

A Summary of State DOT GIS Activities

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Introduction

This is the 11th year that the GIS-T Symposium has conducted a survey of GIS activities at State DOTs. This year, the survey was combined with an information request for the State roll call, and administered using a web-based survey instrument. The response rate improved significantly over last year, with 48 States plus the District of Columbia and the Commonwealth of Puerto Rico completing the survey. These responses were tabulated and are presented in a separate summary table.

A new question was added this year about the technical background of GIS core staff, and two questions on database management software used for enterprise GIS were reinstated after being dropped from last year's survey. Questions on the maintenance of physical mile markers on state roads were dropped from this year's survey.

GIS Organizational Structure and Development Stage

The most prevalent organizational structure for GIS units in State DOTs (49%) continues to be a GIS core unit, providing technical support to a much larger group of end-users throughout the agency. Another 32 percent of the States report having an "enterprise" organizational structure with agency-wide data integration. Four States (AR, ID, ND & SD) report that, although they have "pockets" of GIS applications, there is no agency-wide coordination of geo-spatial data or services.

The organizational location of GIS core units is about equally split between Planning (47%) and Information Services (49%). This appears to reverse a trend over the past few years toward consolidating GIS core units in Information Services. Even in those States that have instituted an enterprise GIS, there is no significant difference in where the GIS core unit is located.

The allocation of GIS staff time across core functions shows more staff time being devoted to road centerline base map maintenance and enhancement (22%), end user support and training (17%) and web applications (15%), compared to last year. However, the distribution of staff activities varies considerably across agencies, and even within an agency from one year to the next.

The number of GIS core staff shows a moderate decrease, compared to last year's survey. The average GIS core staff size for all responding agencies was 7.0, down from 7.4, as reported last year.

GIS professional certification is a small but growing factor in hiring of GIS staff. Twelve (24%) of the States reported that they had at least one certified GIS professional on their staff, and five additional (10%) States reported that certification would be considered in future hiring of GIS staff.

A new question in this year's survey asked about the principal technical backgrounds of GIS core staff. Most of the States (84%) responded that at least one staff member has a geography or cartography background, and at least one staff member has an information technology or computer science background (75%). Staff with engineering or planning backgrounds (37% each) the other principal disciplines identified.

States reported a small increase in the percentage of GIS application development work that was outsourced (from 39% to 43%). Not surprisingly, the annual amount spent on GIS contracts increased by a similar percentage, from an average of \$315,000 to \$342,000 per agency. These relatively modest increases may reflect caution by States in starting new work, due to uncertainty in the amount of transportation planning and research (SPR) funds, prior to passage of SAFETEA-LU.

GIS Software

Seventy-four (74) percent of the States use GIS software from at least two vendors, and 50 percent report having software packages from 3 or more different vendors. All of the "single vendor" States use GIS software from ESRI.

Respondents were also asked to identify what software products were used "principally" by GIS core staff for desktop/workstation applications and for web applications. For desktop operations, 73 percent of those responding use ESRI products, 25 percent use Intergraph products, and 2 percent use Caliper products as their principal GIS software. For web applications, 70 percent of those responding use ESRI's ArcIMS®, and 26 percent use Intergraph's WebMap®.

Most States use commercial relational database management software (RDBMS) in combination with GIS software to manage their geo-spatial data. Oracle® is used by over 70 percent of the States, either alone or in combination with other database software. Other commercial database software used by the States include SQL Server® (36%), Microsoft Access® (32%), DB2 (6%), and Sybase (4%).

ArcSDE® (80%) and Oracle Spatial® (48%) are the principal software packages used to manage the geo-spatial attributes in enterprise data warehouses. A significant number of States (28%) report using both spatial data managers in combination.

Road Centerline Networks and Other Geo-Spatial Databases

A key component of most transportation GIS activities is the road centerline network database. All States that responded to this year's survey reported that they maintain a digital road centerline database. Both the spatial accuracy and coverage of these

databases continue to improve. Nearly two-thirds (64%) of the States report that their road centerline databases have a spatial resolution of 1:12,000 scale or better. Much of the improved accuracy has been achieved through the use of high-resolution orthoimagery and/or kinematic GPS. With respect to coverage, 60 percent of the States report that their road centerline database includes all public roads, and another 22 percent include all State and county routes.

The majority of States (68%) distribute their road centerline database free of charge to whoever wants it. Most other States (22%) have policies that allow the data to be shared with other public agencies, but place restrictions on its use and/or redistribution. Two States (KS & OH) sell their road databases, and three States (CT, HI & OR) do not distribute their databases outside their agency.

States were asked if they maintain any other statewide geo-spatial data layers, beyond the road centerline database. Seventy two (72) percent of those responding reported that they also maintain some other geo-spatial database. Over two thirds (68%) of the State DOTs maintain other transportation networks or features, such as rail lines, airports, etc. Other “framework” geo-spatial data maintained by State DOTs include political and administrative boundaries (50%), geodetic control points (36%), and orthoimagery (32%). State DOTs are less likely to maintain other framework layers such as elevation (14%), water features (22%), or land parcels (10%).

The primary sources of geo-spatial data used by State DOTs are other state and local agencies (identified by 92% of those responding), followed by statewide geo-spatial clearinghouses (66%), and geo-spatial data maintained by federal agencies (58%). Less common sources include data purchased from commercial data vendors (18%), data provided or purchased from GIS software vendors (22%), and data acquired through the Geo-Spatial One-Stop (28%).

Benefits and Costs of GIS Applications

Several questions introduced last year regarding the perceived benefits and costs of geo-spatial technology were continued in this year’s survey. Similar to last year’s responses, enterprise data integration was cited by a majority of the States as yielding the greatest current benefits (54%), but also being the most difficult and costly to implement (54%). CAD/GIS integration was cited as the next application having the greatest current benefits (32%) and most difficult to implement (32%). Asset management was most cited as the application having the greatest potential future benefit (56%), followed by enterprise data integration (48%).

Current Activities

Respondents were asked to list up to four of their current GIS activities for the State roll call. Listed activities were grouped into similar categories and then ranked based on the number of times that they were cited by the respondents. Table 1 lists those GIS activities cited five or more times by the State DOTs.

GIS Activity	# of Citations
Development of web-based GIS application	44
Linear referencing system development / enhancement	15
Enterprise data warehouse	14
Road inventory management system / attribute data	13
Migration to new GIS hardware and software	13
Road centerline database development / enhancement	13
Data sharing partnerships / coordination	12
Orthoimagery data collection / integration	10
Traveler advisory / information system application	10
Development of other geo-spatial databases	10
Safety / crash analysis	9
ITS / traffic management applications	8
Project management applications	8
Environmental / cultural mitigation applications	7
Bridge management applications	7
GIS strategic planning / needs assessment	6
GPS data collection / integration	5

Table 1. High priority GIS activities at State DOTs

Summary

GIS has become recognized in nearly every State DOT as an important tool for data management and integration, analysis, and visualization. The key question is no longer whether the agency should invest in GIS, but rather how much of the agency program data should be integrated using geo-spatial technology. Most State DOTs are either investigating or are actively developing an enterprise GIS data warehouse. Enterprise data integration is seen as yielding the greatest agency benefits from geo-spatial technology, but it is also cited as one of the most difficult applications to implement.

Web-based GIS applications continue to grow, facilitating information exchange both to the traveling public and to DOT field staff. GIS also seems to be used more frequently in specific analysis and planning applications, particularly safety and crash analyses, environmental impact studies, and traffic and bridge management systems.

The recent trend of relocating the GIS core unit from Planning to Information Services seems to have abated. GIS core staff seem to function effectively in either organizational division. Important GIS core staff activities continue to include the maintenance and enhancement of the road centerline database, linear referencing, and migration of legacy applications to new and upgraded commercial software. Increasingly, however, application-specific geo-spatial analyses and map products are being carried out by end-users throughout the agency, both with and without assistance from GIS core staff.