to both target audiences to gain a clearer understanding of the extent and depth by which maps are currently shared across jurisdictional boundaries by and for public safety. The first question was binary, asking whether or not maps are shared. The majority of respondents indicated that they do share their public safety maps outside of their primary jurisdiction. This suggests that with a high instance of map sharing, common and standardized incident symbology is critical to enhancing public safety operations, especially for mutual aid.



**Figure 8 – Comparative Bar Chart on Extent of Map Sharing Outside of the Primary Jurisdiction** – The bar chart above illustrates the extent to which respondents from both target audiences indicated whether or not they share public safety maps outside their primary jurisdiction.

The other aspect of assessing public safety map sharing was which organizational types and levels of government most commonly shared maps. This question was included in the survey for both target audiences and the data was combined to support the analysis of general trends among all respondents. The most commonly shared public safety map products occurred between local and county agencies. This is to be expected since the vast majority of emergency planning and incidents occur at the local/county level. Not far behind these groups though is sharing with state and Federal agencies. State and Federal agencies both provide support and resources when incidents scale, and they are the organizations most frequently involved in emergency operations planning. The ‘Other’ category includes tribal nations, universities, and other non-specified organization types. This finding is particularly informative for the current and future symbology efforts, since it serves as guidance on which organization types the symbology needs to support for fluid map sharing.

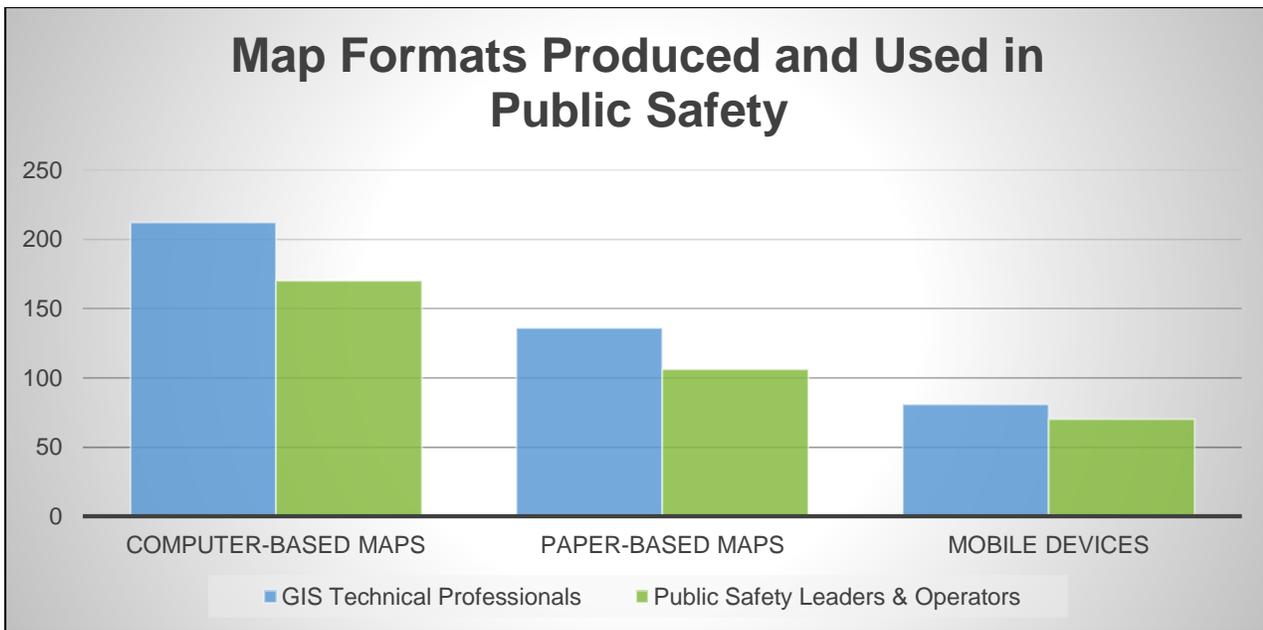


**Figure 9 – Combined Bar Chart on Sharing of Public Safety Maps by Organization Types** – The bar graph above reflects the combined responses from the two target audiences regarding the most common sharing of public safety maps among organization types.

## V. Analysis of Map Formats & Content

When developing and refining a standardized incident symbology guideline and symbol set, it is imperative to look at what formats the map products are generated in for use by the customer – i.e., Public Safety Leaders and Operators. The graph below illustrates the most commonly used map formats. Currently, computer-based maps are the leading format used in public safety, which may take the form of desktop or web-based mapping applications used in a station, emergency operations center, or on mobile data terminals. Paper-based maps are the second most common format and may be wall maps, vehicle map books, or field guides. And last, maps used on mobile devices or handhelds are the least common format but appear to be growing in popularity based on anecdotal comments that respondents included regarding map formats. Growing industry trends for map applications on mobile devices include automated vehicle locating, mutual aid request & tracking, field-based damage assessment, pre-scripted mission planning and many others. It would be beneficial to track change overtime regarding the use of different map formats if this survey (or a similar survey) were conducted annually.

One important consideration in analyzing the results is that both computer-based and mobile device map formats, represent “digital” formats. When you combine the results for both forms of “digital” map formats, there is in fact a much higher usage of “digital” versus “paper”. The high instance of use in digital mapping formats is a salient point in guiding symbol design features and treatments.



**Figure 10 – Comparative Chart on Map Formats Produced & Used in Public Safety** – The comparative bar chart above illustrates the trends in the production and use of different map formats and outputs used in public safety.

The survey also asked Public Safety Leaders and Operators to provide a short description for how they are using maps as decision support tools in operations. The responses were varied and ranged from the basic function of locating the site of an incident to assessing risk and public outreach and education for preparedness & mitigation efforts. When we grouped these anecdotal inputs into categories, clear trends emerged in the most common applications of location-enabled decision support tools.

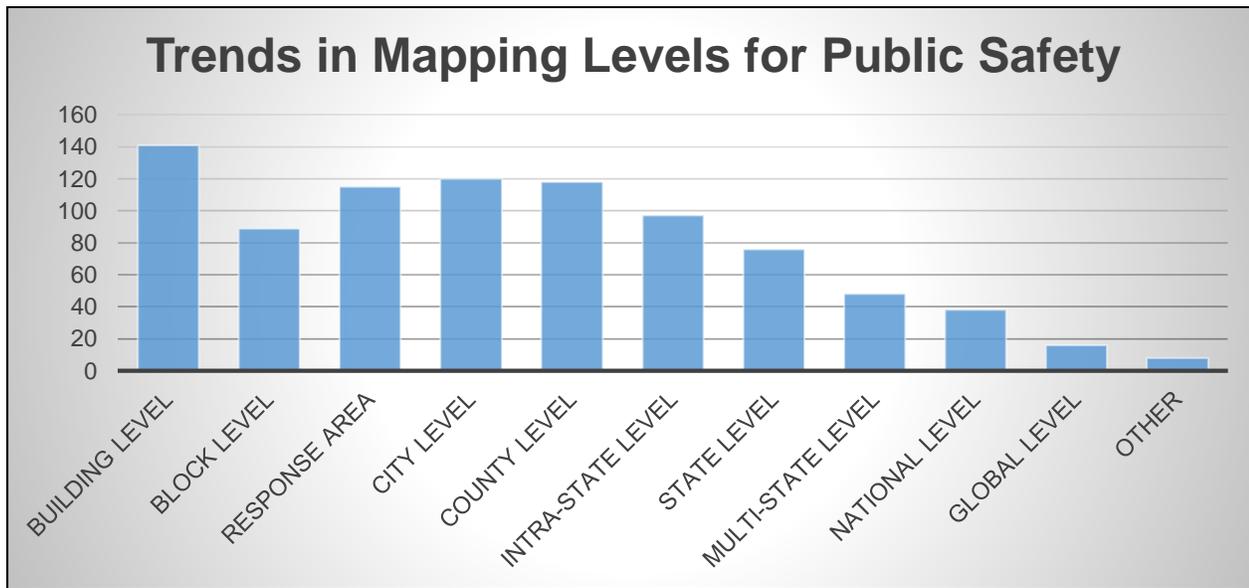
Rank	Application
1	<b>Routing Incidents</b> - Using existing computer aided dispatch
2	<b>Building or Facility Pre-Incident Planning</b> - With building-level risk assessment & route planning
3	<b>Strategic Level Operational Planning</b> – Such as response time analysis and crime analysis trends & forecasting
4	<b>Planning</b> – Highest trends are in hazard mitigation planning and special event planning/response
5	<b>Situational Awareness</b> - Use of common operational pictures in emergency operation center

**Figure 11 – Table on Top 5 Applications of Location-Enabled Decision Support Tools** – The table above lists the top five ranking uses or applications of GIS by public safety.

Another important aspect for consideration in assessing existing (and desired) mapping capabilities and symbology needs is to understand how GIS Technical Professionals are developing the map products to serve the principal customer need, enhanced decision making. The chart below indicates clear trends regarding which map levels are most commonly generated (or desired to be) for public safety map products. The majority of mapping products are generated at the building or facility level, for designated response areas, city level and

county level. There is a clear downward trend when you look at the generation of maps at the state level, multi-state level, and beyond. One outlier to note is the 'Block Level' since it is less commonly mapped since its primary use is in densely populated urban areas and by law enforcement.

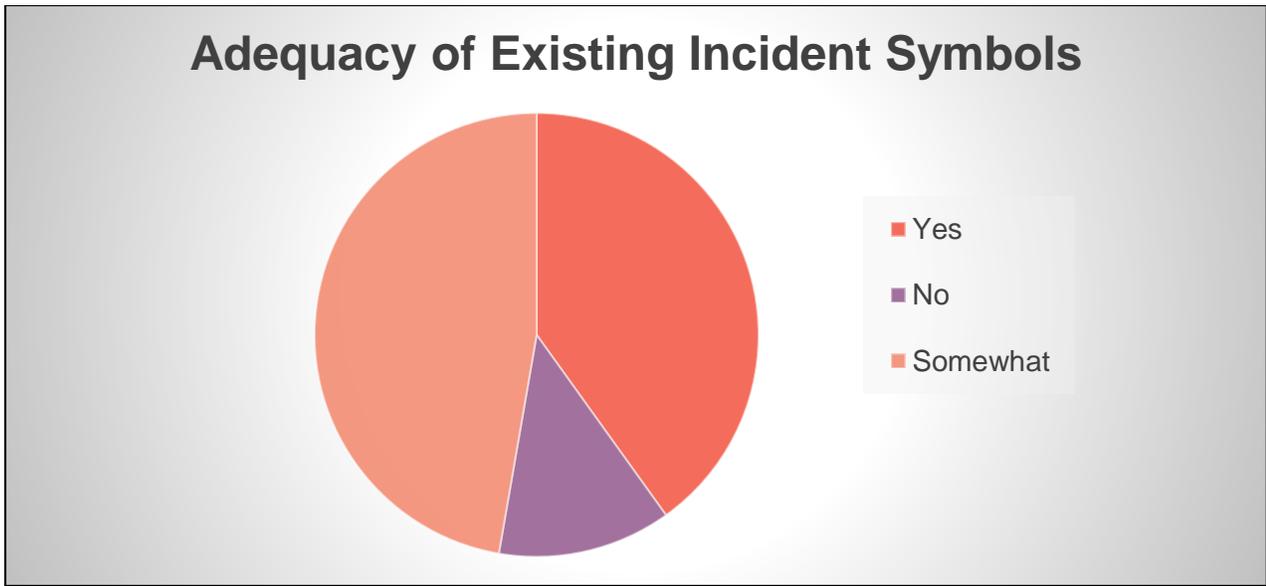
This is a key information point to inform current and future symbology efforts, in that the symbol needs and design features must first and foremost support the maps generated at the most frequently used levels. This also reaffirms the trajectory of priorities for NAPSOG's standardized incident symbology effort with symbols used in building-level pre-incident planning representing the initial phase starting back in 2009.



**Figure 12 – Bar Graph on Trends in Mapping Levels for Public Safety** – The bar graph above illustrates the trends in most common levels mapped to support public safety leaders and operators.

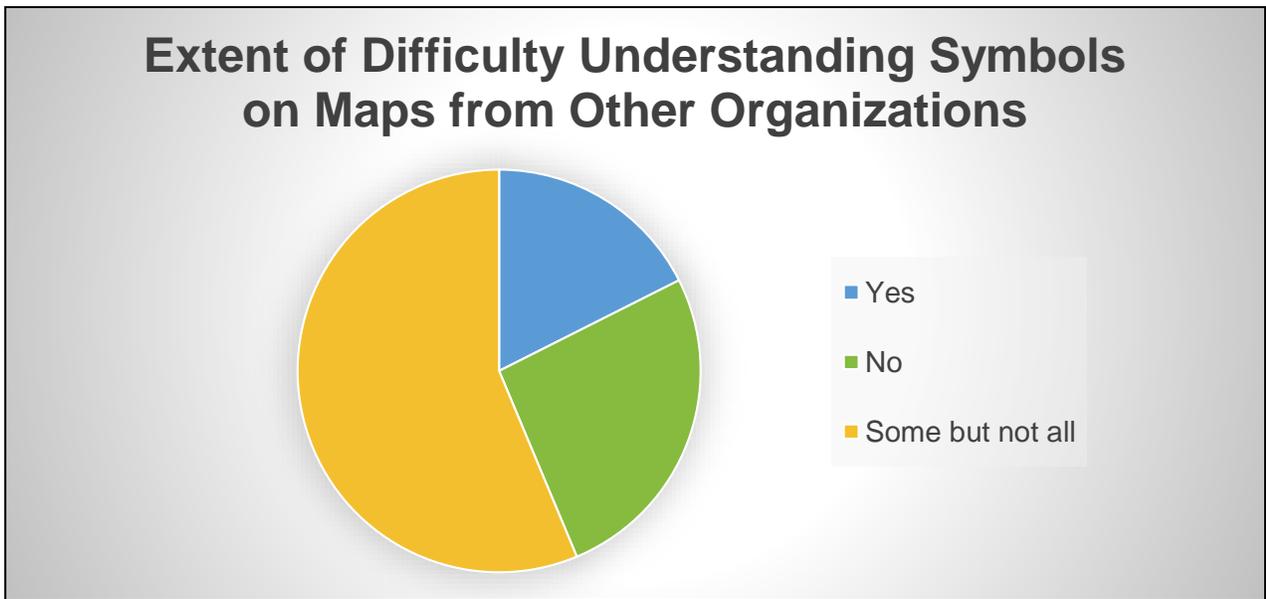
## VI. Analysis on the Adequacy of Existing Incident Symbols

The next area assessed was the adequacy of existing incident symbols to support the generation and application of public safety maps. This is a key area for analysis since it generally indicates the extent of incident symbol gaps and areas for improvement. The pie chart in *Figure 12* reflects the combined responses from both target audiences. The results clearly illustrate that, while a statistically significant number of respondents feel that existing incident symbols are adequate and easily understood, the vast majority of respondents feel that existing incident symbols are only somewhat (or not) adequate or easily understood. There remains significant gaps in incident symbology, and there is room for improvement in the effectiveness of symbol designs.



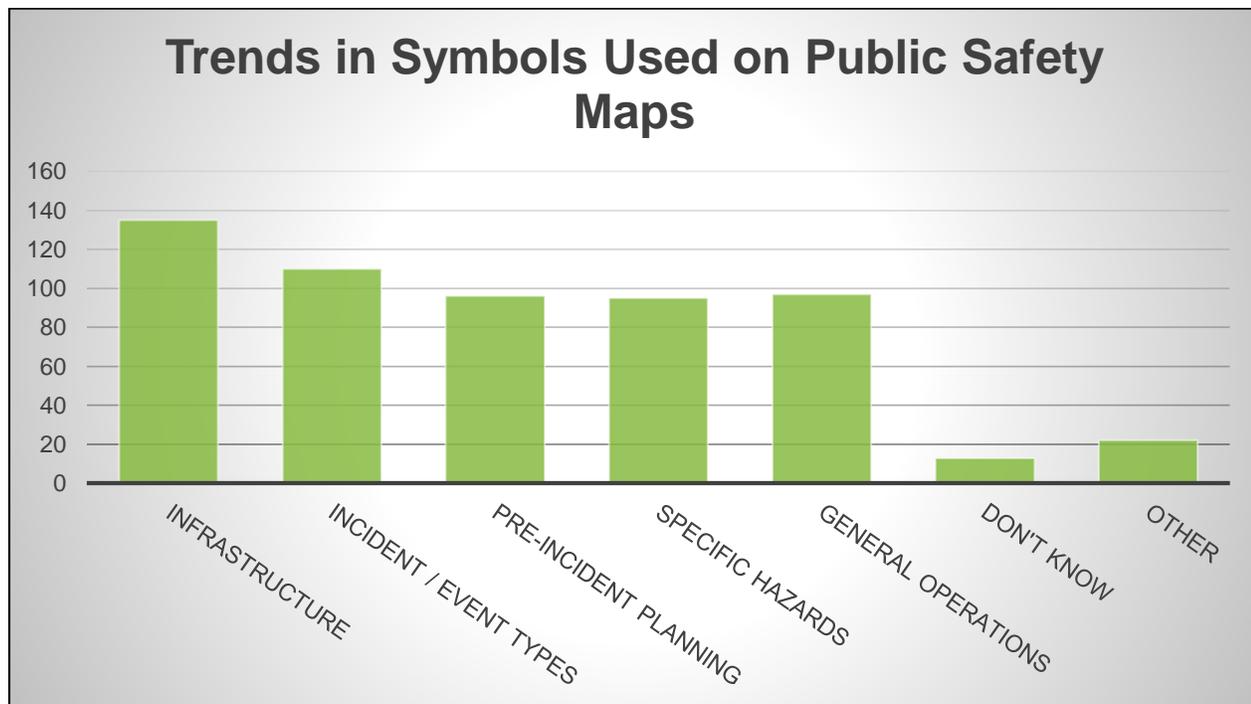
**Figure 13 – Combined Pie Chart on Adequacy of Existing Incident Symbols** – The pie chart above illustrates the trends in respondent sentiment regarding the adequacy of existing incident symbols and whether or not they are easy to understand.

Since the sharing of maps for public safety is a leading driver in establishing effective standardized incident symbology, the survey asked Public Safety Leaders and Operators to indicate if they experience difficulty in understanding symbols used on maps provided by other agencies and/or jurisdictions. The pie chart below reveals that the majority of respondents indicated some level of difficulty understanding symbols on maps shared by other agencies and/or jurisdictions. This further confirms the finding mentioned above, significant gaps still remain in standardized incident symbology and there is room for improvement in the effectiveness of symbol designs.



**Figure 14 – Pie Chart on Extent of Difficulty Understanding Symbols on Maps from Other Organizations** – The pie chart above reflects responses from Public Safety Leaders and Operators regarding the extent of difficulty they experience understanding symbols used on maps shared by other agencies and/or jurisdictions.

The survey then drilled down to get a clearer sense of what types of incident-related symbols are used by Public Safety Leaders and Operators and how they assess symbol adequacy. Due to the magnitude of incident symbols in use nationwide, the survey asked respondents to indicate if their maps contain symbols that could be characterized into five (5) primary categories. These categories are consistent with the breakdown of symbols in NAPSg’s existing Incident Symbology Guideline and Standardized Symbol Set<sup>1</sup>. The bar chart below indicates that infrastructure-related symbols are the most commonly used on public safety maps. This is to be expected when the number one application of maps by public safety is for routing to the site of an incident, since roads and other transportation information are categorized as infrastructure. The other symbol categories appear to be relatively consistently used at similar levels on public safety maps.



**Figure 15 – Bar Chart on Trends in Symbols Used on Public Safety Maps** – The bar chart above reflects responses by Public Safety Leaders and Operators regarding the use of symbols, indicated by category, on public safety maps.

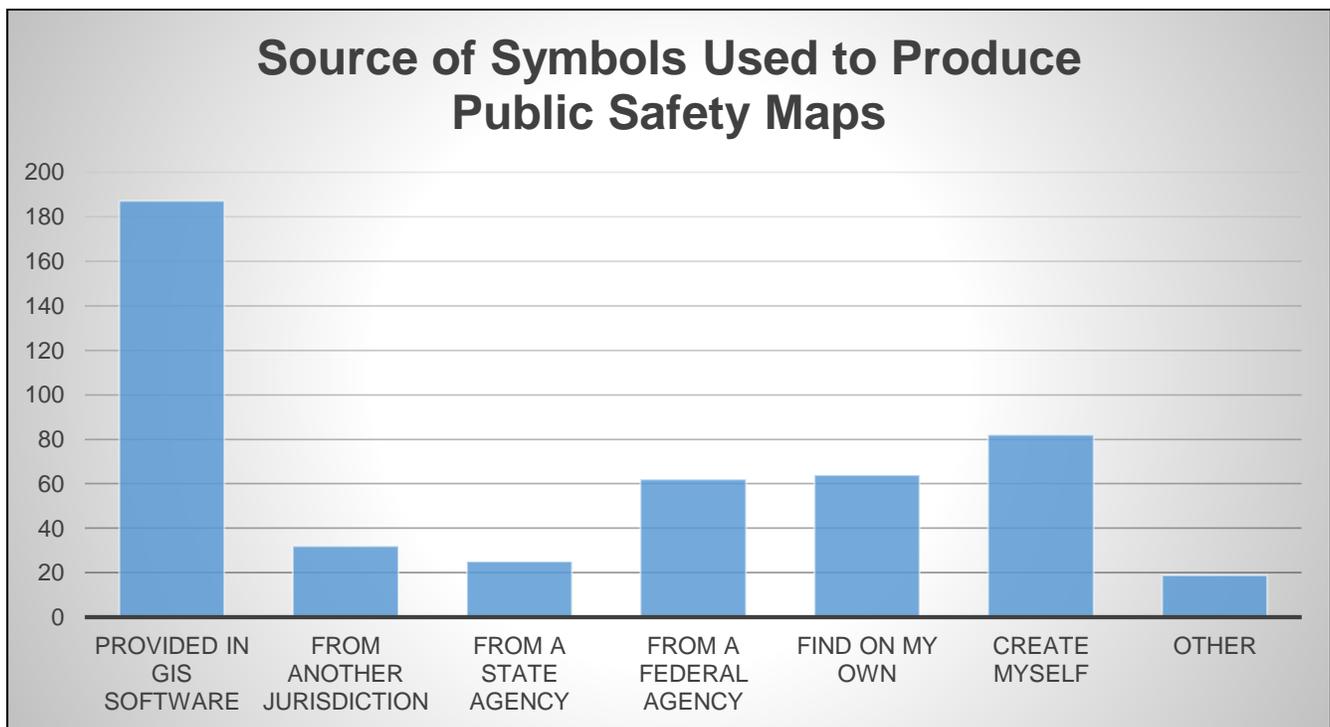
## VII. Analysis on the Use of Existing Symbol Standards & Guidelines

The survey also looked at the extent of use and/or adoption of existing standard incident-related symbols. This includes both formal symbology standards and informal standard symbols and guidelines. A formal symbology standard is one that has been developed and issued by an official Standards Development Organization (SDO). Informal standard symbols and guidelines refer to those developed by the community and are provided by other national organizations that may not operate as an SDO. The related question in the survey was tailored slightly for the respective audiences, providing results for each target audience. The first bar graph reflects the input

<sup>1</sup> National Alliance for Public Safety GIS Foundation. A Final Report of the National Alliance for Public Safety GIS Foundation’s (NAPSg) Incident Symbology Working Group Sept. 2013 <<http://napsfoundation.org/napsg-incident-symbology-guideline-symbol-set/>>

provided by GIS Technical Professionals, who were asked where most of their symbols come from. The results overwhelmingly indicate that the majority use the symbols provided with their GIS software, representing one group of de facto standard symbols. Thus, there is minimal recognition of or deliberate efforts to use standard incident-related symbols. It is also important to recognize that many types of GIS software contain a multitude of symbol sets, and symbol option for the same thing. Some of these are derived from other de facto and formal standard symbol sets. Another point that can be gleaned from this graph is that there is a relatively high number of respondents that indicated that they create the symbols themselves -- the follow-on chart also provides lead-on information regarding the basis for symbol design.

The most important finding from this information point is that NAPSG needs to focus on working with GIS software and technology providers to integrate its existing and updated incident symbol set into the mapping software, in a way that can be readily discovered, accessed and used by the GIS Technical Professionals that generate location-enabled decision support tools for public safety.



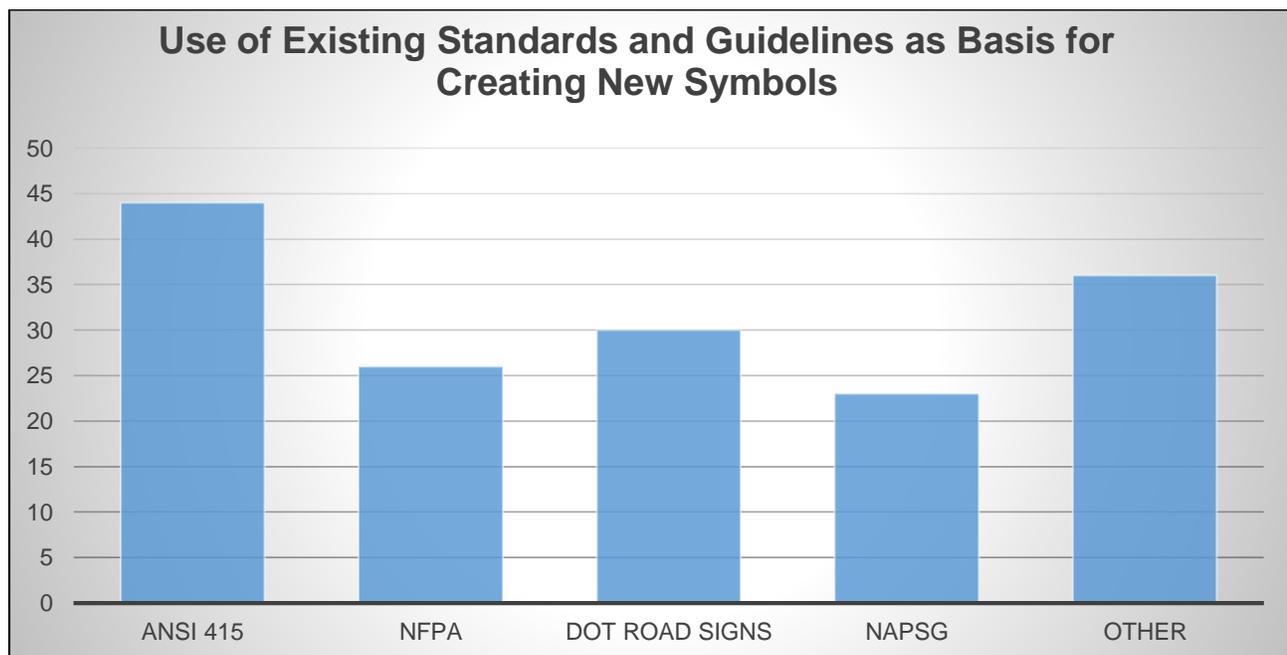
**Figure 16 – Bar Chart on the Source of Symbols Used to Produce Public Safety Maps** – The bar chart reflects responses provided by GIS Technical Professionals regarding the source(s) of symbols used to general maps for public safety.

The chart below reflects the results from the follow-on question in the survey specifically for GIS Technical Professionals regarding what basis (i.e. formal standard, de facto standard, or guideline) they use to create their own incident-related symbols. This survey question was only asked of those respondents who indicated that they create the symbols themselves. Respondents also had the ability to select multiple standards from a list since it was anticipated that they would use multiple standards for different purposes. Currently the most commonly used standard that serves as guidance in creating new symbols is the American National Standards

Institute (ANSI)<sup>2</sup> 415, which has been adopted and promulgated as the symbol standard by the Homeland Security Working Group under the Federal Geographic Data Committee (FGDC). This was to be expected since it is one of the oldest existing formal standards and since it has been widely promulgated by many Federal agencies. The second most commonly used standard or guideline is that provided by the US Department of Transportation (DOT) for road signs. Following those are NAPSG’s symbols and guideline and the formal standard issued by the National Fire Protection Association (NFPA).

Another interesting result gleaned from the chart below is the high number of respondents that indicated using “other” for creating their symbols. There was a wide diversity of “other” standards and guidelines indicated including, but not limited to: other Federal agencies such as US Forest Service & US Geological Survey; Fire Incident Management Tools (FIMT); OpenStreetMap; National Wildland Fire Coordinating Group; etc. There were no particular trends in the other standards and guidelines indicated by respondents.

The important finding derived from this information is that no single existing symbol standard or guideline serves as a highly dominant basis for the creation of new symbols to support public safety. The other piece of actionable information gained from this further confirms the need and importance for NAPSG to conduct substantially more outreach and education around the availability of its existing (and soon updated) Incident Symbology Guideline and Symbol Set. This is to be expected since it is a relatively new effort when compared to some of the others. It would be beneficial to track change over time regarding the use of existing standards and guidelines if this survey (or a similar survey) were conducted annually.

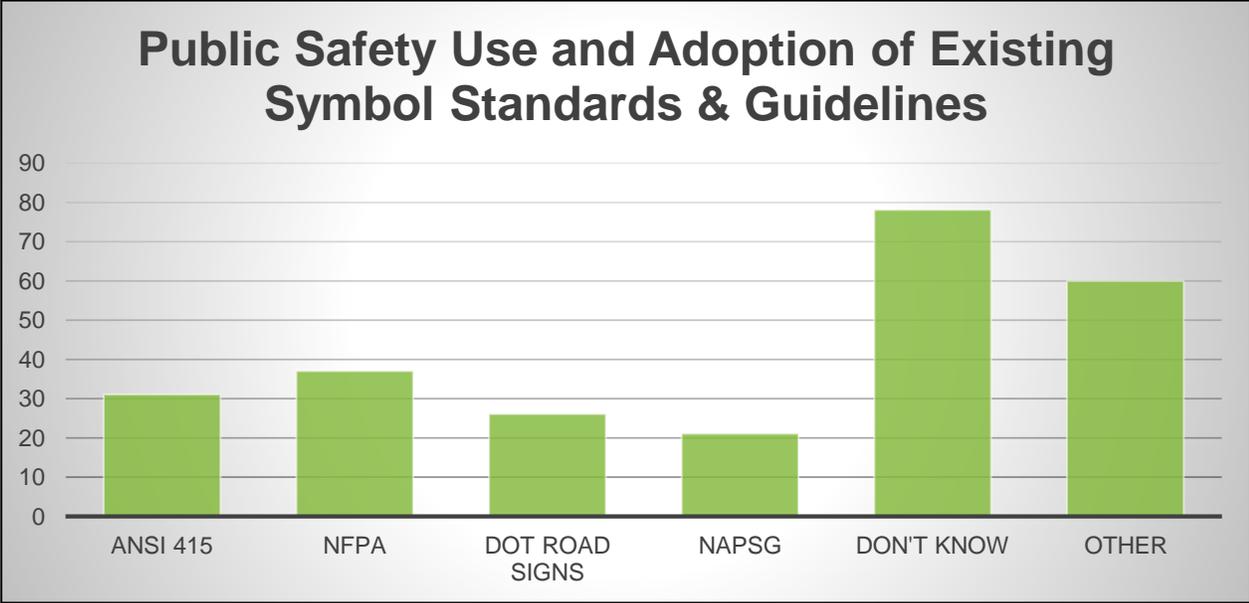


**Figure 17 – Bar Chart on Use of Existing Standards and Guidelines as the Basis for Designing New Symbols** – The bar chart above illustrates the trends in use of several existing symbol standards & guidelines as the basis by which GIS Technical Professionals create new symbols.

<sup>2</sup> American National Standards Institute. Homeland Security Mapping Standard and Point Symbology for Emergency Management: ANSI INCITS 415-2006 Jul. 2006 <<http://webstore.ansi.org/RecordDetail.aspx?sku=ANSI+INCITS+415-2006>>

It is also important to assess the level of awareness that Public Safety Leaders and Operators have on the availability, use, and adoption of existing symbol standards and guidelines. It is commonplace for public safety agencies to formally adopt certain standards or have formal policies and procedures in-place that institutionalize particular practices, standards and guidelines. The survey asked Public Safety Leaders and Operators to indicate which specific symbol standard or guideline is used or adopted by their agency. The chart below reveals a trend; the majority of respondents don't know what symbol standard or guideline is being used, if one is at all. The other noteworthy result is that a large portion of respondents indicated that they use other standards or guidelines. There was a diversity of "other" standards and guidelines, but the majority indicated the National Incident Management System (NIMS) and the Incident Command System (ICS). The Federal Emergency Management Agency (FEMA) is the owner and custodian of NIMS and ICS doctrine, however they have not issued or formally adopted any particular symbol standard or guideline.

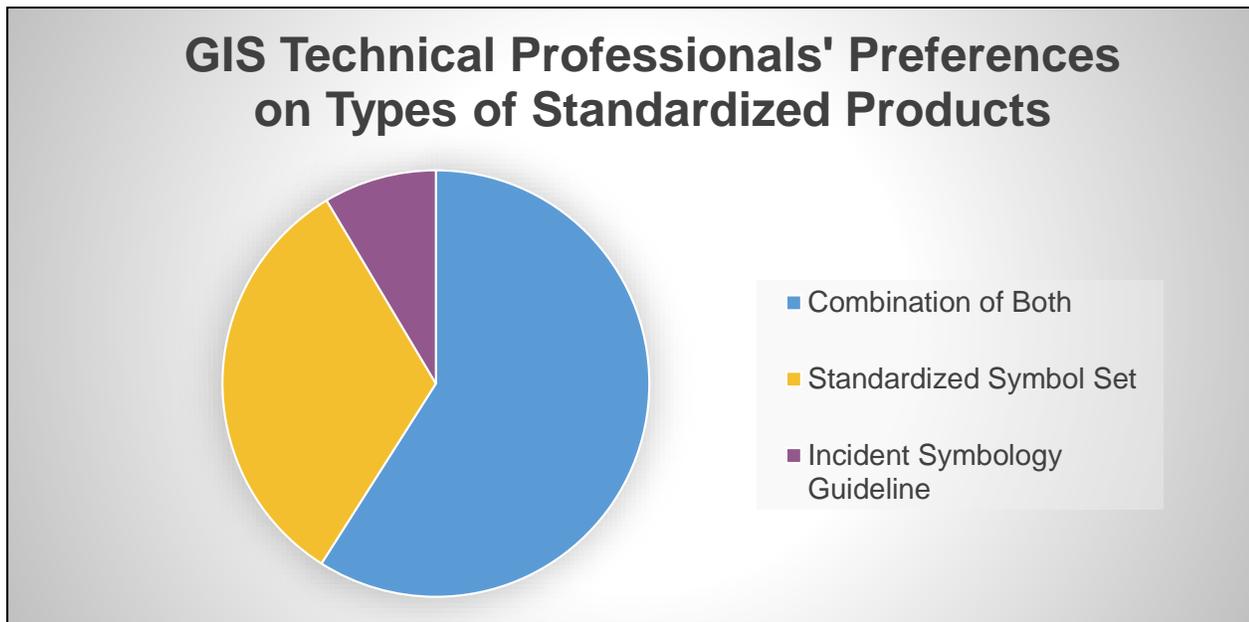
The above findings lead to an important point of coordination for NAPSG once the current phase efforts conclude, which is coordinating with FEMA on potentially using NAPSG's incident symbology guideline and symbol set as a basis for issuing a standard for NIMS and ICS, or requesting that they adopt NAPSG's as a standard. Additionally, it reaffirms the need for NAPSG to increase its outreach and education about its incident symbology guideline and symbol set after the completion of the current third phase efforts.



**Figure 18 – Bar Chart on Public Safety’s Use and Adoption of Existing Symbol Standards & Guidelines** – The above bar chart depicts responses provided by Public Safety Leaders and Operators regarding their agency’s use and adoption of existing symbol standards and guidelines.

As a follow-on question to all survey questions posed regarding incident symbol standards and guidelines, the survey asked GIS Technical Professionals to indicate what types of standard incident products they would prefer if made available. The pie chart below illustrates that the majority of respondents indicated they prefer to have a combination of a standardized symbol set for symbols that can be used consistently and a general Incident

Symbology Guideline to use in tailoring existing symbols and in creating new symbols. This finding reconfirms NAPSOG's current trajectory in expanding its incident symbology set and in enhancing the supporting guideline.



**Figure 19 – Pie Chart on Preferences on Types of Standardized Products** – The pie chart above reflects the responses provided by GIS Technical Professionals on their preferences on the types of standardized incident symbology products.

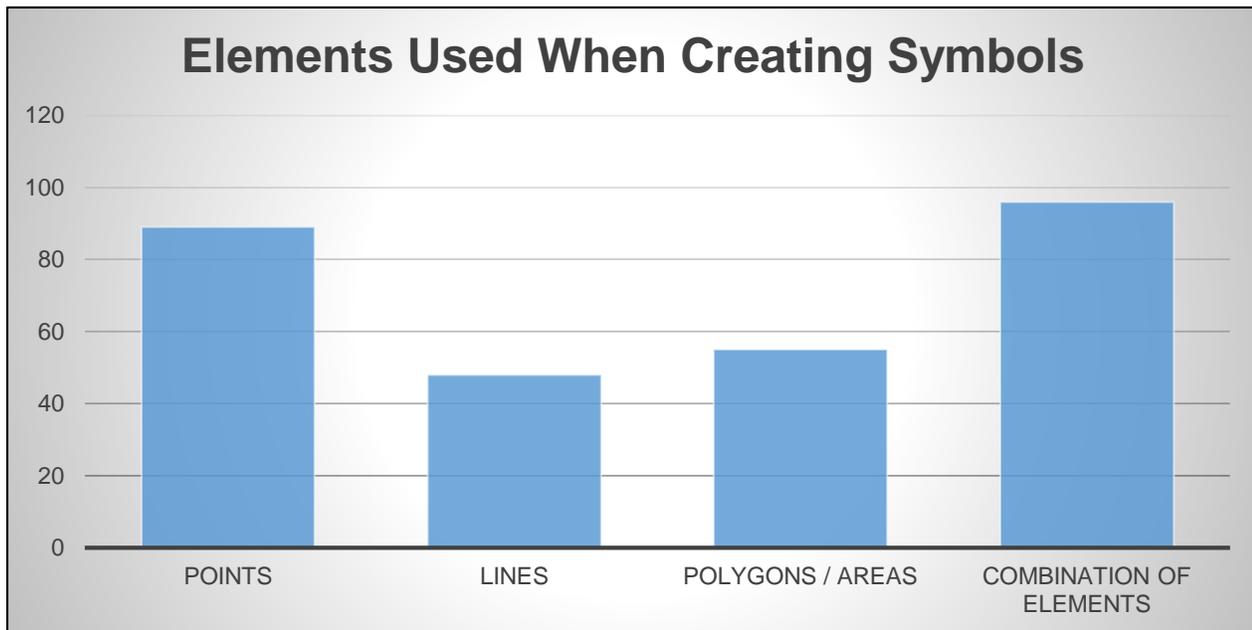
The survey also asked GIS Technical Professionals if and what the barriers are in using or adopting standardized incident symbols. The responses were varied and ranged from issues such as lack of awareness of such standards and the inadequacy of any one standard in addressing most needs to ineffectiveness of specific symbols contained in some of the symbol sets. This anecdotal information will also be used to inform and guide current and future incident symbol efforts, and work to educate the community to overcome any barriers that can be resolved.

### VIII. Trend Analysis on Symbol Elements & Features

With the current third phase of NAPSOG's incident symbology effort underway, the survey also included several questions that inform the design of new symbols in development to build out NAPSOG's standardized incident symbol set. The first chart looks at trends in the types of symbol elements used by GIS Technical Professionals when creating symbols. The majority of respondents indicated that they use a combination of elements during the symbol design and creation process. However, 'Point' symbol elements do appear to be the dominant of the three individual options. This is likely the case since many of the symbols used to support pre-incident planning has a specific location within a small area or a single building.

Until the third phase effort, NAPSOG's incident symbology effort focused almost exclusively on point symbols. The current third phase includes the expansion into priority line and polygon symbols. The findings illustrated in the

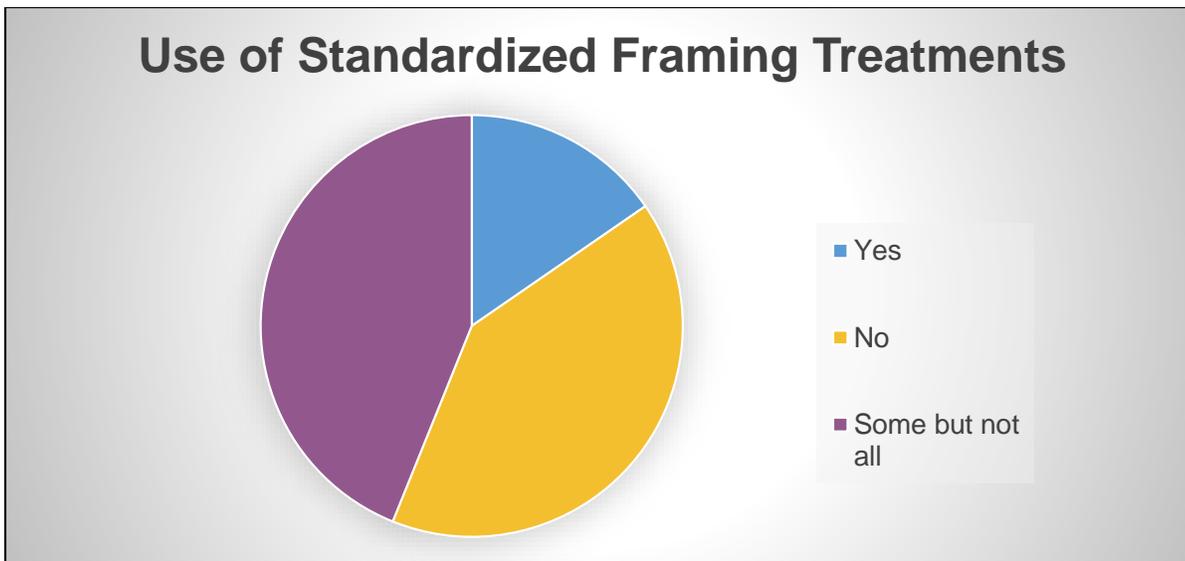
chart below also reaffirm NAPSG’s current direction in combining point symbols with line and polygon symbols to achieve greater consistency and flexibility for different needs.



**Figure 20 – Chart on Elements Used When Creating Symbols** – The bar chart above reflects the responses provided by GIS Technical Professionals on which elements they use when creating new or modifying existing symbols.

The survey also looked at the use of two symbol features: standardized framing treatments and dynamic symbol features. The first analyzed is the use of standardized framing treatments. Standardized framing treatments refers to the use of general shapes for specific symbol categories, for example a circle frame indicates operations and a rectangle frame indicates infrastructure in NAPSG’s Incident Symbology Guideline. The majority GIS Technical Professionals indicated that they don’t use standardized framing treatments or that a standardized framing treatment is applied to some symbols but not all. The use of standardized framing treatments would ease understanding of symbols used on public safety maps that are shared among agencies and jurisdictions. Consistency in other symbol features that may ease understanding include the use of a consistent color ramp indicating severity and action or the clarity of the icons used in many symbols.

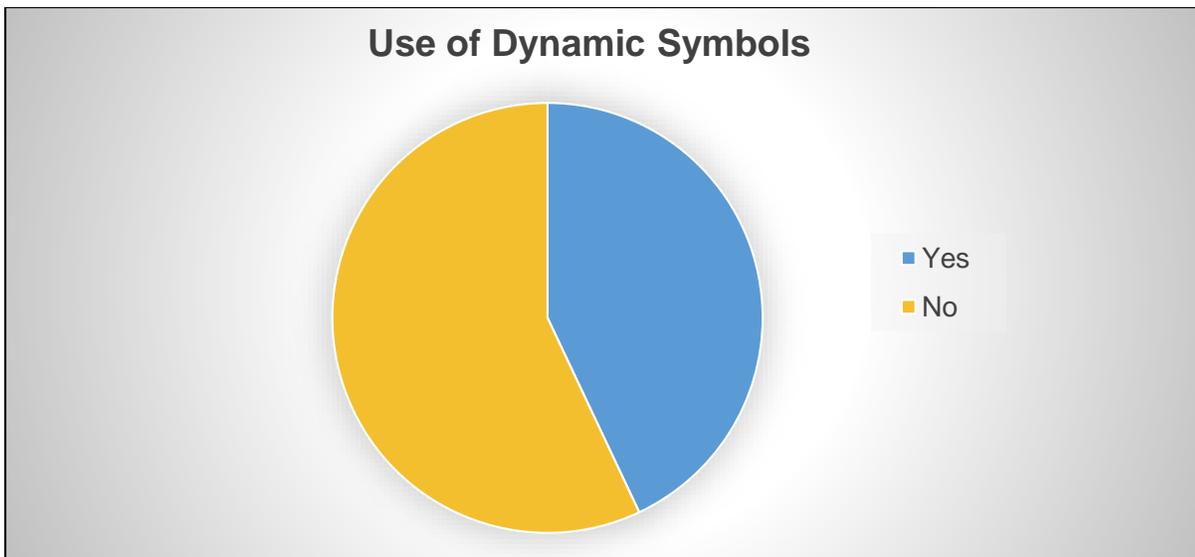
This result provides actionable guidance for NAPSG’s current and future incident symbology efforts. In moving forward NAPSG should assess whether or not symbols already existing in the incident symbol sets, or those in development, would benefit from a standardized framing treatment. When a standardized framing treatment is beneficial, it should be provided as an option. Further, NAPSG needs to conduct more outreach and education around the Incident Symbology Guideline and specifically the availability of standardized framing treatments.



**Figure 21 –Pie Chart on Use of Standardized Framing Treatment –** The pie chart above illustrates the responses from GIS Technical Professionals regarding the use of standardized framing treatments.

The last symbol feature that was assessed in the survey is the extent that dynamic symbols are used. Dynamic symbols refer to symbols that have changing characteristics such as color, intensity or size based on changing conditions, such as unit status or availability. A dynamic symbol can also refer to how and when a symbol is presented for a particular zoom level on the map. Dynamic symbols in this instance may be represented as a shape or framing treatment (ex. Diamond=incident) when the map is displayed, say at a level showing the entire country. As the user zooms in on the map, the diamond shape may reveal more detail within the symbol to better describe the type of incident (i.e. type of fire such as a wild land fire or structural fire). Additionally, by leveraging this digital zoom capability, point symbols can turn into polygons that represent the extent of the area impacted based upon zoom. When a high level of detail (LOD) is achieved by zooming in further, the polygon may reveal additional incident command level symbols of the incident area. Previous incident symbol efforts did not take dynamic symbology into account nor were provisions made for combining point symbol with line and polygon symbols. Using the combination of these techniques allows the user to be quickly informed by providing extensive amounts of intuitive information without cluttering the map with unrequested information. Further, the same techniques can be applied with providing plot sheets or paper maps of these map products as the symbology transitions automatically per the zoom level set.

The analysis revealed that only a slight majority of GIS Technical Professionals reported not using dynamic symbols. This is to be expected since computer and web-based maps is the dominant format used by public safety, and an increasing number of web-based public safety mapping applications and mobile device apps support the use of dynamic symbols and information. This finding also provides actionable information in NAPSG’s current and future efforts, specifically the potential to expand the incident symbology guideline and symbol set to include dynamic symbols and convert existing static symbols to offer dynamic features, thereby providing decision-makers with more relevant and easily understood information.



**Figure 22 – Pie Chart on the Use of Dynamic Symbols** – The pie chart above illustrates the extent that GIS Technical Professionals reported using dynamic symbols for public safety maps.

## IX. Conclusions

Several conclusions were drawn from the results of the national *Survey on Incident Symbology and Mapping Capabilities* that serve as actionable recommendations for use by NAPSG, its partners, and the community at-large. Foremost, the analysis concluded that existing incident symbols are not entirely adequate or effective in supporting decision making by public safety, and there remain numerous areas of improvement in filling unmet gaps and enhancing the elements and features of existing symbols. Below are some of the key findings and recommendations, including:

- **Finding 1:** GIS Technical Professionals have a higher level of confidence and satisfaction in their agency’s mapping capabilities than do the Public Safety Leaders and Operators.  
**Recommendation 1:** NAPSG, Federal agency partners, and national association partners need to bring the community together through a combination of workshops, trainings, and other forums to bridge technical and operational communication gaps between GIS Technical Professionals and the Public Safety Leaders and Operators they support.
- **Finding 2:** While a large portion of Public Safety Leaders and Operators confirmed that their maps serve as effective decision support tools, there is still a portion of the community where maps have not matured into effective decision support tools.  
**Recommendation 2:** NAPSG, Federal agency partners, and national association partners need to work together to build and provide standardized map templates that are proven to have served as effective decision support tools in real world events, and develop and promulgate the guidance required to enable their use.
- **Finding 3:** There already is a high instance of map sharing.  
**Recommendation 3:** Instead of focusing our efforts in continuing to promote more map and

information sharing, NAPSG and Federal agency partners need to re-focus on developing and promulgating the use of common and standardized incident symbology to ensure ease in understanding public safety maps shared across communities.

The analysis also concluded that much work is still needed to standardize incident symbology, due to the diversity of standards and guidelines being used – as well as the known inconsistencies between them. Inconsistencies such as these have the potential to lead to significant issues when multiple agencies respond to an emergency. Below are some of the recommended actions specific to incident symbology standardization, including the following:

- **Finding 4:** Existing incident symbols are only somewhat adequate or easily understood, and there remains significant gaps in incident symbology and room for improvement in the effectiveness of symbol designs.  
**Recommendation 4:** Entities such as the Federal Geospatial Data Committee’s Homeland Security Working Group should take a fresh look at their standard symbols and consider updates based on NAPSG’s current efforts in order to address key gaps and enhance the adequacy of standardized incident symbols. Additionally, NAPSG, Federal agency partners, and national association partners need to work together to address the multitude of gaps and improve symbol designs as a mechanism to aid in increasing the effectiveness of maps as decision support tools for public safety. Further, simultaneously as gaps are being addressed, NAPSG and its partners need to work together to conduct the outreach and education about the availability and use of common and standardized incident symbology, thereby successfully promulgating its use nationwide.
- **Finding 5:** The vast majority of symbols used on public safety maps come from the GIS or mapping software used.  
**Recommendation 5:** NAPSG and its national association partners need to focus on working with GIS software and technology providers to integrate its existing and updated incident symbol set into the mapping software, in a way that can be readily discovered, accessed and used by the GIS Technical Professionals that generate location-enabled decision support tools for public safety.
- **Finding 6:** Monitoring and measuring the results from the same or a similar survey over time will provide invaluable information regarding successes, issues, and constraints in sharing information and the use of a common symbol dictionary for communicating incident information.  
**Recommendation 6:** NAPSG and its Federal agency partners should conduct this survey on an annual basis, or a minimum of every 2 years, in order to inform the expansion and refinement of the standardized incident symbology guideline and symbol set, and to monitor change in adoption and implementation by the community over time.

In conclusion these survey results, and those in future years, will provide us with a greater understanding of the maturity of symbology and mapping capabilities, and the unmet needs & requirements that we must work together to address as a means to enabling more effective public safety.