INFORMATION ENGINEERING BOOSTS UTAH DOT'S EFFICIENCY

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For many years, transportation agencies have been developing systems, such as those for pavement and bridge management, that combine hardware, software, and data files to solve particular problems. These systems have been isolated, with files being unique to the system in which they were created. Moreover, the systems have grown over time, and integration and maintenance problems have resulted. These limitations, together with requirements for increased quality, timeliness, and ability to manage change, are forcing organizations to consider implementing agencywide information architectures.

Problem

The Utah Department of Transportation recently confronted a form of this problem. Geographic information systems (GIS) were being developed or proposed without a comprehensive plan for their agencywide integration. To maximize the efficiency of the various GIS applications within UDOT, it became necessary to have a planned approach for providing the required spatial data to various agency units. Without such centralized planning, it would be difficult for UDOT to achieve the increased productivity promised by automation. UDOT needed to develop a GIS strategic plan that would prioritize applications and establish directions for adoption of the technology. The mission was to create a geographically referenced framework of Utah's transportation infrastructure in order to enhance access to information and group decision making. To achieve this goal, UDOT decided to develop an information strategic plan, limited in scope to infrastructure management.

Solution

UDOT selected eight managers, representing the areas of planning, design, construction, traffic, real estate, and information systems, to form a project team. The team formulated three objectives:

- Developing a comprehensive information framework that would serve as the basis for an information strategic plan for infrastructure management
- Preparing a GIS implementation plan based on that framework
- Providing UDOT with an agreed-upon direction for information system development

A model enterprise information architecture to facilitate the integration of the information systems of state DOTs had already been developed by the National Cooperative Highway Research Program Project on Development of System and Application Architectures for Geographic Information Systems in Transportation. This research applied the information engineering approach. This approach comprises a set of techniques for building three models: (a) an activity model, that is, a hierarchy of ongoing activities in a state, such as transportation planning; (b) a data model, defining subject areas (major classifications of data), entity types (fundamental things of relevance to the enterprise), and relationships among

entity types; and (c) an interaction model, characterizing the operations that activities perform on data. Development of these three models results in an information strategic plan. The NCHRP models were developed through synthesis of the existing information strategic plans of seven transportation agencies.

The generic activity and data models are intended to serve as templates, providing a starting point for refinements that will reflect the unique characteristics of each agency. UDOT used the following existing templates to develop its information strategic plan: the NCHRP model enterprise information architecture, a planning model, and a design and construction model. To complement these templates, Utah developed a new component of the interaction model for transportation operations, which included weather operations, vehicle dispatch, and tracking. The members of the UDOT project team believed that, at a strategic level, most DOTs are similar; therefore the template approach would enable them to complete the information strategic plan successfully. With the help of a consultant, the team produced the required information strategic plan for infrastructure management in just 4 months.

Application

The new UDOT information strategic plan has created an environment for GIS adoption and diffusion to the regional level. There has also been an effort to enhance and integrate the information strategic plan with current management systems for pavements, bridges, safety, and congestion. In addition, UDOT has been developing new GIS applications, including the following:

- Safety—analysis of accidents to support deer fence planning and prioritization of winter weather operations
- Construction—status reporting and analysis of proximity between projects and sources of construction materials
- Maintenance—monitoring of treatment effectiveness and coordination of scheduling for routine maintenance, such as repainting of pavement markings
- Commercial vehicle management—enforcement of legal and regulatory mandates governing the operation of commercial vehicles.

Benefits

The Utah experience indicates that the template approach greatly reduces information strategic plan development time and increases the probability of success. Out-of-pocket costs to Utah for development of its information strategic plan were approximately one-third of the average costs incurred by the agencies whose models were synthesized in the NCHRP research. Use of existing templates whose elements could be accepted, modified, or rejected provided a basis for the development effort. In addition, having the perspectives of other state DOTs increased confidence in the viability of the UDOT model. The immediate benefit of the information strategic plan will be more efficient delivery of UDOT's services. This efficiency will be enhanced over the years as UDOT discovers new ways to apply its information strategic plan.

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EDITOR'S NOTE: *Appreciation is expressed to Kenneth S. Opiela, Joseph R. Morris, and G. P. Jayaprakash, Transportation Research Board, for their efforts in developing this article.*

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