A Summary of
State DOT GIS Activities

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Introduction

This is the 8th year that the GIS-T Symposium has conducted a survey of GIS activities at State DOTs. This year, total of 43 states plus the District of Columbia responded to the e-mail survey. The responses were tabulated and are presented in a separate summary table. For the eight states that did not respond to this year's survey, the table includes information from the most recent past survey to which they responded. Those states are highlighted in the table.

Last year's question on software licensing policy was dropped from this year's survey, and a new question was added about the agency's policy for distributing their geo-spatial road network.

Unlike past years, the Summary of State GIS Activities is not being presented in a plenary session of the GIS-T Symposium. Instead, we have included this written summary and table as part of the registration package. Additionally, a PowerPoint presentation, containing summary graphics, will be posted on the GIS-T web site.

GIS Organizational Structure and Development Stage

Almost 75 percent of the State DOTs report that their GIS unit is "Fully Operational", with widespread GIS use throughout the agency, and a recognized GIS unit with the agency responsible for core GIS functions like base map maintenance, training, etc. Only one State DOT (West Virginia) reports having no significant GIS capability, and most of the remaining State DOTs consider themselves to be in various stages of implementation. The number of State DOTs identifying themselves as fully operational grew from just 5 in 1997 to 38 today.

The most prevalent organizational structure for GIS units in State DOTs (45 percent) continues to be a core GIS unit, providing technical support to a much larger group of end-users throughout the agency. However, over one-third of the State DOTs now report having an "enterprise" organizational structure, with agency-wide data integration and widespread GIS applications.

The location of the GIS unit organizationally within the State DOT has settled, for the most part, in either Planning (33 percent) or Information Services (36 percent), or in multiple organizational locations (21 percent), most often shared between Planning and Information Services.

GIS budgets at State DOTs continue to grow. The combined total of all budgets reported by those agencies that responded to this year's survey was over $45 million. The number of State DOTs reporting GIS budgets in excess of $1 million has grown from 2 in 1997 to 21 in 2003.

The average size of the GIS core unit has remained relatively constant over time. In 2003, the number of full-time core GIS staff actually appears to have declined, dropping from an average of 8.2 per agency in 2002, to 7.8 per agency in 2003. Much of this decrease can be attributed to reported decreases in full-time core GIS in those agencies with 20 or more GIS staff. Job classifications for GIS core staff vary widely among State DOTs, with the majority of GIS core staff identified as either information technology or GIS professional.

While the number of full time GIS staff has remained relatively constant, the number of reported GIS end-users has skyrocketed. In 2003, the combined total of all GIS end users reported was over 16,700. This suggests that, on average, each full-time GIS core staff person in a State DOT is currently supporting over 40 part-time GIS end users within their agency.

Operating Systems and GIS Software
The transition of commercial GIS software from UNIX to a Microsoft Windows operating system has led to a corresponding changeover in the operating platform for GIS at State DOTs. In 1997, virtually every State DOT was running at least their core GIS software in a UNIX operating environment. By 2003, over 70 percent of the State DOTs have transitioned entirely to a Windows operating system (e.g., Windows NT, 2000, or XP), and the rest were running a combination of UNIX and Microsoft based GIS products.

Four GIS software vendors – ESRI, Intergraph, Caliper, and Bentley – appear to dominate the GIS market among State DOTs. ESRI software products were reported in use in 90 percent of the State DOTs, while Intergraph, Bentley, and Caliper GIS software can each be found in about half of the State DOTs.

Over 80 percent of the State DOTs use GIS software from at least two of the major vendors, and nearly half (44 percent) report having software packages from 3 or more different vendors. Development and use of GIS interoperability standards by the software vendors has significantly reduced many of the technical problems associated with sharing geo-spatial data between different GIS software, and has enabled more specialized "niche" GIS software to grow.

Many State DOTs are developing "data warehouses" as part of an enterprise database management strategy, and are using GIS to access and integrate information from different agency databases based on spatial referencing. Beginning with last year's survey, State DOT's were asked to identify what database management software (DBMS) they were using to support their geo-spatial data. Two commercial DBMS

products – Oracle and Microsoft Access -- appear to currently dominate the State DOT market, with use of both products reported by over 70 percent of the respondents. Use of SQL also appears to be growing, with reported use in over 25 percent of the State DOTs. As with GIS software, a majority of agencies (over 75 percent) report using more than one DBMS.

GIS Base Maps and Road Centerline Networks
The foundation of most transportation GIS activities is the underlying road network base map. In 2003, every State DOT but one (West Virginia) reported that they had developed and are maintaining a digital road network base map. The spatial accuracy of these base maps continues to increase. In 2003, nearly one third of the State DOTs reported having road network base maps with a spatial scale of 1:12,000 or better, compared to only two agencies in 1997. Much of the increased accuracy has been achieved by using moving vehicles equipped with kinematic GPS to trace road centerlines.

With respect to road network coverage, nearly half (48 percent) of the State DOTs report that their road networks include all public roads, while approximately one quarter of the State DOTs include only Interstate, U.S., and state highways.

This year, State DOTs were asked about their distribution policies concerning their road network base maps. Over 70 percent of the respondents reported that their road centerline network was available free-of-charge. Another 20 percent reported that their database could be purchased or were distributed through some third party, typically a State GIS clearinghouse. Only 10 percent of the State DOTs reported that their geo-spatial data were not available for distribution.

All but one (Alabama) of the State DOTs that responded to this year's survey reported that their agency participated in sharing geo-spatial data with other agencies or organizations within their state.

GIS Core Functions and Current Activities
Each State DOT was asked to identify if it was actively involved in each of six core functional activities – base map development and maintenance, linear referencing, data warehouse development, technical support and training, end-user application development, and web-based application development. All but one respondent (West Virginia) reported that they were actively involved in development or enhancement of their road centerline base map, and all but three were involved in technical support or training activities. Data warehouse development was the least reported core activity, but even this activity was identified by over 75 percent of the respondents.

Respondents were also asked to list up to five of their highest priority current GIS activities. Listed activities were grouped into similar categories and then ranked based

on the number of State DOTs that cited them among their top five activities. Table 1 lists those GIS activities cited by four or more State DOTs.

GIS Activity	# State DOTS
Development of web-based GIS application	28
Maintenance and enhancement of road network base maps	22
Migration to new GIS hardware and software	14
Development or enhancement of linear referencing systems	12
Development of data warehouse / Enterprise GIS	12
Vehicle crash location / Safety analysis system application	10
Roadway Inventory system application	8
Environmental analysis application	6
Project management and tracking application	6
Implementation or update of GIS strategic plan	4
Establishment of data sharing partnership with other agencies	4
Integration of GIS with digital photologs / videologs	4
Roadway condition / construction application	4
Truck permitting and routing application	4
Traffic management application	4
Production of cartographic maps	4

Table 1. High priority GIS activities at State DOTs

Summary
GIS at State DOTs has clearly reached a level of maturity to where it is now both an accepted part of the organizational structure and an integral tool for many agency applications. Establishment of State DOT GIS web sites and ongoing improvements in web-based GIS software have significantly expanded the number of GIS end-users within the agency. The role of GIS core unit is also evolving from that of a cartographic production shop to more of a technical support function, providing training, database maintenance, and technical expertise for development of end user applications. Agency attitudes toward GIS software seem to be changing, with more agencies using a variety of different GIS packages tailored to specific application needs rather than standardizing on a single software package. Interoperability and data standards have supported this strategy by reducing the technical difficulties of sharing geo-spatial data among different software. Finally, advancements in geo-spatial data collection techniques like remote imagery and kinematic GPS are enabling State DOTs to improve the accuracy of their road network databases at substantially lower costs than by use of manual digitizing just a few years ago. These improvements should enable State DOTs to apply GIS to additional applications, thereby further expanding the role of GIS in the agency.