



# Project Summary

Texas Department of Transportation

## 0-5696: Developing a Statewide, Integrated GIS/GPS Data Model

### *Background*

Transportation planning requires substantial amounts of data and cooperation among transportation planning agencies. Advances in computer technology and the increasing availability of geographic information systems (GIS) are giving transportation planners the ability to develop and use data with a much higher degree of efficiency. However, as information systems advance, the need to provide effective data integration/exchange protocols and procedures to reduce redundancy and data collection costs is becoming more important.

### *What the Researchers Did*

This research resulted in a catalog of spatial data sources available to transportation planning agencies in Texas. The work included a synthesis of current transportation planning practices with a focus on spatial data integration and exchange issues, meetings with transportation planning and data stakeholders, the development of a map of data sources, the development of a preliminary logical data model of spatial data entities, and a compilation of metadata documents for a sample of data sources.

### *What They Found*

Although the Texas Department of Transportation (TxDOT) produces and distributes transportation planning datasets to metropolitan planning organizations (MPOs) using a highly structured, standardized process, these datasets primarily support the metropolitan transportation plan production process. In reality, federal and state legislation requires the consideration of many different planning factors. To support these functions, MPOs need to use datasets from a variety of data sources. To properly characterize transportation planning spatial data integration and exchange issues, the researchers met with many stakeholders, including MPO and TxDOT officials, as well as representatives of councils of governments (COGs), cities, transit agencies, and data distributors. In addition, the researchers conducted an online workshop to receive feedback from stakeholders.

The review of existing sample documentation produced a list of about 13,000 instances of spatial data (where a spatial data layer was displayed or there was a reference to it in the document). To facilitate the analysis, the researchers developed a three-level grouping structure composed of categories (mostly by subject matter), subcategories, and spatial data entities.

#### *Research Performed by:*

Texas Transportation Institute (TTI),  
The Texas A&M University System

#### **Research Supervisor:**

Cesar Quiroga, TTI

#### **Researchers:**

Nicholas Koncz, TTI

Yingfeng Li, TTI

John Overman, TTI

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To assist in this process, the researchers conducted a literature review of national practices to determine how agencies that produce and serve spatial data organize data. The review revealed the lack of a generic catalog of categories, subcategories, and entities for transportation datasets, let alone transportation planning, highlighting the need for the development of such a catalog. Developing the catalog of categories and subcategories for transportation planning spatial data was an iterative process that involved several rounds of data entity categorization, analysis of the resulting structure for inconsistencies, gaps, and redundancies, and subsequent changes to the data entity categorization scheme. In the end, the three-level grouping structure resulted in 7 categories, 63 subcategories, and 589 spatial data entities.

The researchers formalized the prototype data model using the CA<sup>®</sup> ERwin<sup>®</sup> Data Modeler. The model included category-based subject areas and definitions for all 589 spatial data entities. In addition, the researchers developed sample geodatabases and metadata documents following the Federal Geographic Data Committee's (FGDC's) Content Standard for Digital Geospatial Metadata (CSDGM) for a sample of spatial data entities. To facilitate the display and dissemination of transportation planning data (including metadata), the researchers developed a prototype web-based viewer called Transportation Planning GIS (TPGIS) Data Viewer. TPGIS includes a metadata browser and a map viewer that enable users to explore categories, subcategories, and individual spatial data entities, as well as retrieve definitions and metadata documentation.

## *What This Means*

The researchers recommend expanding the data model, data dictionary, and metadata documentation, investigating implementation options for publishing transportation planning GIS data and metadata in a web-based environment, and developing training materials on the use of the data model as well as the map/metadata viewer.

General recommendations for improving data exchange practices among stakeholders in the transportation planning process (including stakeholder-provided recommendations) include the following:

- facilitate web-based access to data,
- develop local and regional visions for spatial data archival and exchange,
- increase training opportunities on relevant topics, including data-related topics,
- improve hardware and software capabilities at the MPOs,
- develop an automated mechanism to enable TxDOT and local governments to notify MPOs when a new facility opens or the characteristics of an existing facility change,
- require the submission of georeferenced data with metadata,
- include stable employer unique identifiers in employment datasets,
- develop reliable income projection methodology and data,
- archive GPS data used for travel surveys, and
- add standardized certification and disclaimer text labels to all relevant geospatial documents.

### *For More Information:*

Research Engineer - Duncan Stewart, TxDOT, 512-465-7403  
Project Director - Karen VanHooser, TxDOT, 512-465-7926  
Research Supervisor - Cesar Quiroga, TTI, 210-731-9938

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