Project Summary

Texas Department of Transportation

0-5246: Data Model and Guidelines for Managing Engineering Design Data in a GIS Environment

Background

During the project development process (PDP), districts produce enormous amounts of engineering data in a variety of formats with varying levels of accuracy and resolution on several types of storage media. Examples include aerial photography and topographic information, drawings, survey data, and right of way and utility maps. These data are a valuable asset, and the Texas Department of Transportation (TxDOT) has begun to implement strategies to ensure the usability and integrity of the data. However, the amount of data is growing steadily, which makes it increasingly difficult to manage the data effectively. Although district personnel have a wealth of data at their disposal, frequent lack of data integrity, accessibility, quality control, or plain unawareness makes it difficult to put the data to good use. These inefficiencies result in redundant data collection efforts and contribute to project delays.

What the Researchers Did

The purpose of the research was to develop a prototype engineering design data model (EDDM) and guidelines for managing engineering data in a geographic information system (GIS) environment during the PDP. To address the research needs, the researchers completed the following activities:

- review engineering design data management practices at TxDOT;
- review practices at other state departments of transportation and government agencies in Texas;
- develop conceptual, logical, and physical data model components for EDDM;
- test EDDM using data from sample projects using offline and online testing environments; and
- develop recommendations for implementation.

What They Found

Depending on the type of project, the path to design, letting, and construction may vary. Although TxDOT intended the *Project Development Process Manual* to provide a consistent definition of project processes and tasks, in practice the manual has limitations that tend to hinder its usability. As a result, although district PDP implementations follow the general principles of the PDP manual, there are differences in interpretation. TxDOT uses a variety of information systems to support PDP, including the Design and Construction Information System (DCIS), the Right of Way Information System (ROWIS), the Texas Reference Marker (TRM) system, and Plans Online. TxDOT is also implementing FileNet statewide, and the use of GIS technology to support design, construction, and operations is growing. There are several GIS-based information systems in production or development at TxDOT, including Main Street Texas (MST), Right of Way Map Locator, Survey Primary Control Markers, and the Highway Conditions Reporting System.

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The development of the prototype engineering data model followed a number of requirements.

- **Data integration**. The model included integration points with existing TxDOT systems. The identification of those integration points was at a high conceptual/logical level because detailed database design documents were not available for all systems. The researchers created "place holders" in the prototype database structure for tables and fields that are related to project data (which are DCIS-related) or engineering documents (which are FileNet-related). During implementation, it should be possible to replace the "place holders" with pointers to relevant existing systems.
- **Compatibility with existing TxDOT information systems**. The data model developed in this research is compatible with existing TxDOT data architecture requirements.
- **Focus on architecture, not graphical user interfaces (GUIs)**. The research focused on data modeling and identification of implementation issues. The researchers developed simple offline (standalone) and online prototype GUIs to test EDDM. The level of functionality of these GUIs, while adequate for assessing the feasibility of the data model and conducting database tests, would probably not reflect the level of functionality expected of a production-level system. Whenever possible, the researchers included data elements in the database design to make sure the database would support appropriate GUI developments.

What This Means

The research resulted in several recommendations:

EDDM implementation:

- develop strategy for GIS-based project data management; and
- conduct pilot EDDM demonstrations.

Project development process:

- review project development process and update manuals;
- develop tool to extract PDP components and required documentation for specific projects; and
- accelerate DCIS modernization.

CAD documents:

- update and enforce CAD document standards;
- develop strategy to build GIS-based datasets from CAD documents; and
- develop standards and/or guidelines for CAD document management.

FileNet implementation:

- optimize FileNet Libraries; and
- add spatial data mapping component to FileNet.

GIS practices:

- add spatial data component to FileNet,
- reevaluate the need to append "point," "line," or "polygon" to GIS feature names;
- disseminate the TxDOT data architecture standard; and
- apply the TxDOT data architecture standard to all GIS datasets at TxDOT.

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